United States Patent [19]

Cole

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[54] SHOCKING DEVICE

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[52] **U.S. Cl.** **43/112**

[51] **Int. Cl.** **A01m 1/22**

[58] **Field of Search** 43/112, 98, 99, 17.1

[56] **References Cited**

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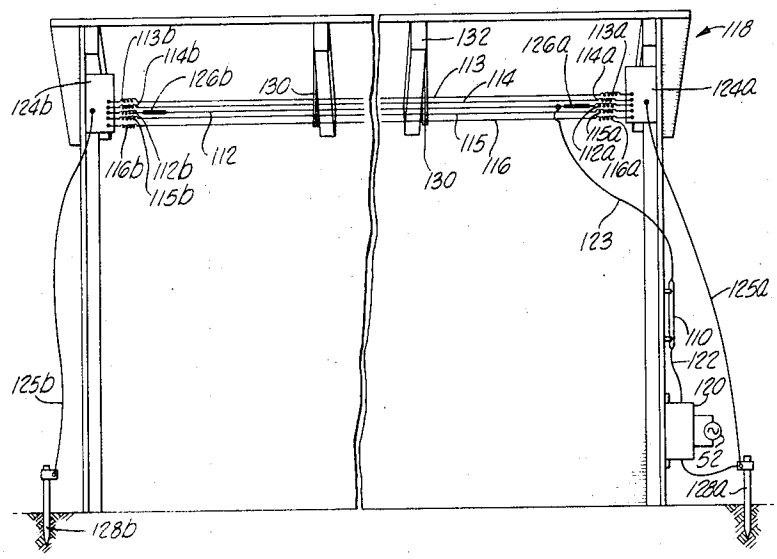
Primary Examiner—Warner H. Camp

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[57] **ABSTRACT**

Current is periodically supplied to a step-up transformer by means of a series of clock-actuated relay switches. A first conductor wire is connected at one end through a neon tube to one terminal of the secondary coil of the transformer and is insulated from ground at the other end. Four grounded conductor wires are secured parallel to and in spaced relation with the first conductor. The voltage between the first conductor and the grounded conductor wires is slightly below the breakdown voltage for the air gap spacing between the first conductor and the grounded wires. Insects flying between the first conductor and any one of the ground wires will shorten the air gap and, when power is being supplied to the transformer, provide a short between ground and the first conductor. Such insects will be shocked.

13 Claims, 5 Drawing Figures



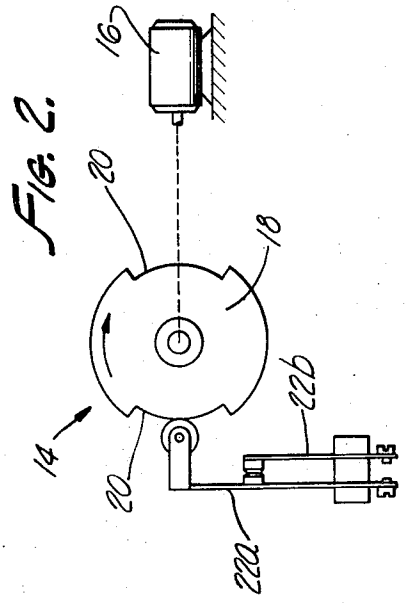


FIG. 2.

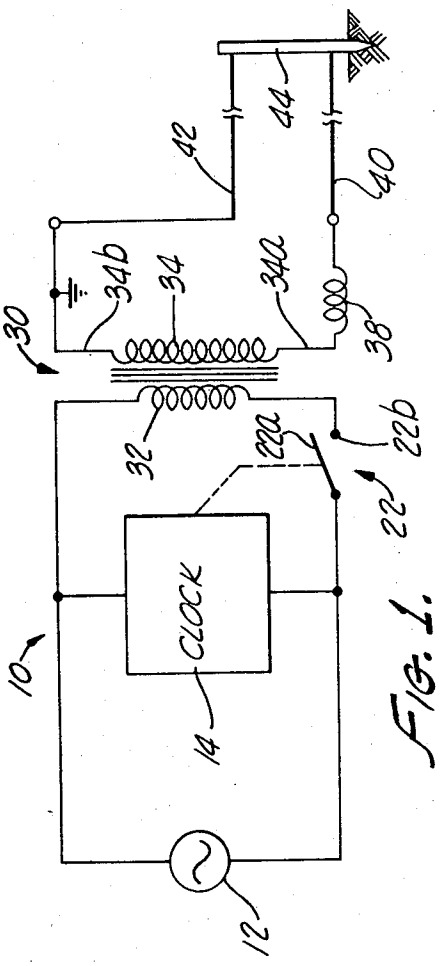


FIG. 1.

