Feb. 8, 1966 K. H. GILLAM ETAL 3,233,904

AUTOMATIC ELECTRICAL TARGET APPARATUS

Filed July 24, 1962 4 Sheets-Sheet 1

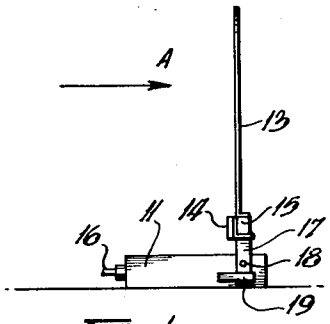


FIG. 1

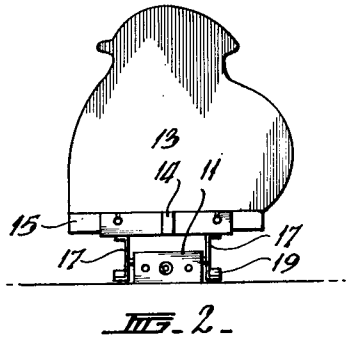


FIG. 2

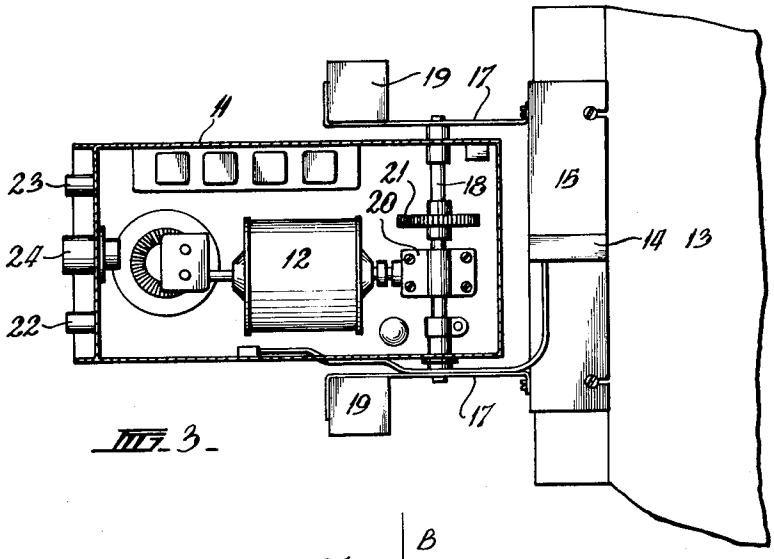


FIG. 3

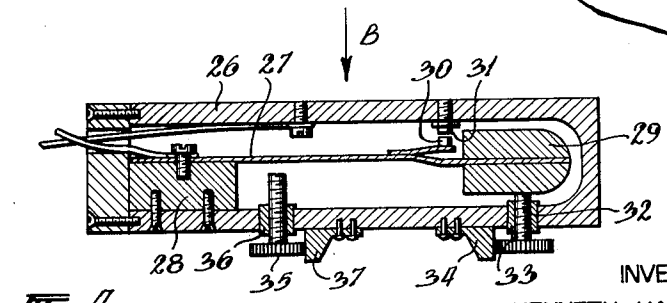


FIG. 4

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AUTOMATIC ELECTRICAL TARGET APPARATUS

