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POLYPROPYLENE PROJECTILE-SHORTING TARGET
WITH WIRE SCREEN ELECTRODES
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3,454,277

FIG. 1

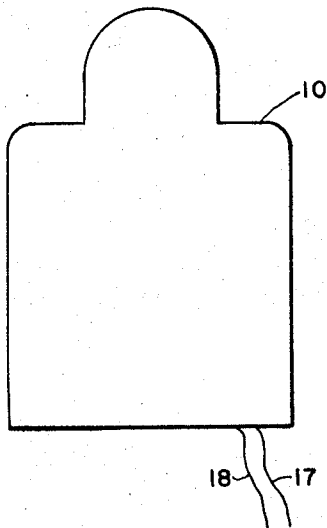


FIG. 2

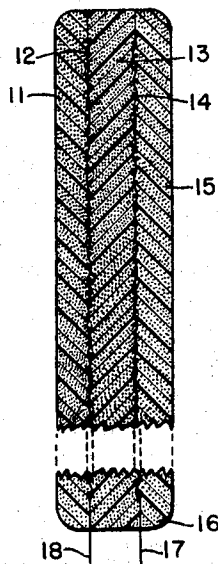


FIG. 3

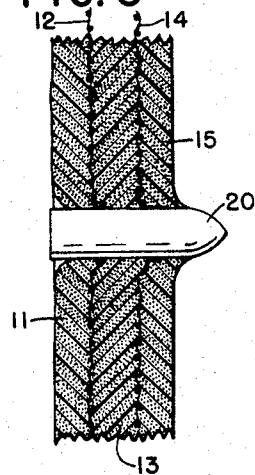
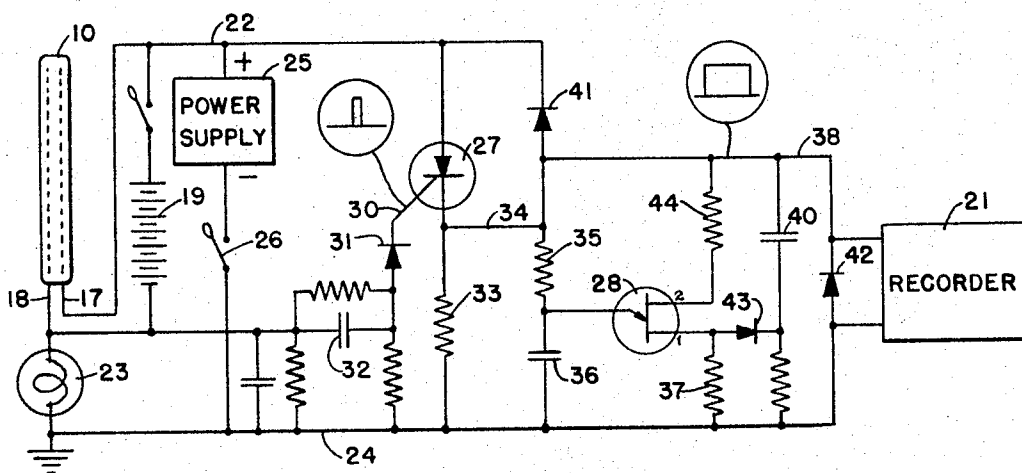


FIG. 4



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POLYPROPYLENE PROJECTILE-SHORTING TARGET WITH WIRE SCREEN ELECTRODES

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Continuation-in-part of application Ser. No. 588,350, Oct. 21, 1966. This application Sept. 12, 1967, Ser. No. 667,298

The portion of the term of the patent subsequent to Sept. 17, 1985, has been disclaimed

Int. Cl. A63b 9/02

U.S. Cl. 273—102.2

2 Claims

ABSTRACT OF THE DISCLOSURE

A target for electrically reporting hits on a target is described. The target comprises three panels of propylene polymer foam and two metal woven screens, the five layers being securely bonded to each other by the application of heat in a hot rolling mill. The recording circuit includes a detecting means and a pulse delay circuit for transforming the sharp pulse created by conduction between the two screens into a broad pulse which can be applied to a recorder.

This application is a continuation-in-part of my co-pending application Ser. No. 588,350, filed Oct. 21, 1966, now Patent No. 3,401,939.

