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Tingey et al.

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[54] **SPARK GAP TYPE ELECTRIC SHOCK-PRODUCING PROD**

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[52] **U.S. Cl.** ..... **273/84;** 231/2 E; 317/262 S

[51] **Int. Cl.²** **F41B 15/04**

[58] **Field of Search** ..... 331/112; 317/262 S; 128/303.18, 405, 404, 420, 419 S, 419 R; 273/84; 231/2 E, 2 R

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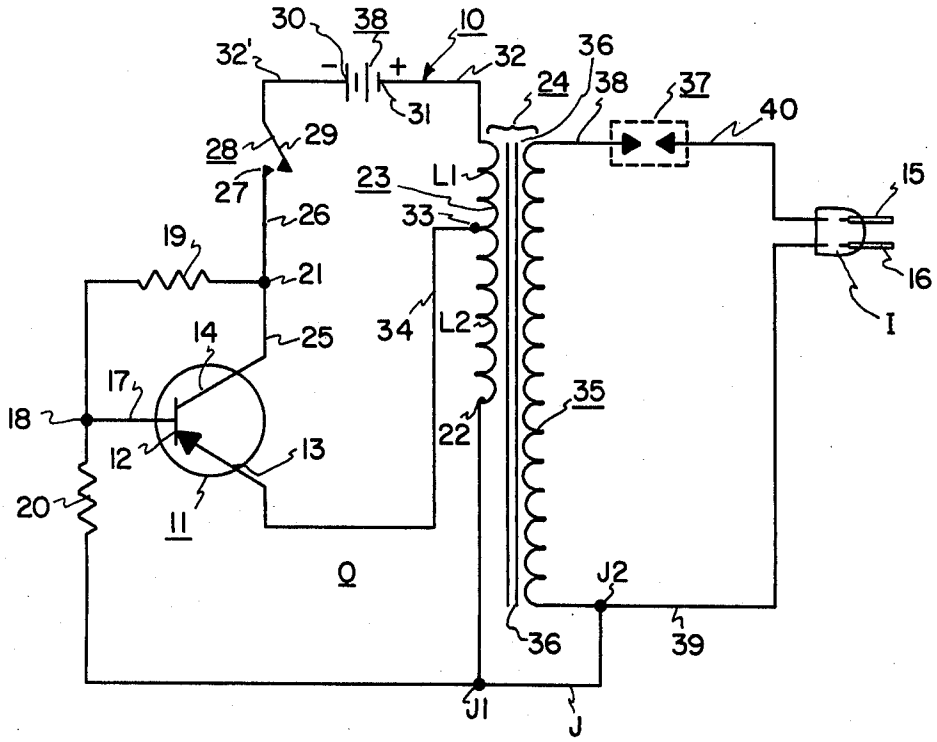
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[57] **ABSTRACT**

An electric shock-producing prod, usable by cattlemen, law enforcement officials, and others, wherein the electrical or electronic circuitry therein consists of a battery-powered oscillator having a coupled output provided with a series-connected spark gap. The spark gap is in series with a leg of the output step-up winding of the transformer used and the oscillator can and will continue to run with the electric-shock contacts of the prod in engagement with the intended, recalcitrant object. The oscillator has on-off switch. The oscillator continues to provide a series of pulses which continue during the time the prod is in electrical contact with the intended object.