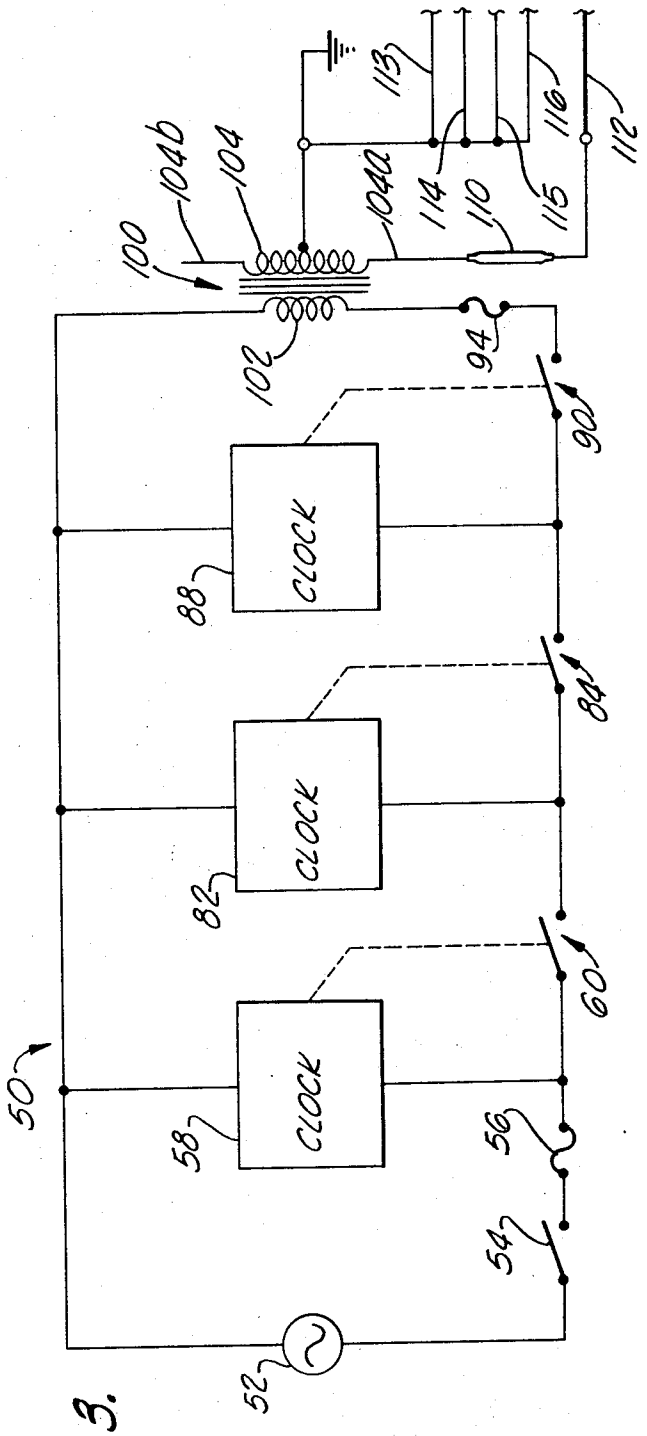


FIG. 3.

