Sept. 23, 1958 E. D. NUNN 2,853,635

ELECTRIC FENCE CONTROLLER

Filed Oct. 26, 1953

Fig. 1.

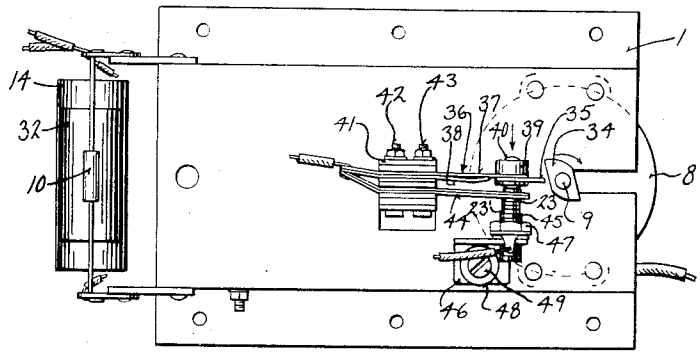


Fig. 2.

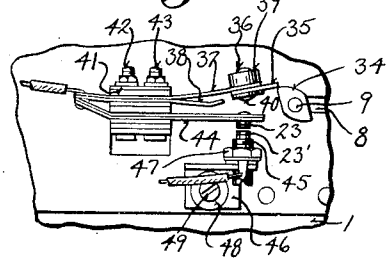


Fig. 3.

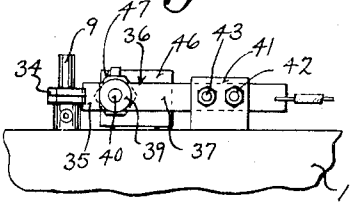


Fig. 4.

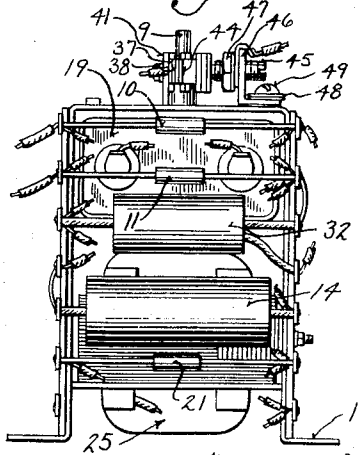


Fig. 5.

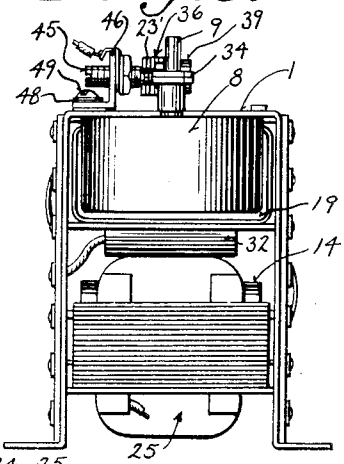
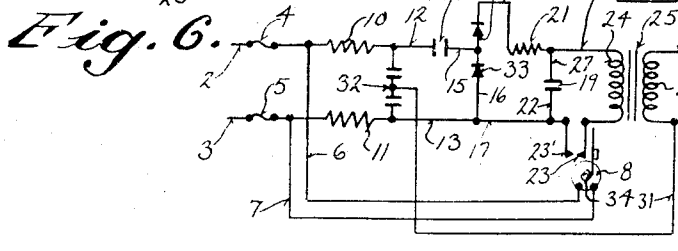


Fig. 6.



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ELECTRIC FENCE CONTROLLER

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7 Claims. (Cl. 307—132)

This invention relates to electric fence chargers for producing a suitable electrical potential for application to fences for control and training of livestock wherein an energy storage circuit is discharged periodically through the primary winding of a transformer and it resides, more specifically, in an improvement in such apparatus in which discharge through the primary takes place through a pair of contacts closed under an impact force applied thereto by a spring loaded hammer which is periodically moved away from said contacts by a continuously rotating member driven by a substantially constant speed motor, the hammer being suddenly released at the end of each outward excursion to apply the impact force to the contacts.

Heretofore, electric fence charging circuits have been employed wherein a capacitor has been charged and periodically discharged through a transformer primary winding to produce in the secondary of the transformer a charge at the desired potential. In such apparatuses, the means regulating the periodicity of discharge, have been sensitive to circuit load. Usually an increased load applied to such circuits has caused an increase in the frequency of discharge. When this occurs, the necessary release interval between impulses becomes diminished and may fall below the interval required for safe muscular relaxation with resulting danger to human life and hazard to livestock.

It is an object of this invention to provide an electric fence charging circuit intended to be energized by commercial alternating current power, in which the periodicity is independent of the load upon the circuit.

Another object of this invention is to provide an apparatus of the class described, wherein circuit failure will not increase the frequency of impulse nor place an unintended charge on the fence.

Another object of this invention is to provide apparatus of the type above described wherein the force applied to cause engagement of the impulse contacts is adequate.

The foregoing and other objects and advantages of this invention will become apparent from the description following which is set forth with reference to the accompanying drawing forming a part hereof in which drawing there is set forth by way of illustration and not of limitation one form in which the apparatus of this invention may be embodied.