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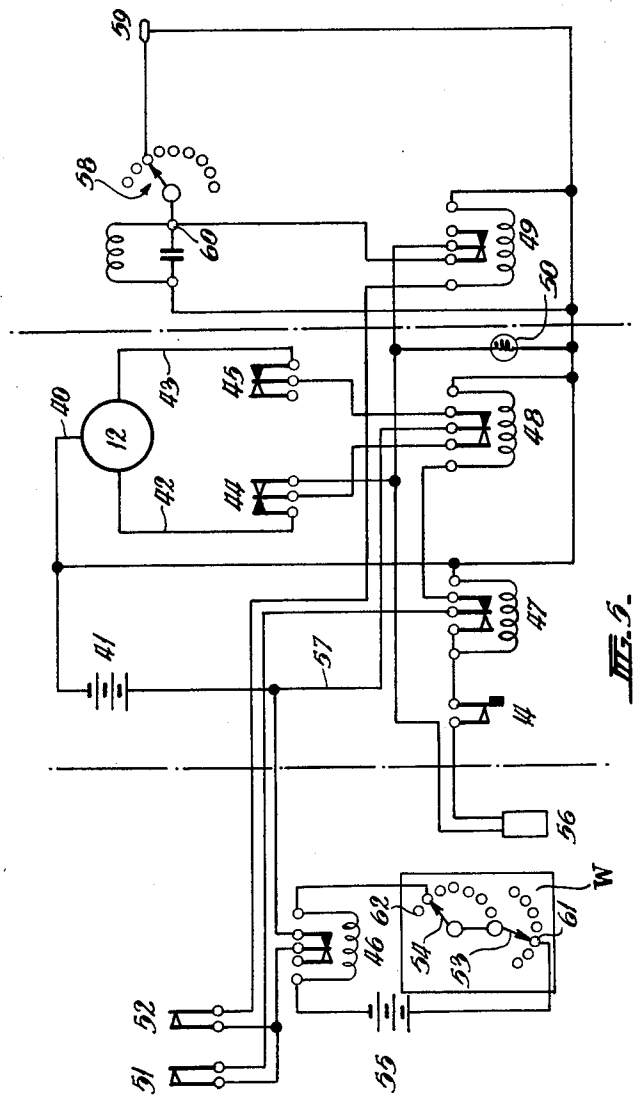


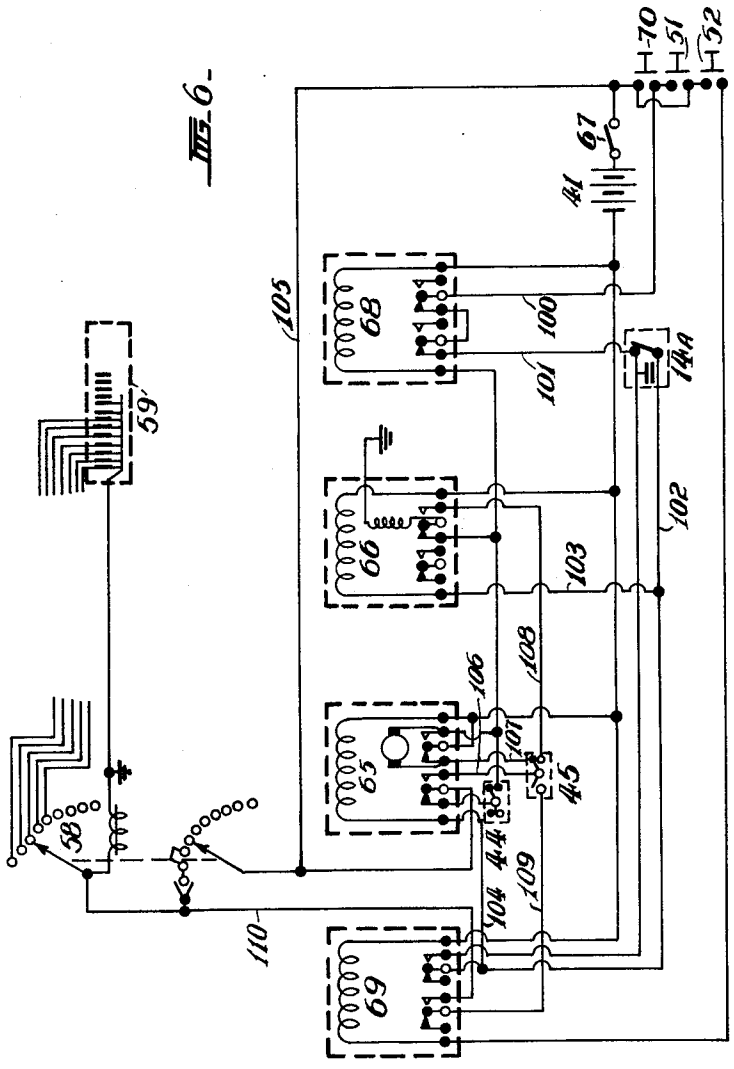
Fig. 5.

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AUTOMATIC ELECTRICAL TARGET APPARATUS

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Fig. 6.