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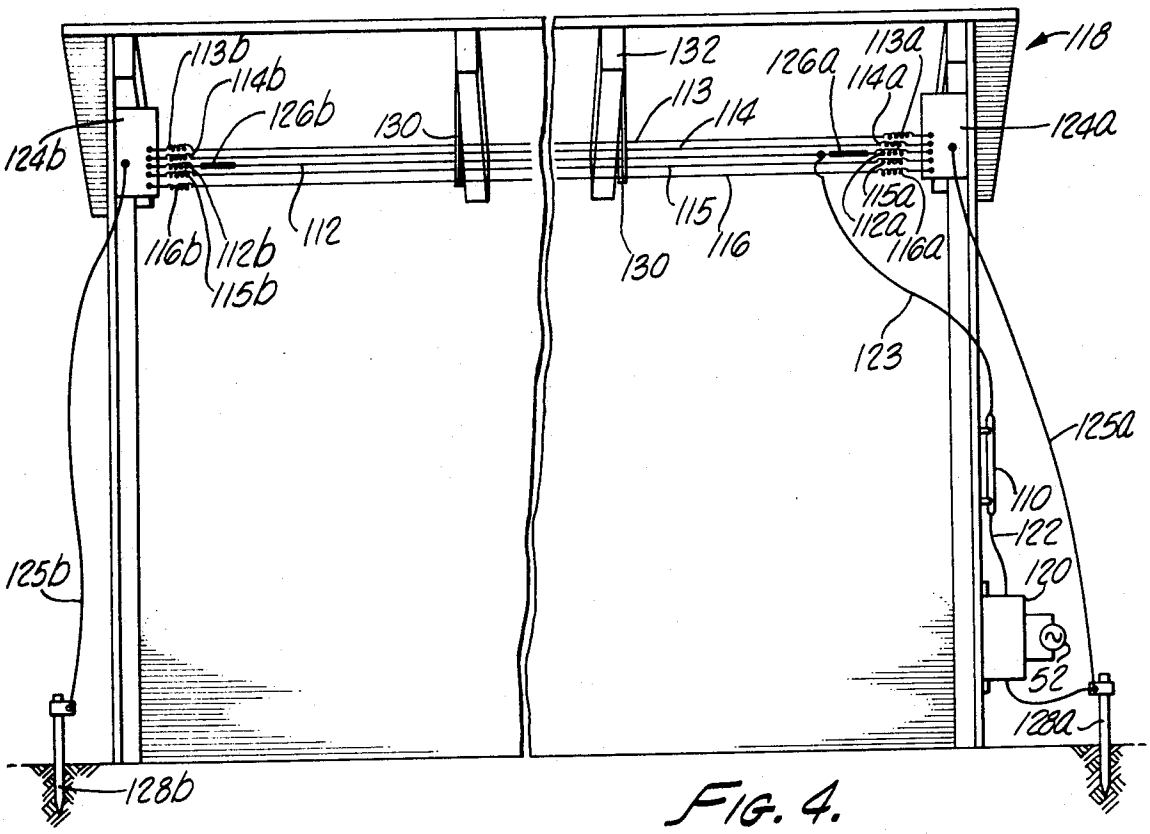


FIG. 4.

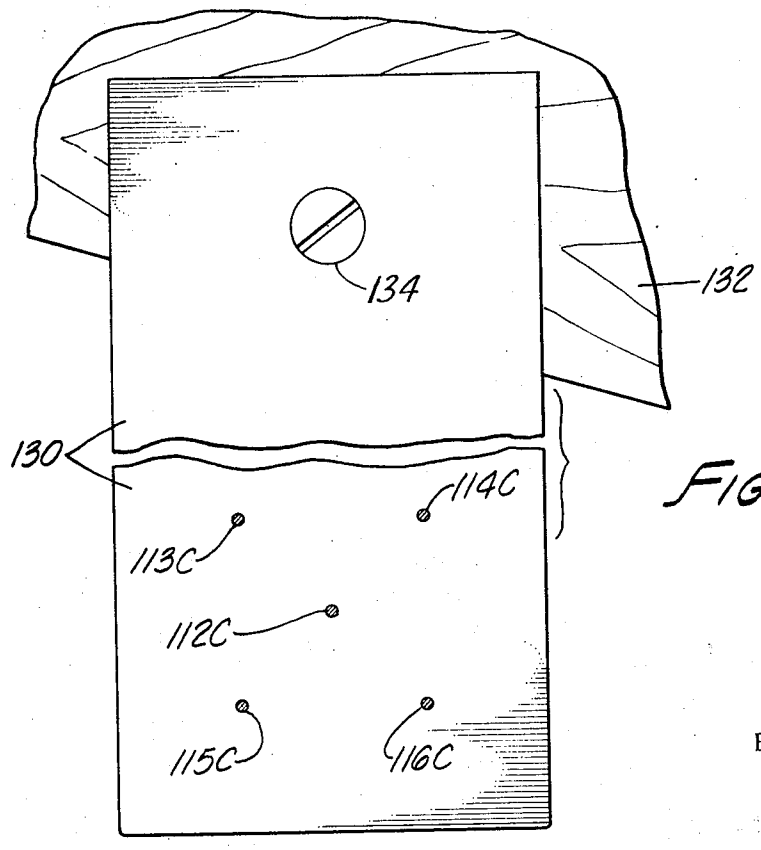


FIG. 5.