This invention relates to a target for electrically recording the perforations caused by projectiles such as rifle bullets, projectiles from various automatic weapons, and bullets from sub-machine guns. It has specific relationship to a target which is impervious to moisture and which will withstand repeated perforations by projectiles.

Many targets have been designed and built for training and testing purposes. A large percentage of these targets have been constructed of flimsy materials such as corrugated cardboard, styrene foam, and foam rubber. These targets work well for a few projectiles but they do not last long and a projectile which may strike the target at about the same position as a previous projectile, will not produce a recording pulse. In addition, many of the prior art targets are not water proof and target practice cannot be held in the rain or in very humid weather. Also prior art targets did not record hits made by an insulated bullet or a bullet covered by paint.

The present target is designed for use in any weather, including driving rain. The target is made of carefully selected materials which have a zero degree of water absorption and any hole made by a projectile will be closed by the resilient material forming the target laminations and a second projectile through the same spot will be recorded. The present target is made of an array of layers of plastic foam which contain two metal woven screen electrodes. The foam layers are cast in such a manner that a continuous impervious layer is on the outside of each target surface so that no moisture can penetrate within the target space.

When an insulated projectile hits the target and passes through the metal screens, the metal wire in the screens is broken apart and the wire ends scrape the paint or insulating cover from the projectile to establish an electrical contact.

For a better understanding of the present invention, together with other and further details thereof, reference is made to the following description taken in connection with the accompanying drawings:

FIG. 1 is a front view of the target.

FIG. 2 is a cross sectional view of a portion of the target showing the laminated construction.

FIG. 3 is a cross sectional view similar to FIG. 2 but showing a projectile piercing the target.

FIG. 4 is one form of circuit which may be used in conjunction with the target.

Referring now to FIG. 1, the target comprises a laminated array 10 of five layers. The details of the construction are shown in FIG. 2 where a front panel 11 is bonded to a woven metal screen 12. A central panel 13 is bonded to the other side of screen 12 and also bonded to a second woven metal screen 14. The third layer 15 is bonded to the other side of screen 14. It should be noted that the upper end of the target, and also the side edges, have the insulating plastic layers bonded together around the ends of the metal screen so that moisture can be kept away from the conductive elements. The bottom portion of the target 16 is formed in a similar manner but at this edge two conductors 17 and 18 are brought out through the bottom surface for connection to an external circuit.

FIG. 3 shows a cross sectional portion of the target similar to FIG. 2 but having a projectile 20 moving through the target. It should be noted that all five layers of the target are displaced by the projectile in the direction of the projectile motion. The three flexible layers 11, 13, and 15 are also compressed by the penetration of the projectile and, after the projectile has left the target, the three foam layers move back into place and partially seal the hole. The metal screens 12 and 14 are torn by the projectile, the ends of the wires scratch the paint from the projectile, and form a connection between the electrodes so that current can pass between them and be recorded by means of an external circuit. There are times when wires from the first electrode may be drawn into contact with the wires in the second electrode to form a shorted connection. The external circuit is arranged so that a large current will then be applied to this short circuit and quickly burn it out to normalize the recorder circuit and condition the target for another projectile action.

The three foam layers 11, 13, and 15 are made of propylene polymer foam which is constructed so that the foam bubbles are very small. One such material which is suitable for this type of target is commercially available and may be obtained from Hazeg, Inc., of Wilmington, Del., as compound Minicel PPF.

A five layer sandwich is formed by the two screens and the three layers of foam as shown in FIG. 2. This array is then passed through heated rolls and a unitary target is formed by the application of heat alone. The surfaces of the foam are sealed to the wire mesh and to each other to form a watertight target.

When the above described target is employed for recording hits by projectiles, a coupling circuit is connected between the target and a recorder 21. A preferred circuit is shown in FIG. 4 where the target conductors 17 and 18 are connected to a positive conductor 22 and an indicating lamp 23. A storage battery 19 of about twenty-four volts is connected across conductors 17 and 18. The other side of the indicating lamp 23 is connected to a grounded conductor 24 which is also connected to the negative terminal of a direct current power supply 25. A manually operated switch 26 may be connected in series between the power supply 25 and the ground conductor 24 to disconnect the source of power when the circuit is not being used. The switch is a safety means for insuring that leakage current cannot flow in the circuit. It is not necessary for normal operation because when there is no current passing through the target, there is no current flowing elsewhere in the circuit.

