Oct. 28, 1947. S. A. MOORE 2,429,764

ELECTRIC FENCE INDICATOR

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Fig. 1.

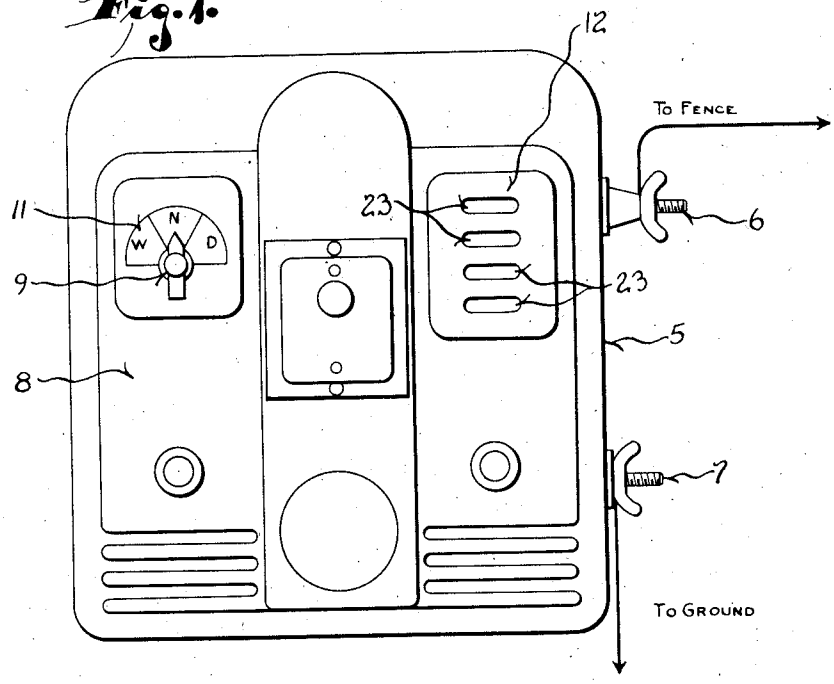
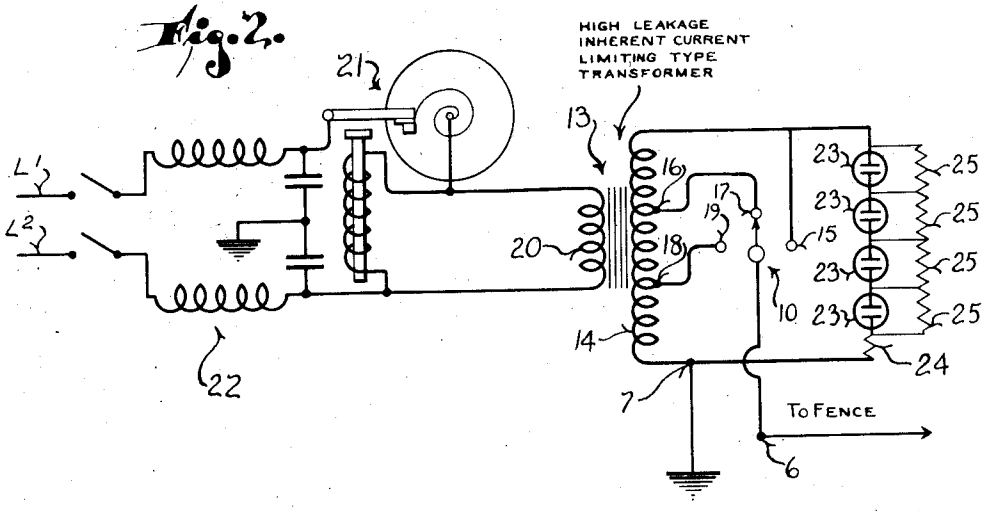


Fig. 2.



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ELECTRIC FENCE INDICATOR

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3 Claims. (Cl. 177—311)

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This invention relates to electric fences and has as its object to provide a satisfactory indicator for actually and truly depicting the condition of the fence, i. e., whether or not the fence is capable of giving an animal a shock of sufficient intensity to be effective in its purpose.

Experience has shown that one of the requirements of a commercially satisfactory electric fence is that it be capable of supplying at least two and preferably three, different open circuit voltages to the fence, the selection to be made in accordance with the conditions of soil and weather. In other words, for an electric fence controller to be fully satisfactory it must be capable of supplying a higher voltage than normal during exceedingly dry weather conditions and a lower voltage than normal in exceedingly wet weather conditions.