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SHOCKING DEVICE

BACKGROUND OF THE INVENTION

This invention concerns shocking devices, and more particularly a device for electrocuting flies and other flying insects.

Insect electrocutors of the prior art are described in Anderson U.S. Pat. No. 2,821,806, Partridge U.S. Pat. No. 2,912,787, and Anderson et al. U.S. Pat. No. 2,917,863. However, devices constructed in accordance with the teachings of these references frequently draw electrical arcs between the conductor wires. Constant arcing burns out the transformers employed in such devices after short periods of time. In addition, the wire conductors themselves break after short periods of time, such as 6 weeks, due to burning by the frequent arcing. The replacement of the transformer and wire conductors is quite expensive. Furthermore, the prior art devices create interference with the reception of nearby radios and televisions.

I have invented a more efficient and effective shocking device which employs clocks that supply AC voltage to a transformer for short intervals, such as for 1 second or less during every 2½ seconds or less. In addition, neon tube impedance or current limiting device is provided in series between the output of the transformer and a conductor connected to the transformer in order to impede the flow of current through this conductor and elsewhere in the system. By periodically supplying voltage to the transformer and by providing the neon tube between the transformer and the current carrying conductor, the life of the conductors is greatly extended (about one year) and the burning out of transformers is all but eliminated (no replacement in about one year). The device of this invention is thus much more economical to operate than the devices of the prior art since it does not require frequent repair and replacement of expensive parts.

The periodic supplying of voltages to the transformer also has another significant advantage of providing a safety mechanism in the event a person happens to contact both the current carrying wire and a ground wire at the same time when voltage is being supplied to the transformer. In one embodiment such a person will receive a low-current, high-voltage shock for about 1 second and will then have about 1½ seconds within which to disengage himself from the wires. Other appropriate time intervals may also be selected.

SUMMARY OF THE INVENTION

A system for electrocuting insects is provided wherein a pair of closely spaced wires are suspended in an area populated by such insects. The wires are connected across the secondary winding of a transformer having its primary winding connected to an alternating current power source of electrical power frequency. The wires are spaced apart a distance large enough to preclude electrical breakdown of the atmosphere when the space between the wires is free of insects but small enough so that electrical breakdown does occur when an insect enters the space between the wires. An impedance element connects one of the wires with the secondary winding of the transformer, which wire is not otherwise connected to the transformer or to other elements of the system.

The foregoing and other features of the invention will be understood by reference to the following descriptions taken in connection with the accompanying drawings wherein:

FIG. 1 is a wiring diagram illustrating a first embodiment of the invention;

FIG. 2 is a schematic drawing illustrating one part of the apparatus employed in the invention;

FIG. 3 is a wiring diagram illustrating a second embodiment of the invention;

FIG. 4 is a schematic diagram further illustrating the invention and how it is employed; and

FIG. 5 is a sectional elevational view illustrating a part of apparatus employed in the invention.

In the first embodiment of the invention, shown in FIG. 1, a circuit is provided which is connected to an AC power source **12**, such as a house wall plug which supplies 110 volts at 60 cps. While the invention is described and explained throughout this application with reference to an AC power supply of electrical power frequency of 20 to 400 cps, it will be recognized that certain modifications and changes could be made in order to adapt this invention to operate with a DC power supply.

In FIG. 1, the circuit **10** is connected to an AC power source **12** which generates power at electrical power frequencies. The motor winding of timing device or clock **14** is connected in parallel across the power supply **12**. The clock motor is driven by power supply **12**. Clock **14** is of a type that is designed to open and close relay switch **22**. The clock **14** is set so that it closes switch **22** for about 1 second and then opens switch **22** for about 1½ seconds. Therefore, relay switch **22** is closed for about 1 second during every 2½ second interval. Of course, other appropriate intervals, such as closing switch **22** for about one-fifth second during every 1 1/5 second interval, may be chosen.