In the drawing:

Fig. 1 is a top, plan view of a fence charging apparatus constructed in accordance with this invention,

Fig. 2 is a fragmentary, detailed, top plan view of the cam, hammer and impulse contacts of the apparatus shown in Fig. 1 with the parts in the position existing immediately prior to the release of the impact hammer,

Fig. 3 is a detailed, side view in elevation of the parts appearing in Fig. 2,

Fig. 4 is a rear end view in elevation of the apparatus shown in Fig. 1,

Fig. 5 is a front end view in elevation of the apparatus appearing in Fig. 1, and

Fig. 6 is a diagram of the circuit of the apparatus shown in the remaining figures.

The fence charging apparatus of this invention, in the form shown in the drawing, is provided with a U-shaped sheet metal frame 1 upon or within which the several parts of the apparatus are mounted. As appears in Fig. 6, the circuit is supplied through input leads 2 and 3, fused at 4 and 5, from which, leads 6 and 7 extend to a synchronous or substantially constant speed motor 8. Motor 8 runs continuously, so long as alternating current is applied through the leads 2 and 3. The motor 8 is of familiar construction and contains reduction gearing of known form, all not shown, connected to an output shaft 9 which turns at approximately 30 to 40 revolutions per minute.

In order to produce a charge at appropriate potential for application to the fence, leads 2 and 3 are also connected respectively through resistors 10 and 11 to the supply leads 12 and 13 of a rectifier circuit including a rectifier 33 joined through lead 15 to an intermediate capacitor 14. A second rectifying element 18, interposed as shown, transfers a direct current charge to the main impulse capacitor 19 through a charging lead 20 and a charging resistor 21 as shown. A charge at a potential in excess of R. M. S. voltage is caused to accumulate in the capacitor 19 in this way.

The charge accumulated in impulse capacitor 19 is periodically discharged through lead 22 and periodically closed contacts 23 and 23', into and through the primary winding 24 of a transformer 25. Primary winding 24 is connected, in turn, through leads 26 and 27 back to impulse capacitor 19. The secondary winding 28 of transformer 25 has an output lead 29 for attachment to a fence and a ground lead 30 for attachment to ground. Ground lead 30 is preferably connected by means of lead 31 to the midpoint of a capacitor bridge 32 to reduce the entrance of radio frequency currents into the power lines 2 and 3.

The input resistors 10 and 11 are preferably of fairly high resistance, in the neighborhood of 2000 ohms. The charging resistance 21, on the other hand, is somewhat lower in ohmic value. The input capacitor 14 has been found with certain transformers to perform satisfactorily with a capacity of approximately 0.4 mfd. The impulse capacitor 19, under the same circumstances, has been found to perform satisfactorily with a capacity of 7.0 mfd.

Mounted on shaft 9 of motor 8 to rotate therewith is a double lobed cam 34 positioned to travel in a circular path which is intercepted by the lifting end 35 of a hammer assembly 36. The hammer assembly 36 comprises a main resilient leaf member 37, a dampening finger 38 beneath the same, the lifting end 35 previously referred to, being composed of a substance having dry lubricating properties, and a hammer weight 39 held in place by a rivet 40. The hammer spring 37 and its accompanying dampening finger 38 are rigidly secured, between insulation layers, to a bracket 41 formed as a raised part of the frame 1. Clamping bolts 42 and 43 passing through the bracket, the insulation layers and the hammer spring 37 and finger 38 unite these parts and provide a rigid anchorage for the hammer assembly 36.

Also held and rigidly supported by the bracket 41 and the bolts 42 and 43, between insulating layers provided therefor, is a laminated movable contact carrier 44 composed of bronze or other substance of high electrical conductivity. Secured at the end of contact carrier 44 is a movable contact 23 previously referred to. When the carrier 44 is in normal or unstressed condition, movable contact 23 rests in a position spaced from stationary contact 23' as shown more clearly in Fig. 2.

Stationary contact 23' is mounted in the end of adjustable threaded stud 45 which threadingly engages a bracket 46. To maintain the adjusted position of stationary contact 23, a lock-nut 47 is positioned to engage the stud 45 as shown. The bracket 46 is rigidly held by screw 49 but electrically insulated from frame 1 by insulating washers 48.

The cam 34, upon clockwise rotation, comes into engagement with the lifter 35 which is gradually lifted as progress of the cam continues. The lifting action continues until cam 34 arrives in a position such as is shown in Fig. 2 and for a short time thereafter. Throughout this lifting action, energy is stored in the spring 37 under conditions which impose a comparatively even and prolonged, but light, load upon the motor 8. As soon as the cam 34 passes beyond the position shown in Fig. 2, the hammer assembly 36, including the hammer 39 and the rivet 40, travel rapidly toward the movable contact carrier 44. These parts come into engagement while the hammer 39 is traveling at a substantial speed. The kinetic energy stored in the hammer is thus transferred rapidly to the contact carrier 44 which deflects until contacts 23 and 23' come into engagement as shown in Fig. 1. Shortly thereafter, carrier 44 resiliently assumes the position shown in Fig. 2 and spring 36 retreats to an even greater degree so that the rivet 40 departs from contact with the carrier 44 in advance of a new engagement between the cam 34 and the lifter 35.

