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- [54] BURGLAR DETERRENT**
8 Claims, 1 Drawing Fig.

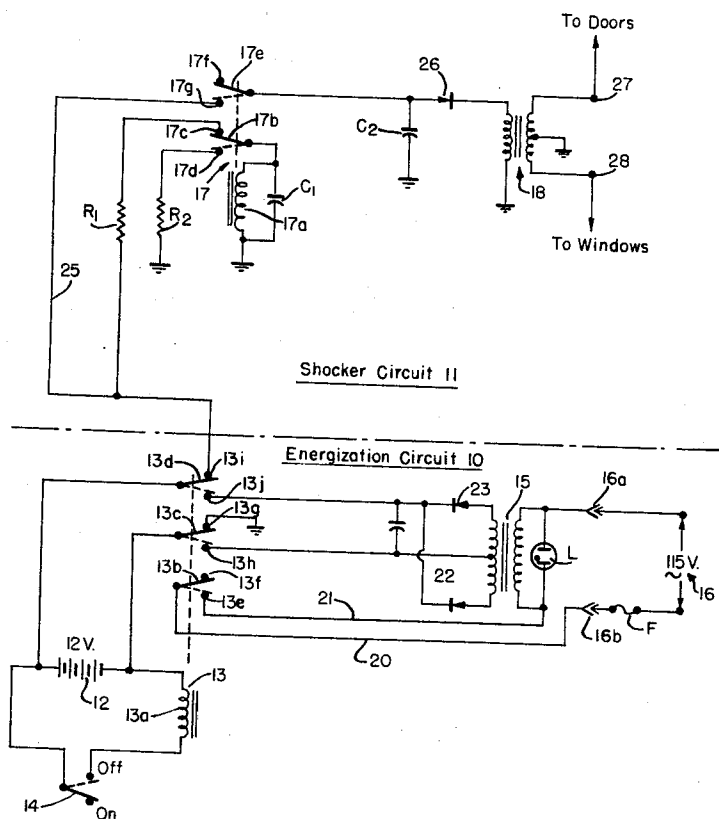
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150; 321/14, 8, 21, 54; 43/59, 98; 109/35