Transformer **30** is an iron core voltage-step-up transformer, having primary coil **32** and secondary coil **34**, which primary coil **32** is connected in parallel across clock **14**. One terminal **34***a* of secondary coil **34** is connected in series to one leg of impedance device or coil **38**. A first conductor or current carrying wire **40** is connected to the other leg of coil **38**. The other terminal **34***b* of secondary coil **34** is connected to ground. A grounded conductor wire **42** is connected to terminal **34***b* of coil **34**. Wire **42** is positioned parallel to and spaced from conductor **40**. Both wire **42** and conductor **40** are suspended from the ground at their remote ends by an insulating post **44**, such as a wooden stud.

While many clocks are known which would be suitable for use as clock **14**, the clock **14** employed is shown in more detail in FIG. 2, wherein shaded pole clock motor **16** drives clock disc **18**, through gearing, (not shown), at about 12 rpm. Disc **18** has notches **20** formed in its periphery and is composed of an insulating material, such as fibrous board material. Relay switch contacts **22***a* and **22***b* are spring loaded to contact each other. Contact **22***a* rides on the periphery of disc **18**. As disc **18** rotates and contact **22***a* rides up on the periphery of disc **18** out of the notches **20**, switch contact **22***a* will be pushed away from switch contact **22***b*, thereby opening relay switch **22**. When contact **22***a* reaches a notch **20** during the rotation of disc **18**, contact **22***a* will snap into electrical contact with switch contact **22***b*, thereby closing relay switch **22**.

In operation of the device of FIG. 1, a high AC voltage is applied across the secondary coil 34 of transformer 30 continuously for about 1 second during every 2½ second interval. The coil 38 has such a value that when the conductor 40 is shorted to ground, such as by an insect flying between conductor 40 and grounded wire 42, as will be explained more fully hereinafter, the arcing which occurs will do little damage to the conductor 40 and wire 42. For example, when about 4500 volts is developed across coil 34, arcing will not occur between wire 42 and conductor 40 until an insect flies between the wire and the conductor when the wire and the conductor are spaced about three-eights of an inch apart. When an insect flies between the wire and the conductor, the arcing will cause little damage.

FIGS. 3 and 4 together show the best embodiment of the invention. Referring first to FIG. 3, the circuit 50 is connected to low frequency AC power source 52. Power switch 54 is connected in series with source 52 in order to connect and disconnect the circuit 50 from power source 52. Power switch 54 is used mainly to disconnect the circuit when maintenance or the like is required. Fuse 56 is connected in series with power switch 54 in order to protect the remainder of the circuit 50 from damage due to power surges.

The motor winding of first clock 58 is connected across power source 52, power switch 54, and fuse 56. The clock motor of clock 58 is driven by the power source 52 and the clock operates first relay switch 60. Clock 58 and switch 60 are similar to those shown in FIG. 2 and previously described. Clock 58 is timed to close relay switch 60 continuously only during the time of day when flying insects are a problem at the particular installation. For example, clock 58 is typically set to close relay switch 60 between about 11:00 a.m. and 5:00 p.m. every day and to open switch 60 at all other times.

The motor winding of second clock 82 is connected in parallel across first clock 58 and first relay switch 60 and is driven by power source 52 when switch 60 is closed. Clock 82 operates to open and close second relay switch 84. Clock 82 is similar in construction to first clock 58. Second clock 82 closes second relay switch 84 continuously for only about 30 seconds during every 10 minute interval.

The motor winding of third clock 88 is connected in parallel across second clock 82 and second relay switch 84. Clock 88 closes third relay switch 90 continuously for only about 1 second during every 2½ second interval when switches 60 and 84 are closed. Clock 88 is the same as clock 14 shown in FIG. 2 and previously described.

Fuse 94 is connected in series with third relay switch 90 in order to protect transformer 100 from power surges. Primary coil 102 of transformer 100 is connected in parallel with third clock 88, third relay switch 90, and fuse 94. Transformer 100 is an iron core step-up transformer having primary coil 102 and secondary coil 104. Secondary coil 104 is center tapped to ground.

A sealed, neon gas filled, tube 110, about 12 inches long and about 12 mm in diameter, is connected in series with secondary coil 104. Conductor 112 is connected in series with a current limiting device 110. In this embodiment, the current limiting device is an electric gaseous discharge device, such as a neon tube. Grounded wire conductors 113, 114, 115 and 116 are connected to the grounded center top of secondary coil 104. Grounded conductor wires 113, 114, 115, and 116, are spaced from and extend parallel to conductor 112, as will be more fully explained hereinafter.