By reason of this action, contacts 23 and 23' remain in engagement for a very brief interval, sufficient only to discharge a substantial portion of the charge accumulated in capacitor 19. By reason of the comparatively high impact with which contacts 23 and 23' engage, intervening oxide or other corrosion deposits on the contacts are prevented from interfering substantially with electrical engagement. The primary circuit of transformer 25 therefor operates with high electrical efficiency and the charge developed in the secondary of this transformer is exceptionally effective. Voltage regulation remains effective over a wide range of loading. The effect of weeds or other foreign objects partially grounding the fence is, therefore, minimized.

I claim:

1. In an electric fence charging apparatus the combination comprising a capacitor, a charging resistor in series connection with said capacitor and with a source of direct current for charging said capacitor, a transformer having a primary winding and a secondary winding adopted to be connected to ground and to a fence, a pair of relatively movable electrical contacts for joining the primary winding of said transformer in circuit with said capacitor, means normally resiliently maintaining said relatively movable contacts in separated relation, a resilient hammer member comprising a weighted spring having a hammer end positioned to engage and deflect said relatively movable contacts into contact with one another, and a motor driven, continuously rotatable cam positioned to deflect, load and release said resilient hammer periodically to cause the same to impinge upon one of said relatively movable contacts to cause the contacts to engage under impact when said resilient hammer is released.

2. In an electric fence charging apparatus the combination comprising a capacitor, a charging resistor and a rectifier in series connection and in series connection with said capacitor, a source of alternating current for charging said capacitor in series with said capacitor and rectifier and said charging resistor, a transformer having a primary winding and a secondary winding adapted for connection to ground and to a fence, a pair of relatively movable electrical contacts for joining the primary winding of said transformer in circuit with said capacitor, means normally maintaining said relatively movable contacts in separated relation, a resilient hammer member comprising a weighted spring having a hammer end positioned to engage and deflect said relatively movable contacts into contact with one another, and a motor driven, continuously rotatable cam positioned to deflect, load and release said resilient hammer periodically to cause the same to impinge upon one of said relatively movable contacts to cause the contacts to engage under impact when said resilient hammer is released.

3. In an electric impulse apparatus the combination comprising a capacitor, a charging resistor in series connection with said capacitor and with a source of direct current for charging said capacitor, a transformer having a primary winding and a secondary winding, a pair of normally separated relatively movable electrical contacts for joining the primary of said transformer in circuit with said capacitor, a weighted resilient member cooperatively related to one of said relatively movable contacts for moving the same into contact with the other, and a motor driven, continuously rotatable cam positioned to load, deflect and release said weighted resilient member periodically to cause said contacts to engage with impact each time said weighted resilient member is released.

4. In an electric impulse apparatus the combination comprising a capacitor, a charging resistor and a rectifier in series connection with said capacitor, a source of alternating current for charging said capacitor in series with said capacitor, said rectifier and said charging resistor, a transformer having a primary winding and a secondary winding, a pair of relatively movable electrical contacts joining the primary of said transformer in circuit with said capacitor, means normally maintaining said relatively movable contacts in separated relation, a resilient hammer member comprising a weighted spring having a hammer end positioned to engage and deflect said relatively movable contacts into contact with one another, an alternating current motor connected to said alternating current source to be driven thereby, a continuously rotatable cam driven by said motor positioned to load, deflect and release said hammer spring periodically to cause the same to engage one of said relatively movable contacts to cause the same to impinge upon the other under impact when said resilient hammer member is released.

5. In a periodically closing switch for periodically energizing an electric fence charger the combination comprising an alternating current motor having an output shaft; a cam mounted on said motor shaft to be rotated thereby; said cam having at least one lobe of increasing radius terminating in a surface having abruptly diminishing radius; a stationary electrical contact disposed in opposition to said cam; a movable contact carrier carrying a movable contact disposed adjacent to said stationary contact and normally out of contact therewith; a hammer spring having a fixed end, a resilient arm and a weighted movable end normally disposed out of contact with said movable contact carrier and deflectable into engagement therewith; and lifting means having dry bearing properties secured to said hammer spring disposed to intercept the path of movement of said cam lobe to be deflected thereby upon rotation of the shaft of said motor to store resilient energy in said resilient arm to be discharged when released by said cam to cause impact engagement of said contacts.

6. In a switch in accordance with claim 5, in which the hammer spring includes a deflectable dampening finger positioned to engage the resilient arm when in a position approaching an unstressed position of said resilient arm.

7. In an electric fence charger the combination comprising a source of alternating current of predetermined frequency, a transformer having a primary circuit and a secondary circuit adapted to be connected to the fence, a pair of normally separated contacts joining said primary circuit to said source when closed, an electric motor joined to said source to be driven thereby including an output shaft, reciprocably movable contact actuating

means actuated by said output shaft cooperatively engaging said contacts to momentarily, periodically close the same with a frequency determined by said motor speed, whereby increased loading of said fence and said source is ineffective to increase the frequency of the periodic closures of said contacts.

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