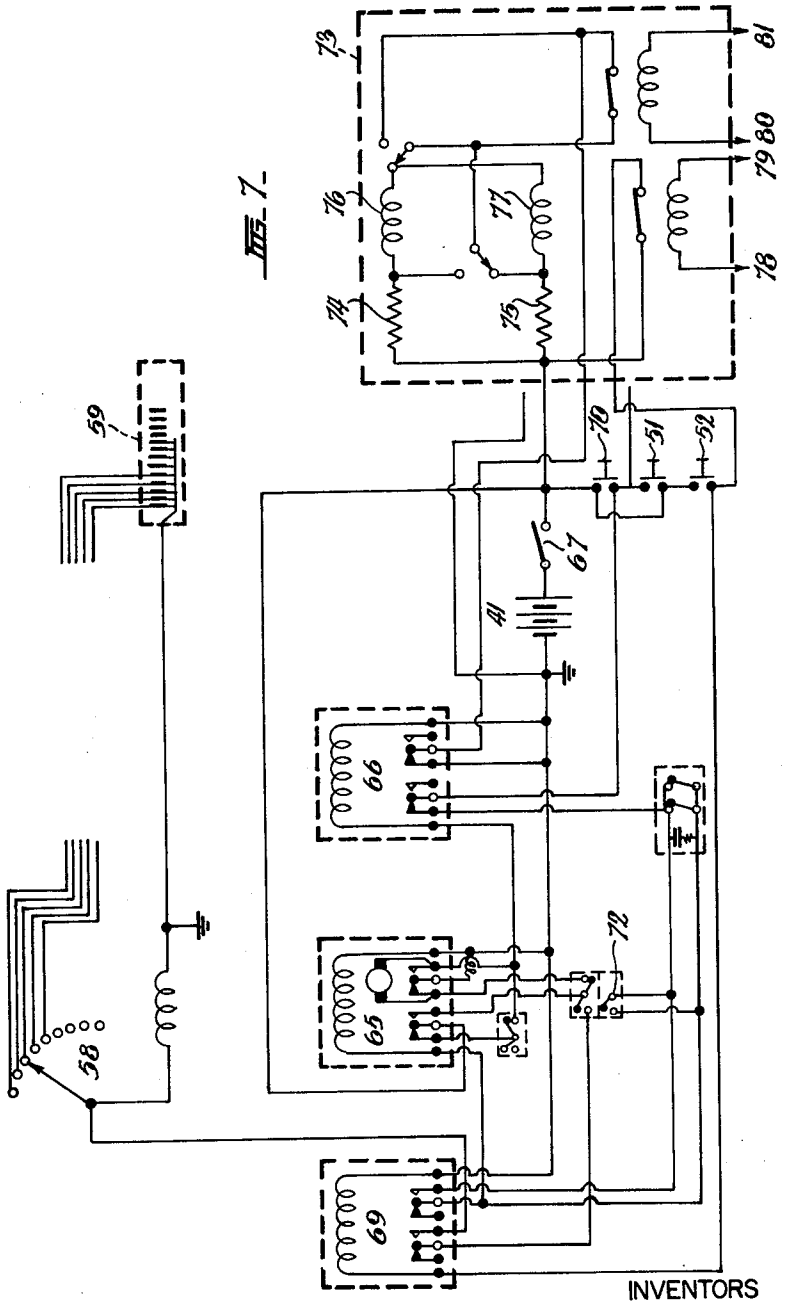
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FIG. 7



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AUTOMATIC ELECTRICAL TARGET APPARATUS

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Filed July 24, 1962, Ser. No. 212,106
6 Claims. (Cl. 273—102.2)

This invention relates to improvements in target apparatus for rifle shooting and it refers particularly, though not exclusively, to target apparatus for use in training troops and others in rifle and/or revolver or pistol firing.

An important object is to provide target apparatus which will be usable for a wide variety of purposes and with which different types of targets may be conveniently used.

Another object of the invention is to provide target apparatus which may be manipulated electrically from a remote control point, either by use of cable connections or by remote or wireless control.

A further object is to provide target apparatus which may either be used to record automatically hits made upon the target or manipulated automatically so as to disappear whenever a hit is scored upon it.