The coupling circuit includes a controlled rectifier 27 and a unijunction transistor 28. A firing electrode 30 of the controlled rectifier 27 is coupled through a rectifier diode 31 and a capacitor 32 to the junction between con-

ductor 18 and one side of lamp 23. This circuit transmits a pulse to the rectifier 27 causing it to conduct and send current from the positive conductor 22 through rectifier 27 and resistor 33, thereby applying a positive potential over conductor 34 to resistor 35 and capacitor 36 to charge capacitor 36. Capacitor 36 reaches its predetermined charging voltage after a short time interval which is determined by the RC charging circuit including resistor 35 and capacitor 36. As the voltage builds up on capacitor 36, the voltage of the emitter of the unijunction transistor 28 is raised until the firing voltage is reached. At this point capacitor 36 discharges its quantity of electricity through the unijunction transistor 28 and resistor 37.

When the controlled rectifier 27 is made conductive, a positive pulse is applied over conductors 34 and 38 to operate recorder 21. The current through the controlled rectifier 27 continues to flow until the unijunction transistor is fired. The time interval between these two events produces a recording pulse which may be many times longer than the pulse received from the target 10. When the unijunction transistor 28 transfers the charge from capacitor 36, the potential of conductors 38 and 34 rises because of a positive pulse transmitted through diode 43 and capacitor 40. This action stops conduction through rectifier 27 and the entire circuit is normalized.

The circuit also includes a diode rectifier 41 which is put in the circuit in order to eliminate any voltage pulses which might raise conductors 34 and 38 above the voltage of the power supply 25. If, for any reason, an inductive kick is applied to these conductors, the excess voltage will be transferred to the power supply which will absorb the additional voltage. Another diode 42 is bridged across the recorder terminals to protect the recorder circuit from negative pulses which may be applied to conductor 38. A third diode 43 is connected between the number 1 base of the unijunction transistor 28 and capacitor 40 so that the capacitor 40 cannot discharge through the unijunction transistor elements and resistor 44.

Under ordinary working conditions the current pulse through lamp 23 will not be enough to light the lamp since the pulse is too short. However, if metal screen 12 is displaced so that it makes contact with film 14 and the short persists, lamp 23 will be lighted, indicating that the target is temporarily not in a condition to record another projectile. It has been found that a condition such as that described above will persist for less than one second at which time the current from the storage battery 19 will burn out the short circuit and normalize the target. At this time lamp 23 goes out and the circuit is ready for another recording operation.

As mentioned above, the target mesh electrodes are

always insulated from each other after each penetration by battery burn out. However, there may be rare occasions when the burn-out arc deposits impurities on the sides of the hole and creates a high resistance circuit between the electrodes. In such a case, the recording circuit will not give a false reading because an appreciable amount of current must be applied to capacitor 32 and diode 31 before the controlled rectifier 27 is made conductive.

The target described above includes three laminations of propylene foam polymer which has been cast with minute bubbles to produce the action desired. It is within the provisions of the invention to use other substances which are similar to this plastic foam and have the same mechanical and electrical characteristics. The only limitations of the invention are therefore to be determined from the scope of the appended claims.

I claim:

1. A target for electrically recording the perforations caused by a surface insulated projectile comprising; a first supporting insulator sheet composed of polypropylene foam in the form of a central flexible panel; electrode means secured to each side of said insulator sheet, each of said electrode means composed of a metal woven wire screen for scratching the insulation from the projectile surface and for making electrical contact with the projectile body as the projectile passes through the target; two additional flat insulator panels bonded to said electrodes for waterproofing the target and for increasing its mechanical strength, said additional panels also formed of polypropylene foam; and a recorder circuit coupled to said target electrodes for recording each current pulse caused by a projectile making electrical contact with both screens.

2. A target as claimed in claim 1 wherein the edges of all the plastic foam layers are bonded together to seal the metal screen electrodes from the ambient space.

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