Experience has also shown that it is desirable to keep the voltage impressed upon the fence wire at the lowest value consistent with effectiveness. This follows from the fact that the danger of current leakage resulting from poor insulators, weeds growing up against the fence wire and other causes, rises with increasing voltage. Thus, provision for adjusting the voltage impressed upon the fence wire by the controller is essential to a commercially satisfactory unit.

The development of the present day commercial electric fence has witnessed a succession of efforts to devise a satisfactory indicator for depicting the true condition of the fence wire, for unless the farmer can quickly ascertain the condition of the fence, it is not much use to him. The indicator should tell him if the fence is in reliable condition.

The first indicators consisted merely of small filament lamps connected in series with the fence which indicated an electrical leakage condition on the fence by lighting up. As the demand for more accurate indication of the fence condition manifested itself, these early indicators gave way to meter-type indicators, but these too were current-responsive and, therefore, unreliable as the fence-to-ground capacity affects the reading of a current responsive indicator. Variations in the length of the fence wire and its height from the ground result in variations in fence-to-ground capacity. A large fence-to-ground capacity often causes considerable charging current to flow into the fence each time the fence is periodically energized even though the fence is in perfectly good condition. Thus a current responsive indicator would indicate a leakage condition when in fact the fence was satisfactory.

Recognition of this deficiency of the current responsive type of indicator has recently led to the use of voltage responsive indicators, but even here complete satisfaction was not achieved, except in cases where the controller provided only a single out-put voltage, as the indicators were always connected between fence and ground. Being voltage responsive it follows that a change in the voltage impressed upon the fence would result in a change in the indication afforded by the indicator.

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Voltage responsive indicators of the type used in such installations generally consisted of a bank of neon glow lamps connected in series with suitable resistance across each lamp so that the number of the glow lamps lighting up with each periodic energization of the fence would afford the desired indication of its condition. If such voltage responsive indicators were employed in fence controllers having a number of voltage taps on the secondary of the supply transformer, they were of necessity so designed that all of the lamps would light up when the maximum voltage was impressed on the fence, assuming of course, that the fence was in good condition. Thus, reduction of the impressed voltage by connection of the fence wire to a lower voltage tap would have the same effect as leakage on the fence with its consequent voltage reduction. The farmer, therefore, could not rely upon the number of lamps glowing as being a true indication of the fence condition. Adjustment at the controller to reduce the voltage impressed upon the fence, of necessity would mean that a lesser number of the lamps would light up.

The disadvantage of this objectionable condition not only resided in the need for checking the setting of the voltage regulator at the controller before using the ratio of lit and unlit lamps as an indication for fence condition, but also in the fact that on low voltage only one or two lamps were left to light up and indicate the entire range of the fence conditions.

With a view toward overcoming all of these disadvantages of past indicators employed in electric fences, it is a particular object of this invention to provide a fence condition indicator of the voltage responsive type so connected in the circuit that regardless of the voltage impressed upon the fence by the controller, the full range of the indicator will be available to show the true condition of 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 drawing illustrates one complete example of the physical embodiment of the invention constructed in accordance with the best mode so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a front elevational view of an electric fence controller embodying this invention; and

Figure 2 is a schematic diagram of its component parts and their connections and showing this invention incorporated therein.

Referring now particularly to the accompanying drawing, the numeral 5 designates a housing or cabinet within which the mechanism of the controller is mounted. As is customary, this housing has an insulated fence terminal 6 and a ground terminal 7 mounted thereon. The bare fence wire (not shown) but which as is customary, is supported off the ground by posts carrying insulators, is adapted to be connected to the fence terminal 6 while the ground terminal 7 is connected in any suitable manner to ground.

Mounted on the front wall or panel 8 of the housing is an adjusting knob 9 which controls a selector switch 10 (see Figure 2). The setting of the knob 9 determines the voltage impressed upon the fence wire. Its center or intermediate position indicated by the letter N on a scale 11 provides voltage for normal weather conditions. Turning the knob to the left to the position W connects the fence terminal 6 with a low voltage tap on the transformer secondary for wet weather conditions, while adjustment thereof to the right to the position D connects the fence terminal with a high voltage tap for dry weather conditions.