Another important object is to provide means for use in rifle shooting target apparatus of the "disappearing target" type which will enable the target to be actuated automatically when a hit is scored upon the target and yet will prevent actuation of the target due to action of the wind, even in boisterous windy conditions.

Automatic target apparatus of the disappearing target type provided according to the invention may be actuated so that it is exposed for a short pre-determined period only, or moved into position and caused to fall when a shot is scored on it, or moved into position and after a predetermined period retaliatory fire from the target simulated if it be not hit in that period. There may be provided a number of targets, either at the one target location or else located at a number of different positions—as along a jungle track—and they may all be capable of operation from the one control position, or from different positions.

The target apparatus comprises a target mounting, electrically operable means for moving the target mounting, an electrical impulse switch for actuating the target operating means when a target fitted to the mounting is hit by a missile, and circuit means by which said switch may actuate the target operating means.

The electrically operable means for moving the target mounting may be an electric motor—as a reversible electric motor—or solenoid actuated means.

In an alternative construction and arrangement of the target apparatus there may be circuit means whereby correct aiming of a weapon—as an automatic rifle—may be made to operate a switch to set in motion the motor or other target-operating means without any shot being fired. In such an arrangement the weapon may be movably mounted upon a rest and electrical means for indicating the elevation and direction of aim will bring the switch into operation when the weapon is correctly aimed.

Preferably, the motor raises and lowers the target to and from a visible position, and operation of the actuating switch causes the motor to return the target to its concealed or "down" position when the apparatus is set to cause the target to fall automatically when it is hit. The switch may also be used to operate a counter, instead of or in addition to causing the target to fall, so as to record the number of hits upon the target. Thus, the target may be held in the "up" position and when a number of shots

are fired the number of scoring shots will be recorded without the target moving.

Other and further objects and advantages of the present invention will be apparent from the following description when taken in connection with the accompanying drawings, wherein:

FIGURE 1 is a front view of a target and target operating mechanism;

FIGURE 2 shows a side view of the apparatus depicted in FIGURE 1;

FIGURE 3 is a plan view of the target operating mechanism with the cover plate removed and the target-holding means in the "target down" position;

FIGURE 4 shows in section a suitable form of inertia switch for use in the apparatus;

FIGURE 5 is a circuit diagram of one embodiment of the invention;

FIGURE 6 is a circuit diagram of a second form of the invention; and

FIGURE 7 is a circuit diagram of a third form of the invention.

The target and target-operating mechanisms illustrated in these drawings comprise a housing **11** wherein is housed a reversible electric motor **12**, by means of which a target **13** is moved to and from its exposed position, and other integers of the actuating means; an impulse switch **14** fastened to the target mounting bracket **15**; an electric power source such as a 12 volt automobile battery (not shown in FIGURES 1, 2 and 3) an doperating switches (also not shown) and suitable electric leads **16** from the housing **11** to the electric power source and the operating switches.

The target is in the shape of a man, or a portion of a man, or other suitable shape representing a military or other target. The target is preferably made from a sheet of marine plywood covered with self-sealing rubber, framed to help absorb shock waves caused by the passage of a bullet and the muzzle blast of a rifle, and it is fastened removably to the target mounting bracket **15**. That bracket **15** is supported by two arms **17** which are fastened to the opposite ends of a transverse shaft **18** mounted in bearings within the housing **11**, and counterweights **19** are provided on the lower ends of the arms **17**. The motor **12** is adapted to drive the shaft **18** through a gear box **20** and gears **21**, and it is operative to raise the target from a flat or horizontal position close to the ground (as depicted in FIGURE 3) to an upright position (as shown in FIGURES 1 and 2) substantially at right angles to the trajectory of a bullet from the firing position—indicated by the arrow A in FIGURE 1. The raising and lowering motion is at right angles to the plane of the target, and the target raises forwardly and falls rearwardly.