In operation, when the circuit 50 shown in FIG. 3 is connected to power supply 52 and when power switch 54 and relay switches 60, 84, and 90 are closed, voltage will be applied to transformer 100 for about one second intervals for 30 seconds every ten minutes during 11:00 a.m. and 5:00 p.m. of every day. The voltage across primary coil 102 is stepped up by transformer 100 so that about 9000 volts appears across secondary coil 104. When there is no short between conductor 112 and any one of the grounded conductors 113, 114, 115, or 116, no current flows in conductor 112. However, when a short occurs between conductor 112 and one of the grounded wires, current flows through neon tube 110 and conductor 112. In this short situation, neon tube 110 glows brightly or lights to indicate that a short is occurring. Neon tube 110 is also an arc suppressor and acts to impede the current flowing in conductor 112.

The entire apparatus shown in FIG. 3, except for power source 52 and neon tube 110, is enclosed in box 120 shown in FIG. 4. The ground connections shown in FIG. 3 are connections to the box 120, which box is in turn grounded. An insulated wire 122, such as a conduit wire, conducts current from secondary coil 104 out of box 120 to neon tube 110. Neon tube 110 is secured to the side of a structure 118, such as a chicken coop, where it is desired to control flies or other flying insects.

Below the roof of the structure 118 where flying insects gather, such as about one-half foot below the roof, are secured conductor 112 and four grounded wire conductors 113, 114, 115 and 116. The four grounded conductors 113, 114, 115 and 116 are arranged at the corners of a square. The conductor 112 is positioned in the center of the square. Such an arrangement may be more clearly seen in FIG. 5 where holes 112*c*, 113*c*, 114*c*, 115*c*, and 116*c* are provided in spacer 130 to receive the conductors 112, 113, 114, 115 and 116. Conductor 112 is positioned below the grounded wires 113 and 114. Grounded wires 115 and 116 are in a horizontal plane below conductor 112.

Each grounded wire 113, 114, 115, and 116 is spaced from the conductor 112 by a distance slightly greater than the minimum distance for the breakdown voltage of air for the voltage which is charging the conductor 112. In the embodiment of the invention shown in FIGS. 3 and 4, each of the wires 113, 114, 115, and 116 in spaced from conductor 112 by about three-eights of an inch. In addition, each of the wires 113, 114, 115, and 116 are spaced from each other by an angle of about 90°.

The grounded wires 113, 114, 115 and 116 are each secured to structure 118 at both ends. Springs 113*a*, 114*a*, 115*a*, and 116*a* are connected to conductive plate 124*a* and secure wires 113, 114, 115, and 116 respectively to structure 118 at one end. The grounded wires 113, 114, 115, and 116 are secured by a similar plate 124*b* and by springs 113*b*, 114*b*, 115*b*, and 116*b* at their other end to structure 118. Plates 124*a* and 124*b* are pieces of angle iron or the like. Conductor

112 is secured to plate 124*a* by spring 112*a* and insulator 126*a*. Conductor 112 is similarly secured to plate 124*b* by means of spring 112*b* and insulator 126*b*. Insulators 126*a* and 126*b* are secured between springs 112*a* and 112*b* and conductor 112 respectively in order to insulate conductor 112 from ground. Insulators 126*a* and 126*b* are composed of glazed ceramic material or the like.

Current is conducted from neon tube 110 by insulated wire 123, such as conduit or the like. Ground rods 128*a* and 128*b* are electrically connected, by means of insulated wires 125*a* and 125*b*, to plates 124*a* and 124*b* respectively so that plates 124*a* and 124*b* and ground wires 113, 114, 115, and 116 are grounded.

Conductors 112, 113, 114, 115 and 116 are composed of suitable electrically conductive material. In the best embodiment of the invention, all of these conductors are composed of stainless steel in order to limit the amount of rust formed on these conductors and to therefore decrease the amount of necessary repairs of the wires. The wire is about 0.03 inches in diameter and is 150 feet long or more. Such wire typically has a resistance of about 480 ohms per millimeter-foot.