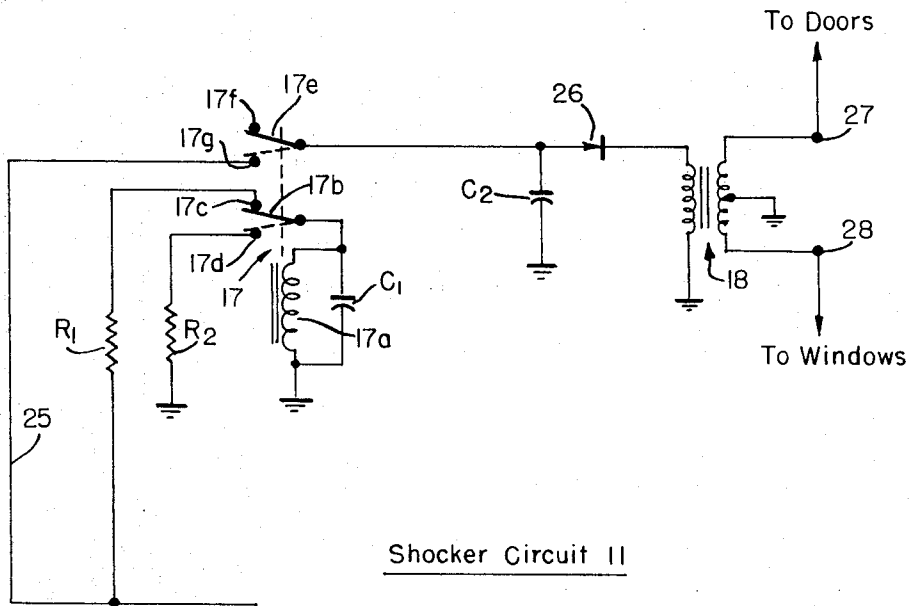
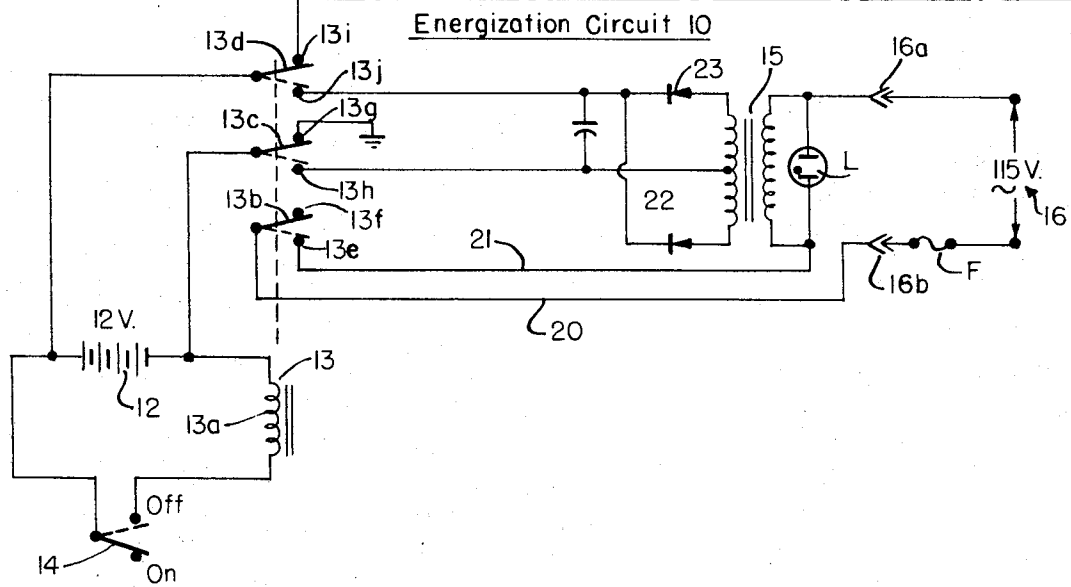
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ABSTRACT: A shocker circuit is provided comprising a timing circuit arranged to periodically energize the primary of a transformer from a relatively low voltage rechargeable DC supply. The secondary of the transformer is connected to potential entry locations of a building to be protected, or to other ungrounded metallic objects, and operates to apply high voltage low current pulses thereto. A switching circuit selectively connects a recharging source, energized from a higher voltage main power supply, to the DC supply for charging purposes, said switching circuit being so arranged that the main power supply is never applied to the shocker circuit and any attempt to disable the recharging circuit assures that the shocker circuit is fully operative.





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BURGLAR DETERRENT

BACKGROUND OF THE INVENTION

"Shocker" type devices have been suggested for a wide variety of purposes in the past, e.g., bird repellers, and so-called "fence chargers" adapted to electrify the boundaries of an enclosure to confine animals such as cattle. Circuits of this general type are capable of use not only for the purposes mentioned, but also as burglar deterrents. More particularly, known "fence chargers," which characteristically operate to produce one or more relatively high voltage output pulses, can be coupled to an area to be protected so as to deter the entry of undesirable individuals to that area. However, notwithstanding the capability of known "fence charger" for such use, burglar deterrents of the types suggested herein have not in fact been available commercially to any extent heretofore, primarily because of the risk to life which prior art "fence chargers" may impose when used in a home environment.

To the extent that it has been desired to employ an available 115 volt AC home power source for energization of an "electric fence" or the like, arrangements suggested heretofore have been subject to the possible danger that failure or improper operation of some electrical component in the circuit may impose full line voltage on an element accessible to human touch, with attendant risk to life. Such a system is not acceptable as a burglar deterrent in a home environment. Indeed such a system would be prohibited for installation under regulations existing in many communities, which regulations prohibit any "protective" circuit from being operated by more than a relatively low potential, e.g., 25 volts. When efforts are made to avoid this difficulty, e.g., by employing a relatively low voltage battery source for energization, the resultant circuit cannot normally employ a battery of the rechargeable type since the very use of a higher voltage recharging source still subjects the system to the possible danger that the high voltage may be applied to elements which can be engaged by humans. The use of a nonrechargeable battery source as the sole source of energization, on the other hand, necessarily gives the system a limited operational life, and imposes maintenance problems to assure proper voltage output from the battery, and to periodically replace the battery.