The housing **11** has three points—**22**, **23**, **24**—for the entry of leads of the electrical circuitry. There are two leads at the point **22**, one connecting the motor **12** to the power source and the other connecting the power source to the operating switches. There are also two leads at the point **23** for connecting the motor **12** to each of the two operating switches and so arranged that when the operating switches are actuated they will cause the motor **12** to raise or lower the target **13**, one of the switches being effective to cause the target to rise and the other being effective to lower the target. Those operating switches should be actuated only when the target is in the fully lowered position and the fully raised position, respectively. The point **24** is provided to permit the incorporation of a lead to a detonator block so arranged that, if desired, when the target is in the raised position, a detonator may be exploded to give the effect of retaliatory fire.

The housing **11** also has mounted in it certain relays

and a condenser and switch devices to be hereinafter mentioned in the description of the circuits of FIGURES 5, 6 and 7.

The impulse switch 14, which may be connected to apparatus in the housing 11 by a lead, may be constructed as shown in FIGURE 4. In this construction there is provided a waterproof case 26 and the switch itself is housed in that case. The switch comprises a leaf spring 27 fastened at one end to an insulating block 28 and having a weight 29 attached to its opposite or free end, a movable contact 30 secured on the leaf spring 27 near the weight 29 and normally close to but not touching a fixed contact 31 mounted in the case 26, an adjustable screw 32 engaged in an insulating block 33 in the case 26 and having associated with it an insulated spring lock 34 for preventing accidental rotation of the screw 32 due to vibration, and a second adjustable screw 35 engaged by an insulated spring lock 37 for preventing accidental rotation due to vibration. One lead is connected to the leaf spring 27 and a second lead is connected to the stud bolt in case 26, and, thereby, to the fixed contact 31. The initial separation of the contacts 30, 31 is regulated by the adjustable screw 32, and the second adjustable screw 35 regulates the clamping of the spring 27.

The switch 14 is mounted on the bracket 15 in such manner that the direction of movement for a hit is in the direction of the arrow B of FIGURE 4. The impulse imparted to the target 13 by a bullet hitting it will move the switch suddenly in that deviation; but owing to the inertia of the weight 29, the weight and the leaf spring 27 will temporarily resist that movement so that the contacts 30, 31 will momentarily close.

In an alternative arrangement of the switch illustrated in FIGURE 4, the contacts 30, 31 may be in contact when the switch is in the normal or inoperative position. In this arrangement the position of the switch on the bracket will be reversed so that the contacts 30, 31 will momentarily open when the target is hit by a bullet.

The impulse switch 14 requires a fast, hard and sudden movement of the target to cause it to operate. If the target is moved by the motor 12 or is vibrated by a strong wind the movements are slow enough to allow the weight 29 to follow such movements without actuating the contacts 30, 31. Reference will now be made to the three circuits shown in FIGURES 5, 6 and 7, the circuit of FIGURE 5 being described first.

This circuit consists of three main sections—the control section I, the target actuation section II, and the retaliation section III.

A lead 40 connects the motor 12 directly with the power supply 41, and a "forward" lead 42 and a "reverse" lead 43 are connected to limit switches 44 and 45, respectively, which are actuated when the target 13 is in the fully raised and fully lowered position, respectively. Four relays, 46, 47, 48 and 49 are provided, the relay 46 being a target selection relay, the relay 47 being a self-holding relay connected to the impulse switch 14, the relay 48 being a motor relay, and the relay 49 being a retaliation control relay.

For clarity the limit switches 44, 45 and the relays 46, 47, 48 and 49 are shown with black back contacts, and outlined front contacts. The back contacts will be referred to by designating the switch or relay and placing *b* after it, and the front contacts will be referred to in the same manner but by use of *f*. Thus, 46(*f*) indicates the front contact of relay 46 and 44(*b*) the back contact of limit switch 44.

As is well known in the art, when there is no current flowing through the coils of the relays 46–49, i.e., when the coils are deenergized, one of the contacts for each relay, in this case the back contacts *b*, is closed, and the other contact *f* is open. Conversely, when the relay coils are energized, the back contacts *b* are closed and the front contacts *f* are open.

The control section I comprises two manually operable

switches 51, 52 for raising the target and for actuating a retaliation device in section III, respectively, an assembly comprising the relay 46, multipoint switches 53 and 54, a power supply 55, and a counter 56. The relay 46 is assumed to be initially un-energised so that switch 51 connects to the lead 57 and one side of the power supply 41 through relay 46(*b*).