7 Claims, 4 Drawing Figures



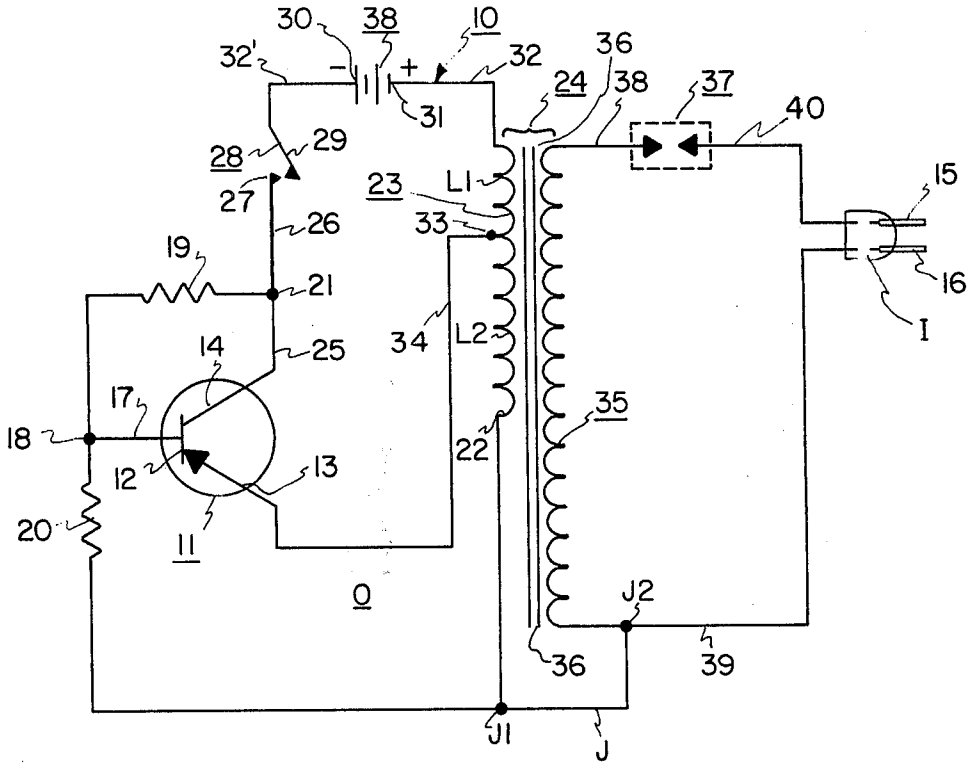


FIG. 1

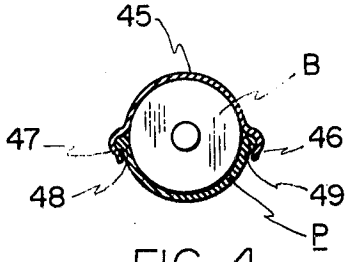


FIG. 4

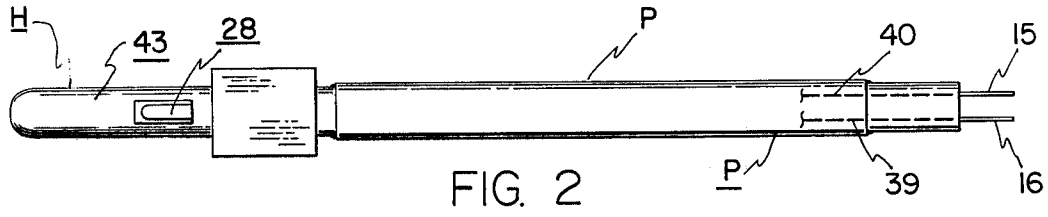


FIG. 2

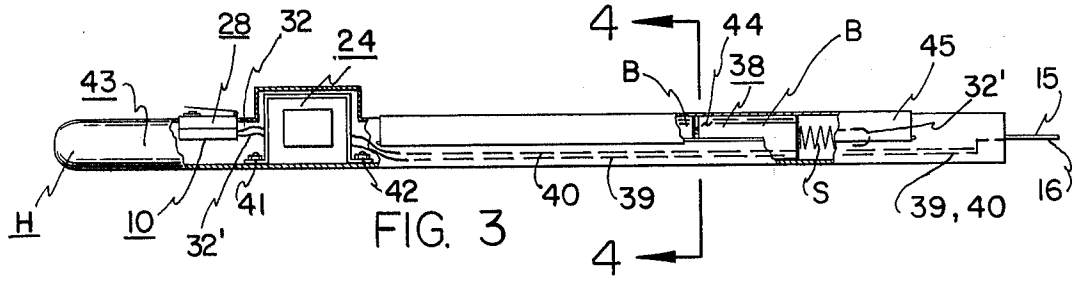


FIG. 3

SPARK GAP TYPE ELECTRIC SHOCK-PRODUCING PROD

The present invention relates to electrical shock-producing probes used by cattlemen, law enforcement officials, and others, and, more particularly, to a new and improved probe wherein, when the same is energized for free-running by the actuation of a single switch, the same will continue to function even though the electrical probes of the unit are in engagement with the intended object.