The foregoing disadvantages of known systems have been aggravated, moreover, by the fact that systems suggested heretofore are often relatively complex, and costly to manufacture, install, and maintain in proper operating condition. All of these problems have limited the usefulness of "shocker" type circuits suggested heretofore, and have for all practical purposes prevented their utilization in home environments as burglar deterrents.

The present invention, recognizing these characteristics of systems suggested heretofore, is concerned with an improved shocker system of simplified, highly reliable circuit configuration, adapted for use in home environments as burglar deterrents.

SUMMARY OF THE INVENTION

In accordance with the present invention, a shocker type burglar deterrent is provided comprising an RC timed switching circuit adapted to apply relatively high current, relatively low voltage pulses to the primary winding of a step-up transformer. The secondary of the transformer, in response to the pulsing of its primary, produces relatively low current, relatively high voltage pulses; and these pulses can in turn be connected to parts of a building structure to be protected against burglars whereby a burglar coming into contact with such building structure parts will be exposed to high voltage nonlethal repeated electrical shocks. The transformer secondary is preferably center tapped to provide two substantially independent output circuits one of which may be coupled to the doors, etc., of a building, and the other of which may be coupled to the windows, etc., of the building; and said output circuits may also be connected to ungrounded metallic struc-

tures within the building itself, e.g., safes, storage cabinets, etc. The arrangement is such that any attempt to impair the circuit operation at any particular location, e.g., by a burglar coming into contact with that location, or attempting to apply a ground connection thereto, would actually have little or no effect on the circuit output at that location or at any other location in the building.

The battery source employed for energization of the shocker circuit is in turn associated with a further switching device controlled by a main key-operated switch arranged to selectively disconnect the battery source from the shocking circuit and to connect it to a recharging circuit operated from the main powerline for recharging purposes. The key-operated switch circuit is such that the main powerline is at no time, and cannot be, connected to any part of the shocker circuit; and this assures that the relatively high voltage of the main powerline is completely isolated from the shocker circuit. In addition, the key-operated switch arrangement is such that the main powerline is positively isolated from the key-operated switch itself to avoid any possibility of relatively high voltage being applied thereto. In addition, the key-operated switch arrangement is such that any attempt to disable the key-operated switch circuit actually results in the shocker circuit being rendered operative, rather than being disabled; whereby attempts by a burglar to impair the operation of the circuit at locations normally accessible to such a burglar, e.g. the key switch in a door, etc., will have no practical effect on the deterring operation of the overall system.

BRIEF DESCRIPTION OF THE DRAWING

The foregoing features and operation of the present invention will become more readily apparent from the following description and accompanying drawing, comprising a schematic diagram of a burglar deterrent shocker circuit constructed in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A burglar deterrent shocker circuit constructed in accordance with the present invention can, as indicated in the drawings, be broadly divided into two circuit portions comprising an energization circuit 10 and a shocker circuit 11. Energization circuit 10 comprises a relatively low voltage DC battery 12, e.g., a rechargeable battery of the type conventionally employed in automobiles, associated with a switching circuit comprising a relay 13 and a key-operated main switch 14 selectively operative to connect battery 12 either to a charging circuit energized from main powerline 16, or to shocker circuit 11. The details of energization circuit 10 will be described with greater particularity subsequently.

Shocker circuit 11 in its broadest aspects comprises an RC timing circuit adapted to control the energization of a relay 17, with said relay 17 in turn functioning to periodically connect and disconnect battery 12 to and from the primary winding of a transformer 18. The high voltage, low current output across the secondary of transformer 18 is used for burglar deterrent purposes.