The target actuation section II has the motor 12, power supply 41, limit switches 44, 45, relays 47, 48, impulse switch 14, and a floodlight 50.

The retaliation section III has the relay 49 and a stepping selector switch 58 of which the fixed contacts are wired to electric detonators, one of which is indicated at 59.

The sections II and III are normally located at or near the target and section I is located at a control position, usually close to the firing point. The leads connecting sections I and II may therefore, in many cases, be cabled and/or permanently installed and connection made by multi-pin plugs and sockets.

The operation of the apparatus will now be described.

To raise the target, switch 51 is closed so as to complete the circuit from lead 57 via relay 46(*b*), switch 51, and relay 47(*b*) to operate relay 48 and thereby energise the motor on leads 40 and 42 via limit switch 44(*b*) and relay 48(*f*) to raise the target. The parts are so arranged that the target will rise to upright position as shown in FIGURES 1 and 2 and limit switch 44 will be then actuated to break the motor circuit at 44(*b*) and thereby stop the motor.

The target may be lowered at any time by opening switch 51, which releases relay 48, thus energising motor 12 at leads 40, 43 via limit switch 45(*b*) and relay 48(*b*). When the target is fully retracted, limit switch 45 is actuated and opens the motor circuit at 45(*b*).

When the target is fully raised, power is applied via the circuit of switch 51 described through limit switch 44(*f*) to the counter 56 and impulse switch 14. If a hit is then scored, impulse switch 14 is closed momentarily by the impulse of the bullet on the target. Relay 47 is therefore energised through the impulse switch 14, counter 56, limit switch 44(*f*), switch 51 and relay 46(*b*), and is held operated by holding contact 47(*f*). The circuit of relay 48 is simultaneously broken at 47(*f*) and the motor 12 energised at leads 40, 43, via limit switch 45(*b*) and relay 48(*b*) to lower the target.

Thus the target is lowered either by opening switch 51 or automatically when a hit is scored at fully raised target position. If the target is not fully raised, the circuit of switch 51 is open at limit switch 44(*f*) and the target does not automatically fall.

On the impulse switch 14 being closed by a hit, the counter 56 counts one so that the number of hits may be recorded.

Turning now to section III, on closing of switch 52 in section I, relay 49 is operated and point 60 is connected to lead 57 via relay 49(*f*), limit switch 44(*f*), and relay 48(*f*) if the target is fully raised. The detonator 59 is therefore fired and stepping switch 58 steps to the next contact where it is ready to fire the next detonator.

The detonators simulate retaliatory fire from the target.

As before, retaliation cannot be initiated except when the target is fully raised, and limit switch 44(*f*) closed.

By means of the relay 46 and its associated circuits, the target may alternatively be used to indicate correct aim without live firing. For this purpose a weapon W shown schematically in FIGURE 5 is operatively connected to the two multipoint switches 53 and 54 in such a manner that movement of the weapon horizontally is coupled to the moving arm of switch 53 and movement vertically is coupled to the moving arm of switch 54, as would be obvious to one skilled in the art. The fixed contacts 61 and 62 of switches 53 and 54 representing correct aim are connected to the secondary power supply 55 and relay 46 as shown.

If switch **51** is closed to raise the target and the weapon is aimed correctly, the circuit of a relay **46** is completed through contacts **62, 61** and power supply **55** and relay **46** operates. Contact **46**(*b*) therefore opens and the target is retracted as before described. The circuit of switch **52** is also opened at **46**(*b*) and a retaliatory shot cannot be fired.

A switch, to be closed by operating the trigger, may be incorporated in series with the operating circuit of relay **46**, so that said relay **46** can only be operated when the trigger is operated.

In the circuit described above the raising and lowering of the target and the actuation of the detonator **59** are by manual switches which are conveniently under the control of an instructor.

It is frequently desirable for a target to be exposed for a predetermined time only, and this may easily be accomplished by closing a time-switch by switch **51**, the time-switch being adjustable to give any of a range of exposure times, at the end of which the switch will open and the target will be lowered by operation of the motor **12**.

Similarly, "retaliatory fire" may be made to occur if the target has not been hit within a set time after being raised.

For night shooting, the flood light **50** may be connected to light whenever the target is raised as shown in FIGURE 5.