The conductors 112, 113, 114, 115 and 116 are secured in spaced relationship to the roof of structure 118, and are also held spaced from each other, by means of a series of insulating spacers 130 mounted under the roof of the structure 118, as may be seen in FIGS. 4 and 5. In the best embodiment of the invention, the spacers 130 are secured to beams 132 or the like of the roof of the structure 118 about every eight feet. Spacers 130 are composed of glazed ceramic material or the like. Each plate 130 has at least six holes preformed at predetermined positions in the plate. The plates 130 are secured to the beams 132 by means of a screw 134 or the like driven through the hole in the upper portion of each plate 130. The holes 112*c*, 113*c*, 114*c*, 115*c* and 116*c* formed in the lower portion of each plate 130 are formed in the relationship previously described for the conductor and grounded wires. These holes receive the conductor 112 and wires 113, 114, 115 and 116. The spacers 130 thus hold the conductor and wires below the roof structure 118 in the spaced relationship previously described.

In operation, when voltage is supplied to the transformer 100 of the embodiment of the invention shown in FIGS. 3 and 4, flying insects, such as flies or the like, which fly between conductor 112 and any one of the grounded wires 113, 114, 115 or 116 will sufficiently shorten the air gap between the conductor and the respective grounded wire so that current, in the form of an arc, will flow between the conductor 112 and the respective grounded wire and electrocute the insect. At the same time, neon tube 110 will glow brightly because of the flow of current, thus indicating a short between the conductor 112 and ground. When the insect falls out of the air gap between the conductor 112 and one of the grounded conductors, the flow of current and the arcing will cease. Alternatively, if the insect or some other conducting object remains in the air gap between the conductor 112 and one of the grounded conductors, current will cease to flow after a maximum of about 1 second since the third clock 88 will then open the third relay switch 90. If the object in the air gap is not removed while relay switch 90 is open, neon tube 110 will flash brightly for about 30 seconds during every 10 minute interval, between 11:00 a.m. and 5:00 p.m. each day. This intermittent bright flashing will indicate to an observer than an object is causing a short and should be removed.

Thus, a device is provided for shocking flying insects and the like, while at the same time providing a device which is safe for use around humans and which is not in need of continual repair. It is to be understood, of course, that the invention may be modified in many ways within the scope of the appended claims. In particular, it is to be understood that the invention is not limited to the specific embodiments wire configuration, or clock settings disclosed or to the numerical values employed in describing the invention. Furthermore, many other types of components may be employed in practicing the invention in place of those which have been specifically described.

The invention claimed is:

1. A shocking device having a circuit adapted to be connected to a power source, said shocking device comprising:
   - a conductor connected to said power source;
   - signal interrupting means connected to said circuit to periodically interrupt the signal from said power source to the conductor; and
   - an electric gas discharge device connected between said power source and said conductor, said electric gas discharge device being adapted to restrict the flow of current in said conductor in a predetermined manner in order to reduce the burning of said conductor when current is flowing through the conductor during shocking.

2. A shocking device as defined in claim 1 wherein said electric gas discharge device comprises a sealed, neon gas filled, tube and further comprising voltage step-up means adapted to step-up the voltage from said power source and to apply said voltage across said conductor and ground.

3. An insect controlling device having a circuit adapted to be connected to a power source, said circuit comprising:
   - a current interrupter connected to said power source and adapted to continuously connect the circuit to said power source for short intervals of less than about 1 second;
   - a transformer having a primary coil adapted to have voltage supplied across it by said power source and said current interrupter, the secondary coil of said transformer having first and second terminals;
   - an electric gas discharge device having a first end connected in series to a first terminal of the secondary coil of said transformer; and
   - a first conductor connected to a second end of said electric gas discharge device in series with said electric gas discharge device and said secondary coil, said electric gas discharge device being adapted to restrict the flow of current in said conductor in order to reduce the burning of said conductor when current is flowing through said conductor.

4. An insect controlling device as defined in claim 3 further comprising at least two second conductor wires coextensive with said first conductor and positioned in substantially parallel relation thereto, said first conduc-

tor being spaced from each of said second conductor wires by a distance which slightly exceeds the dielectric strength of air between the conductor and said second wires for the voltage between said conductor and said second wires.

5. An insect controlling device as defined in claim 4 wherein said electric gas discharge device comprises a sealed, neon gas filled, tube.