Switching relay 13, in energization circuit 10, comprises a coil 13a the state of energization of which controls the position of three movable contacts 13b, 13c, and 13d. Movable contact 13b selectively switches between fixed contacts 13e, 13f to control application of line power from line 16 to the recharging circuit. Movable contact 13c selectively switches between fixed contacts 13g, 13h to connect one side of the battery 12 either to one side of the recharging circuit, or to ground (comprising one side of shocker circuit 11). Similarly movable contact 13d selectively switches between fixed contacts 13i, 13j to selectively connect the other side of battery 12 either to the recharging circuit or to shocker circuit 11. The actual positions of the several movable contacts 13b, 13c and 13d are controlled by the state of energization of relay coil 13a which is connected in series with battery 12 through key-operated switch 14.

Switch 14 is movable between two positions designated "on" and "off." These "on" and "off" designations refer to the state of operation of the shocker circuit; and it will be noted that the shocker circuit 11 is actually "on" when switch 14 is open circuited. This condition of operation is depicted in the drawings by the full line representation of switch 14, and by the corresponding full line representations of movable relay contacts 13b, 13c and 13d. When the shocker circuit is "off," switch 14 is moved to the position depicted in broken line in the drawings; and relay contacts 13b, 13c and 13d correspondingly move to the positions designated in broken line. It will be noted that switch 14, by reason of the connection shown in the drawings, cannot have more than 12 volts applied to it even when it is in its "off" position; and at no time can the main power source 16 be applied to any portion of switch 14. This constitutes a positive safety feature, in full compliance with regulations in many localities.

Considering energization circuit 10 in greater detail, it will be noted that powerline 16 has one side coupled to a separable connector 16a and thence to one side of the primary in a step-down transformer 15. The other side of powerline 16 is coupled via a fuse F to separable connector 16b and thence via line 20 to movable contact 13b of relay 13. Fixed contact 13e is in turn connected via line 21 to the other side of the primary winding in transformer 15. By reason of this arrangement, energization of transformer 15 from line 16 is controlled by main switch 14 and relay 13 so that when switch 14 is in its "on" position, transformer 15 is disconnected from line 16, thereby to further eliminate any possibility of line voltage being imposed on any part of shocker circuit 11 or switch 14.

Separable connectors 16a and 16b are provided to permit the line 16 to be disconnected from the remaining portions of energization circuit 10 and shocker circuit 11. In this respect, circuits 10 and 11 are housed together in a casing of relatively small size and ready portability; and as will become apparent from the subsequent description, shocker circuit 11 will operate properly from battery source 12 even though line 16 is disconnected therefrom at 16a and 16b. This permits the overall system to be readily transported to other locations, e.g., for use by persons who may wish to temporarily provide a burglar deterrent in their automobile, boat, airplane, etc., or for use by hunters, campers, or military personnel who wish to use the equipment to set up a temporary protective enclosure.

Considering now the operation of the energization circuit 10 for the "off" position of key-operated switch 14, it will be noted that when switch 14 is moved to its "off" position coil 13a of relay 13 is connected across battery 12. The resultant energization of relay coil 13a moves relay contacts 13b, 13c, and 13d into contact with fixed contacts 13e, 13h, and 13j, respectively. When movable contact 13b makes with fixed contact 13e, a circuit is completed via lines 20 and 21 between line 16 and the primary of transformer 15 to energize said transformer.

The energization of transformer 15, which corresponds to the "charging" condition for battery 12, may be monitored by a glow lamp L which may be connected across the primary of transformer 15 as illustrated. The reduced voltage across the secondary of transformer 15 is rectified by diodes 22 and 23 and applied to fixed contacts 13h and 13j which, in turn, are connected via movable contacts 13c and 13d to the opposite sides of battery 12.