The circuit described operates a single target, but it is often desirable to operate a plurality of targets either singly in sequence or in groups. In such a case a circuit as described with reference to FIGURE 5 may be provided for each target, with connections allowing a single control switch **51** to operate a selected group of targets together or to initiate a sequence switch to operate a series of targets in succession.

Referring now to the circuit shown in FIGURE 6, the target is once again moved by a reversible electric motor **12**, the armature and field winding of which are indicated in the relays **65** and **66** respectively, and the raising and lowering motion may be the same as described in the first embodiment. The operation of the apparatus is controlled by switches **51** and **52** which are situated at the control point and the power supply **41** is provided with a master switch **67**. Numeral **51** indicates the target control switch and numeral **52** the retaliation switch.

Numeral **68** indicates the main relay which over-rides the switch **51** when the inertia or impulse switch **14A** is actuated. In this circuit, the contacts of the inertia switch are normally in their closed position until the switch **14A** is actuated whereby they open momentarily.

The relay **66** controls the flow of current to the field of the motor **12** and relay **65** controls the current to the armature of the motor to move the target to either its visible or "up" position, or to the concealed or "down" position and this relay is connected to the limit switches **44** and **45**. The limit switch **44** provides the down limit and breaks the current supply to the armature when the target reaches its fully down position and the limit switch **45** operates similarly when the target reaches its fully up position.

Relay **69** controls the operation of the retaliation device, shown as a series of detonators **59** which are selected by the stepping switch **58**, and **70** is a test switch which is mounted on the body of the apparatus and operates similarly to switch **51** so that the operation of the apparatus may be tested on installation. The relays **68, 66, 65** and **69** are, in their unenergised condition, as shown in FIGURE 6 with the black contacts contacting and the open contacts not contacting.

When either switch **70** or **51** is actuated, current passes through conductor **100**, through relay **68**, out through conductor **101**, and through the impulse switch **14A** and along conductor **102**. Conductor **102** passes current to conductor **103** which energises relay **66** and causes it to take its other position. Conductor **102** also passes current to conductor **104** which energises the relay **65** causing it to assume its other position.

Current passing through conductor **105** passes through relay **65** which has assumed its energised position into conductor **106** to the limit switch **45**. The current then passes into conductors **107** and **108**. As relays **66** and **65** have both assumed their energised positions, current through conductor **107** actuates the armature and through **108** actuates the field of the motor and the motor causes the target to assume its up or visible position. When this position is reached limit switch **45** breaks the contact to conductors **107** and **108** and the motor stops with the target in its up position.

The target remains in this position until either the switch **70** (or switch **51**) is released or a bullet impinges on the target momentarily opening the inertia switch **14A**.

When either of these actions take place, conductor **102** no longer passes current and thus the relays **66** and **65** assume their unenergised position and current pasess to the armature and the field of the motor by way of limit switch **44** which also causes relay **68** to be energised, preventing use of switch **51** or inertia switch **14A**. When the target reaches its fully down position, limit switch **44** opens and prevents further movement of the target and de-energises relay **68**, and limit switch **45** closes so that the target may be again actuated by switch **51** to bring it to its up position.

If the target is in its up position and no bullet has passed through the target to actuate the inertia switch, actuation of switch **52** causes the relay **69** to be energised.

As relay **65** is energised and limit switch **45** is closed, current may pass through conductor **106** to conductor **109** to relay **69** and thus through conductor **110** to the stepping switch **58**, and this current will cause the switch **58** to move one step and fire a detonator in the detonator bank **59**.

As shown, switch **58** is a double bank switch and there will be two banks of detonators. These detonators cannot be fired unless the target is in its up position as current cannot pass through conductor **109** except in this position.

In a modification of this type of circuit, the detonators may be replaced with any other type of audible device, such as horn if the detonators are considered dangerous in any particular application.

It is also possible, and desirable, that a further audible device be connected so as to operate when the motor is bringing the target to its down position to indicate that the target has been hit. This is essential in night shooting when the target is only dimly visible.