Also mounted on the front panel 8 of the housing or cabinet is a bank of glow lamps indicated generally by the number 12. The specific manner in which these glow lamps are mounted in the cabinet being no part of this invention need not be described, suffice it to say that the lamps are arranged behind suitable window openings in the front panel.

As indicated in Figure 2, the transformer 13 is of the high leakage, inherent current limiting type, having a magnetic shunt built into it. Transformers of this type are customarily employed in A. C. fence controllers. It is a characteristic of such transformers that full short circuit current across any of its secondary taps results in zero voltage across the entire secondary. In other words, the voltage across the entire secondary is inversely proportional to the current across any of its taps.

One end of the secondary 14 of the transformer is connected to ground through the terminal 7. Its opposite end is connected to the high voltage contact 15 of the selector switch 10. A mid-tap 16 connects with contact 17 of the switch, and a low voltage tap 18 connects with the remaining contact 19 of the selector switch. Thus, depending upon the setting of the selector switch, the voltage impressed upon the fence wire may be any one of three values. As a specific illustration, but not for sake of limitation these voltages may be 1500 for dry weather and soil conditions, 1000 for the normal voltage, and 600 volts for wet weather. The corresponding current for these voltages would be 20 milliamperes, 30 milliamperes and 50 milliamperes.

The primary 20 of the transformer is adapted to be periodically energized from a commercial A. C. power source represented by lines L—1 and L—2. A timer mechanism indicated generally by the numeral 21 controls the periodicity of the energization and maintains it at approximately one per second. Such timing mechanisms are, of course, well-known and consequently detailed description is not required.

The primary circuit also includes a control unit indicated by number 22 and which embodies a radio interference suppressor and an automatic cut-out unit as shown in Patent Re. No. 22,143, issued July 21, 1942, to J. E. Vaughan for Electric fence.

The indicator 12 consists of a bank of neon glow lamps 23 connected in series across the entire secondary of the transformer, a calibrating resistor 24 preferably being incorporated in this series connection. In addition, a resistor 25 is connected across each glow lamp 23. The values of these resistors are progressively greater so that a reduction in the voltage across the series connected lamps reduces the number of lamps that light up each time the fence is energized. Thus as leakage on the fence increases and the voltage across the secondary drops proportionately, the number of glow lamps lighting up decreases. If there is no leakage on the fence, all of the glow lamps will light up whether the fence is connected to the high, low, or medium voltage tap. If a leakage condition has reduced the efficacy of the fence by fifty percent (50%) for a given applied voltage, one-half the lamps will light up no matter which of the selected voltages it happens to be. In other words the number of glow lamps which light up is the same for a given percentage of leakage regardless of which one of the secondary taps is connected with the fence wire.

Inasmuch as the probability of leakage on an electric fence, and for that matter any current carrying conductor, increases as the voltage applied thereon is increased, it follows that the percentage of leakage is a function of the applied voltage. Thus, for instance, with an applied voltage of 1,000 volts (obtained in the present instance with the voltage selector switch at "normal"), leakage of about forty thousand (40,000) ohms would decrease the efficacy of the fence to about seventy-five percent (75%) of its full capability to give an animal a shock. In other words, there would be approximately twenty-five percent (25%) leakage on the fence.

Under such conditions the fence still would be capable of giving an animal an effective shock and the farmer would know this because three of the four glow-lamps would be lighting up with each energization of the fence.

If the voltage selector switch was turned to, or happened to be in its high voltage position so that the applied voltage was 1500 volts, and assuming the same condition of the fence, the increased voltage in this instance would raise the percentage of leakage to about seventy-five percent (75%) leaving the fence only one-fourth effective. This is not sufficient and the farmer would be advised of the deficiency by the fact that only one of the four glow-lamps would be lighting.

On the other hand, if the voltage selector switch was in its low voltage position so that 600 volts were being applied to the fence, the same leakage, that is forty thousand (40,000) ohms, would not materially reduce the efficacy of the fence. In this case the percentage of leakage would be

so slight that all of the four glow-lamps would continue to light up, thus telling the farmer that the shock upon the fence was entirely satisfactory.

Of course, inasmuch as the voltage selector switch should be set to correspond with weather conditions, the farmer would not turn it down to its low voltage wet weather position, or even to its medium voltage, "normal" position, if the ground and weather were extremely dry. An indication of leakage under such dry weather conditions would be a reliable indication that the fence needed prompt attention. It would mean a broken wire or other such serious condition, for the probability of serious leakage at the insulators or from weeds is slight in real dry weather.