Cattlemen, peace officers, and others have found it useful to have an electrical shock-producing probe to urge recalcitrant cattle or other animals or even human beings into a desired activity. Certain prods of the past have incorporated electrical or electronic circuits wherein the actuation switch must be energized a series of times in order to provide a series of electrical shocks.

The use of a oscillator in such a circuit presents certain problems, among which is the fact that when the probes or contacts touch an object having a characteristic surface resistance, the impedance of the output circuit changes so as to affect deleteriously the operation of the oscillator. As a consequence the oscillators, if intended for free-running, simply cease their operation.

What is needed, therefore, is the provision of an oscillator in a shock-producing probe wherein the operation of the oscillator is unaffected by contact by the shock probes with the intended object. In the present invention a single actuation of a switch, so as to turn on the oscillator, is sufficient to retain the same in a continuous operating condition even though the probes touch an intended animal, for example, having a certain characteristic electrical surface resistance, but only provided there is a spark gap disposed in series with one of the leads coming from the step-up transformer winding of the unit. It has been found that the incorporation of a spark gap operates electrically so as not to change the characteristic impedance of the oscillator circuit, reflected back, even though the shock-producing probes are actually contacting the animal or human being.

The essence of the present invention, therefore, is the provision in the output circuit of a probe of a serially connected spark gap in the step-up winding portion of a transformer having an oscillator input. The oscillator, generally a blocking or free-running choke circuit, is generally conventional in form herein, but the step-up transformer includes in its secondary winding circuit a series-connected spark gap disposed within the lead path leading to a respective one of the shock-producing probes. It is the presence of this spark gap that precludes malfunction of the oscillator during operation of the unit.

Accordingly, a principle object of the present invention is to provide a new and improved shock-producing probe for cattlemen, peace officers, and the like.

A further object is to provide for a shock-producing prod a circuit including an oscillator having a transformer output circuit provided with a series-connected spark gap.

An additional object is to provide a shock-producing prod which is conveniently packaged as an elongate unit having a self-contained circuit which is easily manipulated both for use and for battery replacement.

The features of the present invention may best be understood by reference to the following description taken in connection with the accompanying drawings in which:

FIG. 1 is a schematic diagram of an electrical circuit in a preferred embodiment of the present invention, and showing the series-connected spark gap in the output circuit of the transformer used.

FIG. 2 is a side elevation of a physical prod unit incorporating the circuit of FIG. 1 by way of example; FIG. 2 represents a plan view of the unit.

FIG. 3 is a side elevation of the structure shown in FIG. 2 and is broken away to show the packaged electronics and transformer of the unit.

FIG. 4 is a section taken along the line of 4—4 in FIG. 3.

The oscillator used, though not restricted to that shown, preferably takes the form of a free-running, blocking oscillator selectively turned on and off by a single on-off switch. Further, while the transformer is preferably a closed core, multiple-winding transformer, it will be obvious that other types of transformers such as an auto-transformer may be used. In any event, a step-up transformer is intended in order that a minimum power input will ensure the requisite final output voltage needed to produce the electrical shock train intended.

In FIG. 1 circuit **10** includes transistor **11** provided with base **12**, emitter **13**, and collector **14**. Transistor **11** preferably comprises a germanium PNP transistor such as RCA 2N301. Were a silicon transistor used here, much less spark would be developed at prongs **15** and **16**, hereinafter fully described.