A difficulty encountered with metal or like solid targets is that a bullet will make a hole considerably larger than its diameter, so that a second shot may pass through the hole thus formed without touching the target and therefore without operating the impulse switch. To prevent this, the target is made of plywood and it is provided on one or both sides with a resilient layer—as a layer of sponge rubber about ¼" thick—which provides for "self-sealing" of the bullet holes.

Alternatively, the target may be made of foamed plastic material such as polystyrene or phenol-formaldehyde moulded or cut to the required shape. Larger targets are preferably curved or dished to give greater rigidity to prevent deflection by wind and also to transmit the impulse from a hit to the switch more effectively. The pattern, or target picture, is painted upon either type of target with plastic paint having strong adherence to the surface.

An aural indicator of hits scored may be provided instead of or in addition to the counter **56**.

Such an indicator may comprise an audio oscillator and amplifier feeding a loud speaker at the control position, the oscillator being initiated by the momentary current on actuation of impulse switch **14** (or **14A**).

Power for the apparatus may be from mains or battery, according to circumstances.

As evident, the target may be made to appear from behind a tree or other obstacle. Such movements are particularly suited to jungle training and "sneaker" courses.

FIGURE 7 illustrates the incorporation of an opening time delay limit switch 72 and a circuit for radio control of the apparatus, the latter circuit being indicated at 73. In this latter circuit are resistors 74, 75, relays 76, 77, leads 78, 79 to the relay for controlling the detonator relay, and leads 80, 81 to the relay for controlling the "up" and "down" movements of the target.

Among the various functions of the apparatus are:

(a) Automatic operation and timing of identification targets.

(b) Automatic operation of target for range shooting.

(c) Automatic targets for "sneaker" and jungle training courses. Each function (b) and (c) may be combined with—

(d) Drop-on-hit.

(e) Aural indication or counting of hits.

(f) Retaliatory fire.

(g) Automatic timing of target exposure.

It is to be understood that various changes and modifications may be made to the apparatus described without departing from the invention defined by the claims.

We claim:

1. A target assembly including a housing, a target mounted to pivot between an operative generally vertical position and an inoperative generally horizontal position, an impulse switch means carried by the target adapted to be actuated by physically striking the target, a reversible electric motor within the housing operable to move said target between said positions, a switch means in said housing, said switch means being adapted to be directly actuated by said impulse switch means to energize said electric motor and move the target to the inoperative position, a limit switch means in the housing actuated by contact with the target in said inoperative position to stop said electric motor, and a circuit means having a manual switch means, said circuit means being operative when said manual switch means is closed to operate said motor to move said target to the operative position, and operative when said manual switch means is opened to operate said motor to move said target to the inoperative position, and control means for controlling said motor to return said target to the inoperative position when said impulse switch is actuated and said manual switch means is closed as aforesaid.

2. An assembly as claimed in claim 1 wherein said control means include a self-holding relay.

3. An assembly as claimed in claim 1 further including a time-switch means, said manual switch means being so arranged that closure of said manual switch means initiates said time-switch means to open said circuit means on expiry of a predetermined time.

4. An assembly as claimed in claim 1 including a radio receiving device fitted to said manual switch means, said manual switch means thus being adapted to be controlled from a distance in response to a signal from a radio transmitter actuating said radio receiving device.

5. A target assembly including a target, reversible electric power means for moving said target between an operative position and an inoperative position, a circuit means including a manual switch means, said circuit means being effective when said manual switch means is closed to cause said electric power means to move said target to such operative position, and being effective when said switch means is opened to cause said electric power means to move said target to such inoperative position, an impulse switch means adapted to be actuated by physically striking said target, and control means directly actuated by said impulse switch means for controlling said electric power means to return automatically said target to such inoperative position when said impulse switch means is actuated, irrespective of the position of said manual switch means.

6. A target assembly as claimed in claim 5 further including an aiming device, two multi-point switch means serially connected with said aiming device, one of said switch means being coupled to the horizontal movement of said aiming device to indicate the direction of aim of said aiming device, and the other of said switch means being coupled to vertical movement of said aiming device to indicate the elevation of said aiming device, and a further electric switch means operative to be actuated by both of said multi-point switch means when said aiming device is correctly aimed at said target, said further electric switch means, when so actuated, being operative also to open said circuit means to cause said electric power means to move said target to such inoperative position.

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