Where weather conditions would permit, the farmer might very well reduce the voltage impressed upon the fence by merely adjusting the selector switch **9** and thus restore the efficacy of the fence, assuming the indicator had registered a deficient fence at a higher voltage being applied at the time the deficiency was noticed. It follows, therefore, that the indicator of this invention serves not only to show the farmer the true condition of the fence (that is, its ability to give an animal a shock) regardless of which of the secondary taps the fence is connected with; but it also serves to educate the farmer out of the mistaken belief that his fence will be improved by increasing the voltage applied thereon.

The apparent anomaly of the fence being better able to give an animal a shock if the voltage is reduced, is explained by the fact that an electric fence is seldom is ever adequately insulated from ground. Even though the fence is free from contact with weeds and is otherwise in good condition, the leakage path between the tie wires by which the fence wire is held to the supporting insulators and the heads of the nails holding the insulators to the posts usually is only three eighths to one-half an inch. This short leakage path, duplicated at each insulator, makes some leakage inevitable, except in very dry weather, and of course as the voltage is increased, the percentage of leakage rises.

For purposes of illustration but not limitation, the specific values of the resistors employed in the indicator network may be as follows, reading from bottom to top in Figure 2: 25 M ohms, 60 M ohms, 150 M ohms, 500 M ohms and the calibrating resistor **24**, 100 M ohms.

From the foregoing description taken in connection with the accompanying drawing, it will be readily apparent to those skilled in this art that this invention achieves what the industry has been seeking since electric fences came into commercial use, namely an indicator which actually and truly depicts the leakage condition of the fence regardless of the voltage being impressed thereon by the controller.

What I claim as my invention is:

1. Means for indicating the effectiveness of an electric fence having a bare fence wire connected with one of a plurality of taps on the secondary of a transformer having its primary suitably energized and adapted to provide an open circuit voltage to the fence wire of a value depending upon the secondary tap with which the fence wire is connected, said transformer being of the high leakage, inherent current limiting type so that full short circuit current across any of its secondary taps results in zero voltage across the entire secondary, comprising: a bank of glow lamps; means electrically connecting the glow lamps in series circuit across the entire secondary of the transformer; and a plurality of resistors, one connected across each of said glow lamps, said resistors being of progressively greater resistance values so that a reduction of the voltage across the glow lamps decreases the number of lamps that light up with each energization of the fence wire, the high leakage, inherent current limiting characteristic of the transformer assuring that the voltage across the glow lamps is inversely proportional to the percentage of leakage on the fence, so that the number of glow lamps lighting up when the fence wire is energized indicates the percentage of leakage of the applied voltage regardless of which one of the secondary taps the fence wire is connected with.

2. In an electric fence, the combination of: a high leakage inherent current limiting type transformer having a plurality of taps on its secondary; means for connecting the fence with any one of the secondary taps so that the voltage applied to the fence may be selected to best suit different weather and soil conditions; a bank of glow-lamps; means electrically connecting the glow-lamps in series circuit across the entire secondary of the transformer; and a plurality of resistors, one connected across each glow-lamp, said resistors being of progressively greater resistance values so that a reduction of the voltage across the series of glow-lamps decreases the number of glow-lamps that light up with each energization of the fence; the high leakage inherent current limiting characteristic of the transformer assuring that the voltage across the glow-lamps is inversely proportional to the percentage of leakage on the fence, so that the number of glow-lamps lighting up when the fence is energized indicates the percentage of leakage of the applied voltage regardless of which one of the secondary taps the fence is connected with.

3. In an electric fence, the combination of: a high leakage inherent current limiting type transformer having a plurality of taps on its secondary; means for connecting the fence with any one of the secondary taps so that the voltage applied to the fence may be selected to best suit different weather and soil conditions; a voltage responsive indicator comprising a plurality of voltage responsive devices, each of which is responsive to a different voltage; and means connecting said voltage responsive indicator across the entire secondary; said indicator devices each constituting display means and together depicting percentage of change from a predetermined voltage across the entire secondary; the high leakage inherent current limiting characteristic of the transformer assuring that the voltage across the entire secondary, and thus across the indicator, is inversely proportional to the percentage of leakage on the fence, so that the depiction afforded by said display means at all times shows the percentage of leakage of the applied voltage regardless of which one of the secondary taps the fence is connected with.

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