Thus, in the "off" condition of switch 14, transformer 15 is energized; power is supplied to battery 12 for charging purposes; and the battery 12 and line source 16 are positively disconnected from shocker circuit 11 by reason of the fact that movable contacts 13c and 13d are in engagement with fixed contacts 13h and 13j rather than in engagement with contacts 13g and 13i. The shocker circuit is thus rendered inoperative, and a continuous trickle charge is applied to battery 12.

When switch 14 is moved to its "on" position, said switch 14 is actually opened so as to break the energization circuit for relay 13; and this ultimately operates to deactivate the charg-

ing circuit for battery 12, and also renders shocker circuit 11 operative. In this respect, moreover, it should be noted that a similar result is accomplished if anyone cuts one of the lines leading to switch 14. Thus if a burglar, in an attempt to impair operation of the system, should try to disconnect or otherwise deactivate switch 14, such attempts will actually result in shocker circuit 11 being rendered operative rather than inoperative.

With switch 14 in its "on" position, and relay coil 13a deenergized, movable contacts 13b, 13c, and 13d are caused to move, by appropriate spring means forming a portion of relay 13, to the positions shown in full line in the drawing. Contact 13b breaks from fixed contact 13e, and thereby opens the energization circuit to the primary of transformer 15, thus preventing any voltage from being inadvertently applied via the transformer 16 secondary to switch 14 or to shocker circuit 11. Movement of contact 13c connects one side of battery 12 to grounded contact 13g, thereby completing an energization circuit from one side of battery 12 to the grounded side of shocker circuit 11; and movement of contact 13d into engagement with contact 13i connects the other side of battery 12 to shocker circuit 11. At the same time, the breaking of contacts 13c and 13d from fixed contacts 13h and 13j further assures that there is no possibility of main line voltage from line 16 being imposed on shocker circuit 11.

Shocker circuit 11 includes the aforementioned relay 17, comprising relay coil 17a shunted by a capacitor C₁. Relay 17 further includes a movable contact 17b switchable between fixed contact 17c, 17d; and movable contact 17e switchable between fixed contact 17f, 17g. Contact 17c is connected via a resistor R₁ to contact 13i of switching relay 13; and said contact 13i is also connected via line 25 to contact 17g of relay 17. Contact 17d of relay 17 is connected via a further resistor R₂ to ground. Movable contact 17b is connected to the parallel circuit comprising relay coil 17a and capacitor C₁.

Movable contact 17e is connected via an arc suppression circuit, consisting of capacitor C₂ and diode 26, to the primary of transformer 18. The secondary of transformer 18 may be of the grounded center-tap type, as illustrated, with the opposing ends of said secondary connected to terminal 27 and 28. Terminals 27 and 28 may each, in turn, be parallel connected respectively to the several doors and windows in a building being protected.

Alternatively, the secondary of transformer 18 may be of the single-ended type.

If center-tapped, the center tap of the transformer secondary may or may not be connected to the frame of the transformer. In the single-ended version, one end of the secondary is connected to ground, with the opposite end of the secondary being connected to doors, windows, etc., to be protected. In the grounded center-tap transformer arrangement, there are effectively two outputs which are relatively independent of each other with respect to ground. If desired, the full output voltage of the center-tapped transformer may be employed by connecting the transformer in the manner of the single-ended transformer, ignoring the center tap of the secondary. In addition, in such an arrangement, the center tap of the secondary can be used as another output of reduced voltage. The output in either case may be taken from terminal 27 and, if used, from terminal 28 in the case of a center-tapped secondary. The output from terminal 27, and, if used, terminal 28, may be connected to articles or locations to be protected, e.g., doors, windows, etc.

With switch 14 in its "on" position, one side of battery 12 is connected via relay 13 (movable contact 13d and fixed contact 13i) to resistor R₁ and thence via fixed contact 17c and movable contact 17b to one side of capacitor C₁. The other side of capacitor C₁ is grounded, and is thereby effectively connected to the other side of battery 12 via grounded contact 13g and movable contact 13c of relay 13. For this condition of operation, therefore, a series timing circuit comprising resistor R₁, and capacitor C₁ in conjunction with relay coil 17a, is connected across battery 12. At this same time, battery 12 is

disconnected from transformer 18 by reason of the fact that movable contact 17e does not engage relay contact 17g.