Base **12** is connected by lead **17** to junction **18**, the latter serving as a connection point or junction of seriesconnected resistors **19** and **20**. The remaining ends of these resistors are connected to junction **21** and also to the lower end **22** of primary winding **23** of the transformer **24**. In a preferred embodiment of the invention resistors **19** and **20** can have values of **18K** and **250** ohms, respectively. Leads **25** and **26** interconnect junction point **21** with collector **14** and switch contact **27** of on-off swiitch **28**, respectively. The arm **29** of switch **28** is connected to lead **32'** to battery terminal **30** in the manner illustrated. Battery terminal **31** is connected by lead **32** to the upper end of primary winding **23**. Primary winding **23** is tapped at **33** and at such tap is connected to lead **34** leading and connecting to emitter **13**. The turns ratio of winding segments L1 to L2 of primary winding **23** may be of the order of **45** to **100**; thus, in example indicated, L1 will have **45** turns whereas L2, **100** turns. Secondary winding **35**, however, will have from **5,000** to **6,000** turns. This is merely by way of example. Hence, the transformer **24** comprises a step-up transformer with preferably an iron, closed core as at **36**. Spark gap **37** may comprise an Admiral **62A2-1**, or similar gap. These gaps are made generally by simply forming a block of insulated plastic about a wire and then slotting the plastic through the wire; spark gaps are conventionally used in television sets, for example. Battery **38** may comprise a **10.5** volt dry cell battery, the polarity of which is indicated.

As seen, secondary winding **35** is connected by lead **38** to one side of spark gap **37**, and lead **39** interconnects the remaining end of secondary winding **35** to spark probe **16**. Lead **40** interconnects the remaining side of spark gap **37** to the spark prong **15**.

As to afore-described details of the circuit as shown in FIG. 1, FIGS. 2–4 will be discussed. FIGS. 2–4 represent a physical embodiment of the structure, illustrated in the formation of an elongate cattle probe in one embodiment of the invention.

In FIGS. 2 and 4 the circuitry 10 may be easily miniaturized by known techniques and be disposed adjacent switch 28. A series of 1½ volt or other dry cell batteries B may be disposed end-to-end in series relationship to form the battery 38. Transformer 24 is shown centrally mounted in the structure by attachment means 41 and 42. The entire structure may be a molded or otherwise include fabricated plastic case 43 having a battery-receiving opening 44 over which is pressed a cover 45. The latter may comprise hemi-cylindrical segment having outwardly extending detent flanges 46 and 47 overlapping horizontal beads 48 and 49 in the housing structure 43. Thus, all the parts may be easily molded in place, with the housing 43 including a central cavity 38 for receiving the series of batteries B as aforesaid. These batteries may be spring loaded by a spring S in the usual manner, such as in connection with flashlights. Leads 39 and 40 may be molded into the plastic case 43 to be connected to prongs 15 and 16.

With respect to the circuit of FIG. 1, jumper wire J may connect the lower ends of windings 23 and 35 so as to eliminate inter-winding sparks. This is shown by jumper wire J connecting between junction points J1 and J2.

Portion H of housing 43 comprises a handle portion, whereas the elongated extension portion P leading forwardly from the transformer terminates in shock probes 15 and 16.

The operation of the invention is as follows. Reference is now made to FIG. 1 wherein the circuitry to the left of the iron core depiction at 36 comprises a blocking oscillator, also known as a ringing-choke converter. The blocking oscillator is a well-known device fully described in the literature as, by way of example, the standard text Functional Circuits and Oscillators by Reich, Van Nostrand series published in 1961 at page 274 et seq. Detailed descriptions of such oscillators, including the present transistorized type, may be found at page 202 of Power Supplies for Electronic Equipment, published by Leonary Hill, and authored by Nowicki, 1971. See also the following references: T. Konopinski, 1962, "The Influence of Transformer Losses on the Operation of Ringing Choke Transistor Converters," Direct Current, February., pp. 55–8, and T. Konopinski, 1959, "Load Characteristics of Transistor Converter," Prace Inst. Tele-I Radiotech., Vol. 3, pp. 87–96. Such oscillators, likewise ringing choke converters, may be provided starting bias in the provision of resistors 19 and 20. An additional resistor, not shown, may be added in the emitter circuit including emitter 13, there be used to stabilize oscillation as desired. Such oscillators, termed relaxation oscillators, generate a series of rectangular pulses of large amplitude and duration, which may range from a fraction of a micro-second to several hundred micro-seconds, can be generated, as desired, by the feedback circuit utilized.