6. A shocking device having a circuit adapted to be connected to an alternating current power source, said circuit comprising:

a first current interrupter adapted to be connected to said power source and to supply voltage to the remainder of the circuit for less than about one-half of every 24 hour interval;

a second current interrupter adapted to be connected to said power source by said first current interrupter and to continuously supply voltage to the remainder of the circuit for about 30 seconds during about every 10 minute interval;

a third current interrupter adapted to be connected to said power source by said first and second current interrupters and to continuously supply voltage to the remainder of the circuit for about one second during about every 2½ second interval;

a transformer having a primary coil adapted to be connected to said power source by said first, second and third current interrupters;

a first conductor connected to a first terminal of the secondary coil of said transformer; and

an impedance device connected between said conductor and said secondary coil, said impedance device being adapted to impede the amount of current flowing through said conductor.

7. A shocking device as defined in claim 6 wherein said impedance device comprises a sealed, neon gas filled, tube connected in series between said secondary coil of said transformer and conductor, said neon tube being adapted to glow brightly when current flows through said conductor.

8. A shocking device as defined in claim 7 further comprising four grounded conductor wires coextensive with said first conductor and positioned in parallel relation thereto, each grounded conductor wire being spaced from said first conductor by about three-eights of an inch and being positioned at an angle of about 90° from each other grounded conductor wire, two of said grounded wires being positioned below said first conductor and two of said grounded wires being positioned above said first conductor.

9. In an insect controlling device adapted to be connected to a power source having a current carrying wire secured beneath the roof of a structure, said insect controlling device comprising:

a power switch adapted to disconnect said controlling device from said power source;

a first clock adapted to be connected to said power source;

a first relay switch adapted to be continuously closed by said first clock only for about one-fourth of each 24-hour interval;

a second clock adapted to be connected to said power source by said first clock and said first relay switch;

a second relay switch adapted to be continuously closed by said second clock only for intervals of less than about 1 second and only when said first and second relay switches are closed;

a transformer having a primary coil adapted to be connected to said power source only when said first and second relay switches are closed simultaneously;

a sealed neon filled tube having a first end connected to a first leg of the secondary coil of said transformer;

a first conductor connected in series with said neon tube to the second end of said neon tube, said neon tube being adapted to restrict the current flowing through said first conductor and being adapted to glow brightly when current flows through said neon tube;

at least two conductor wires coextensive with said first conductor and positioned in parallel relation thereto, each conductor wire being spaced from said first conductor by about three-eighths of an inch the voltage charging said first conductor being slightly below the breakdown value of air for the spacing between the first conductor and the wires;

said conductor wires and said first conductor extending beneath the roof of said structure and being held in place in spaced relation with each other by insulating spacing members secured to said structure; and

said conductor wires and said first conductor being resiliently connected at their ends to said structure.

10. In a system for electrocuting insects wherein a pair of closely spaced wires are suspended in an area populated by such insects, said wires are connected across a secondary winding of a transformer having its primary winding connected to the power source, and said wires are spaced apart by a distance large enough to preclude electrical breakdown of the atmosphere when the space between the wires is free of insects but small enough so that electrical breakdown does occur when an insect enters the space between the wires, the improvement comprising an electric gas discharge device interconnecting one of the wires with the secondary winding of the transformer, said electric gas discharge device being adapted to restrict the flow of current through said one wire in a predetermined manner in order to reduce the burning of said wires when current is flowing through said wires during electrical breakdown.

11. A shocking device having a circuit adapted to be connected to an alternating current power source, said circuit comprising:

a first settable current interrupter adapted to be connected to said power source and to supply voltage to the remainder of the circuit for less than about one-half of every 24-hour interval;

a second current interrupter adapted to be connected to said power source by said first current interrupter and to continuously supply voltage to the remainder of the circuit for intervals of less than about one second;

a transformer having a primary coil adapted to be connected to the power source by said first and second current interrupters;

a first conductor connected to a first terminal of the secondary coil of said transformer; and

an electric gaseous discharge device connected between said conductor and said secondary coil, said gaseous discharge device being adapted to restrict the current flowing through said conductor in a predetermined manner in order to reduce the burning of said conductor when current is flowing through said conductor during shocking.

12. A shocking device as defined in claim 11 wherein said gaseous discharge device comprises a sealed, neon gas filled, tube connected in series between said secondary coil of said transformer and said conductor, said neon tube being adapted to glow brightly when current flows through said conductor.

13. A shocking device as defined in claim 12 further comprising at least two conductor wires coextensive with said first conductor and positioned in parallel relation thereto, said first conductor being spaced from each of said conductor wires by a distance which slightly exceeds the dielectric strength of air between said first conductor and said wires for the voltage between said first conductor and said wires.

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