Capacitor C₁ charges through resistor R₁ under the conditions specified, and, after a time interval determined by the values of R₁ and C₁, a potential is built up across capacitor C₁ sufficient to operate relay 17. When coil 17a is energized by a sufficient potential across capacitor C₁, contact 17b and 17e are moved into their broken-line positions, i.e., into engagement with fixed contacts 17d and 17g respectively. A circuit is thus completed from one side of battery 12 via line 25, fixed contact 17g and movable contact 17e to the primary of transformer 18. At the same time, the movement of contact 17b into engagement with fixed contact 17d disconnects capacitor C₁ from its charging circuit, and completes a discharge circuit for said capacitor C₁ via resistor R₂.

Capacitor C₁ discharges at a rate determined by resistor R₂ and the ohmic value of relay coil 17a, which discharge rate may, indeed, be different from its charge rate via resistor R₁. When the voltage across capacitor C₁ falls to a potential insufficient to maintain energization of relay coil 17a, spring means associated with contact 17b and 17c move said contacts into their full line positions, in engagement with contact 17c and 17f. This breaks the energization circuit for the primary of transformer 18 and, in accordance with known principles, transformer 18 accordingly produces a high voltage pulse across its secondary which is then applied via terminals 27 and/or 28 to the doors, windows, etc. of an area being protected. The return of movable contact 17b into engagement with fixed contact 17c completes the charging circuit for capacitor C₁ once more. The cycle of operation is thus repeated, at rates determined by resistors R₁ and R₂, to produce successive pulses of relatively high voltage, relatively low current energy at terminals 27 and/or 28.

It will be noted that capacitor C₁ is not employed to effect actual energization of transformer 18, but is used to control the timing of said energization from battery 12 via relay 17. Moreover, it will be noted that when the primary of transformer 18 is connected to battery 12 for energization purposes, battery 12 is effectively disconnected from timing capacitor C₁ and from coil 17a of relay 17. This has the effect of making the timing of the shocker circuit independent of any operations performed by contacts 17e and 17g of relay 17, thereby assuring a stable cycling rate, and further assuring maximum voltage across the secondary of transformer 18 at all times. Thus, but reason of the particular circuit arrangement described, even if the secondary of transformer 18 should be grounded, e.g., by a burglar grasping a door knob connected to terminal 27, transformer 18 will continue to put out successive electrifying shocks. The parameter values of resistors R₁ and R₂, and of capacitor C₂, as well as the resistance of relay coil 17a, determine the timing rate at which shocks are produced; and one or more of these parameters may be made adjustable so that the cycling rate can be similarly adjusted to suit varying environmental conditions, or to achieve peak performance of the circuit, at the discretion of the manufacturer or user of the equipment.

It will be appreciated that, while the system illustrated and described, includes electromechanical relays 13 and 17, the switching functions accomplished by these components can be achieved by other switching arrangements, including completely solid state circuits. For the particular relay embodiment illustrated in the drawings, it is preferable to provide a protective circuit between movable contact 17e and the primary of transformer 18 to eliminate arcing between contacts 17e and 17g when movable contact 17e breaks from fixed contact 17g. Such arcing would normally occur due to the inductive effect of the primary winding in transformer 18, and, in the absence of protective means, would tend to pit contacts 17e and 17g thereby reducing the practical life of the overall system. Diode 26, connected and poled as shown, tends to eliminate such arcing by preventing reverse voltages from the primary of transformer of 18 from being applied to contacts 17e and 17g. Capacitor C₂ enhances this effect by insuring

that, to the extent that any reverse voltage or leakage current does pass through diode 26, such reverse voltages or currents will be effectively grounded by capacitor C₂.