The crux of the invention involves the use, with the oscillator, of a step-up transformer circuit as at the right-hand side of FIG. 1 including spark gap 37. Where the spark gap is not included in series between prong 15 and secondary winding 35, then it has been found that the touching of the probes 15 and 16 against a recalcitrant cow, for example, will result in a change of impedance reflected back to the oscillator circuit, which will result in an interruption or stopping of the oscillation train of pulses thereat.

FIGS. 2–4 illustrate a physical embodiment of the circuits of FIG. 1 wherein an actual elongate cattle probe may be had. In the drawings in FIGS. 2–4 there is shown a housing 43 that includes handle H and also elongate portion P terminating in probes 15 and 16. The insulator I may be disposed in the right tip of the forwardly extending portion P in FIG. 2. Portion I may be made of any insulative material, as may also housing 43. Circuit 10 includes switch 28, see FIG. 3, and the housing may be hollow to receive the batteries B in series as illustrated in FIG. 3. A spring S may be supplied much as in the case of a flashlight, with leads 32 and 32′ connecting to the battery to the circuit 10. Transformer 24 and switch 28 are all so illustrated in FIG. 3.

To enclose the series of batteries there may be provided a cover 45 having formed snap-type flanges or margins 46 and 47. These will loop over horizontal beads 48 and 49 as shown in FIG. 4.

The structure of FIGS. 2–4, as contain the circuit of FIG. 1, operates as follows. When the batteries B are disposed within opening 38, then cover 45 is installed as per FIG. 4 and the device is ready for use. The user merely grasps the handle H and closes the normally-open switch 38. The switch may be either of the very simple type, i.e. singlepole, single-throw, so that the thumb remains on the switch while the probe is used. Alternatively, of course, there may be bi-stable or other types of switches used which do not require the application of a continuous thumb pressure in order to close, and releasably remain closed, the circuit of a transistor alone in FIG. 1. In any event, the oscillator operates to give a train of sharp-spaced pulses of large voltage magnitude, amplified by the step-up character of transformer 24. These pulses are applied to probes 15 and 16 by a spark gap 37. The spark gap is included in the circuit, again, so that the lower impedance that results, through connecting the probes 15 and 16 to the cattle hide, will not be reflected back so as to interrupt the operation of the oscillator. Rather, incorporation of the spark gap in the circuit as shown ensures the continuous series of shocks to be applied to any recalcitrant animal so long as the switch 28 remains closed.

Accordingly, the present invention provides a new and useful circuit and embodiment thereof forming a cattle probe or suitable for other uses as in riot control work and so forth.

While particular embodiments of the invention have been shown and described, it will be obvious to those skilled in the art the various changes and modifications which may be made without departing from the essential features of the present invention and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of the invention.

We claim:

1. An electrical shock-producing prod including, in combination: an oscillator means for producing a train of pulses; switch means coupled to said oscillator means for selectively turning said oscillator to free-running and also off conditions; battery means coupled to said oscillator means for powering the same; a transformer winding means coupled to said oscillator means for amplifying said pulses; spark gap means for cata-

clysmically conducting high-potential electrons across the gap thereof; and mutually spaced probes coupled across said transformer winding means, said spark gap means being serially interposed between one of said probes and said transformer winding means.

2. The combination of claim **1** wherein said oscillator means comprises a transistorized blocking oscillator.

3. The combination of claim **1** wherein said oscillator means comprises a transistorized blocking oscillator having an output step-up transformer, said step-up transformer including an output winding comprising said transformer winding means and coupled to said probes.

4. The structure of claim **1** wherein said prod includes a housing having a handle and also an elongate portion, forwardly extending from said handle, and having an insulative end, said probes being mounted proximate and extending forwardly of said end, said elongate portion including a cavity, said battery means comprising a series of axially aligned batteries operatively contacting one another, disposed in said cavity, and provided with means for coupling to said oscillator means.

5. A combination of claim **4** wherein said switch means is physically and accessibly disposed proximate said handle.

6. The structure of claim **4** wherein said prod includes an elongate cover releasably disposed over said cavity, whereby to withdrawably cover said battery means.

7. The structure of claim **4** wherein said transformer winding means is encased within said housing intermediate said handle and said elongate portion.

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