The overall shocker and energization circuit thus described is, as already mentioned, adapted for ready portability, and achieves the various protective features and safeguards already discussed even though disconnected from line 16. Moreover, the burglar deterrent described may be utilized as a portion of a more complete home protection system by the addition of appropriate modular units adapted to control floodlights, audible alarms, appropriate local or remote signals of other types, etc., and adapted to respond to burglars, fire, smoke detection, etc. To the extent that such additional systems are added, however, the overall resultant system should incorporate an appropriate switching arrangement which assures that the shocker deterrent is completely operative when the standard audible burglar alarm is operative, but which permits the audible burglar alarm to be turned off without affecting the shocker deterrent.

While we have thus described a preferred embodiment of the present invention, many variations will be suggested to those skilled in the art. It must therefore by understood that the foregoing description is intended to be illustrative only and not limitative of our invention; and all such variations and modifications as are in accord with the principles described are meant to fall within the scope of the appended claims.

We claim:

1. A burglar deterrent comprising a relatively low voltage rechargeable battery energization source, a shocker circuit comprising a timing circuit and an output transformer having primary and secondary windings, switching means for connecting said battery source to said shocker circuit for causing said transformer primary winding to be intermittently energized at a rate determined by said timing circuit, whereby relatively high voltage relatively low current pulses are induced in the secondary winding of said transformer for use as a burglar deterrent, a relatively high voltage main power source coupled to said switching means, manually operated control means for controlling the operating state of said switching means to selectively disconnect said battery source from said shocker circuit and simultaneously to couple said battery source to said main power source thereby to deactivate said shocker circuit and simultaneously to complete a charging circuit between said main power source and said rechargeable battery source, said timing circuit including a relay having an operating coil and movable contact means, capacitor means connected across said operating coil, charging circuit means including said movable contact means for selectively charging said capacitor means from said battery source to control the energization of said relay operating coil, further circuit means including said movable contact means for selectively connecting said battery source to, and disconnecting said battery source from, the primary winding of said output transformer in dependence upon the state of energization of said relay operating coil, and discharging circuit means comprising said movable contact means for completing a discharge path for said capacitor separate from said charging circuit when said battery source is connected to the primary winding of said output transformer.

2. The combination of claim 1 wherein said main power source comprises a voltage source and a further transformer having primary and secondary windings, said switching means including first means for selectively connecting said voltage source to the primary winding of said further transformer only when said battery source is disconnected from said shocker circuit, and said switching means including second means for coupling the secondary winding of said further transformer to said battery source only when said battery source is disconnected from said shocker circuit.

3. The combination of claim 1 wherein said switching circuit comprises an electrical circuit connected to said battery source, said manually operated control means being connected to both said electrical circuit and to said battery

source, whereby said electrical circuit is energized selectively from said battery source in dependence upon the operating state of said control means, said switching circuit including means operative to connect said battery source to said shocker circuit only when said electrical circuit is in its deenergized state.

4. The combination of claim 3 wherein said switching circuit comprises a relay, said electrical circuit comprising the coil of said relay, said manually operated control means comprising a switch, the coil of said relay and said switch being connected in series with one another across the terminals of said battery source.

5. The combination of claim 4 wherein said relay includes a pair of simultaneously operable single pole double throw contacts positionally controlled by the state of energization of said coil, and circuit means including said pair of contacts for connecting said main power source only to said battery source when said switch is closed and said relay coil is energized, and

for connecting said battery source to said shocker circuit when said switch is open and said relay coil is deenergized.

6. The combination of claim 1 wherein said charging circuit means and said discharging circuit means include separate resistive means connected alternatively to said capacitor means for respectively determining the RC charge and discharge time constants of said timing circuit.

7. The combination of claim 1 wherein the secondary winding of said output transformer includes a grounded center tap, the opposing ends of said secondary winding being connected to different output circuits respectively.

8. The combination of claim 1 including arc suppression means in said further circuit means between said movable contact means and the primary of said transformer, said arc suppression means comprising diode means in series with said transformer primary.

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