Jan. 7, 1958 F. W. BROWN ET AL 2,819,085

ELECTRICALLY SCORING TARGET

Filed June 13, 1955

FIG. 1

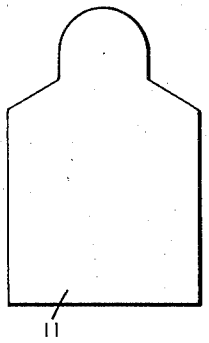


FIG. 2

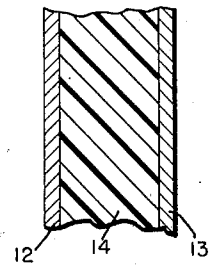


FIG. 3

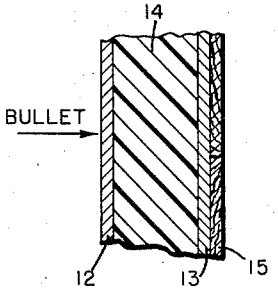
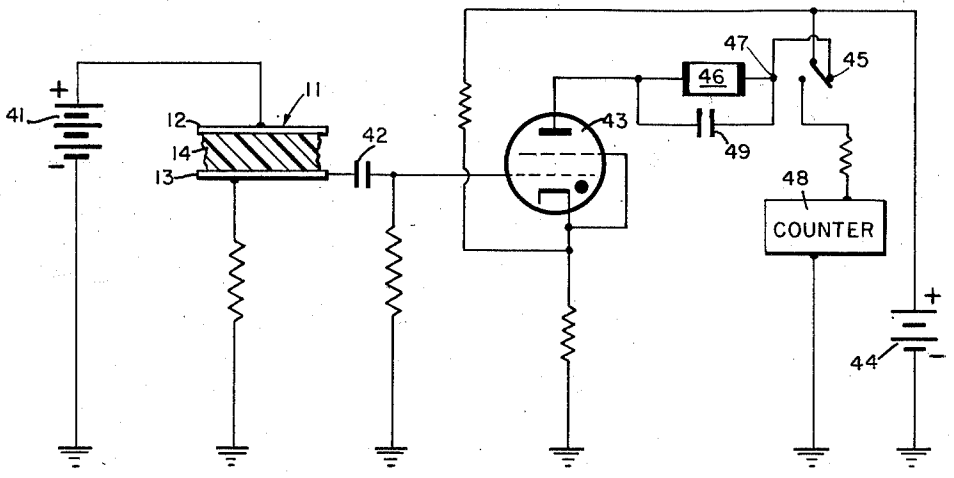


FIG. 4



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ELECTRICALLY SCORING TARGET

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6 Claims. (Cl. 273—102.2)

This invention relates to targets and more particularly to electrically scoring targets for use in practice with rifles and machine guns.

The instant application is related also to an electrically scoring target disclosed in copending application for letters patent, Serial No. 502,447, filed April 19, 1955. However, the target structure disclosed in the instant application is simpler and considerably less expensive to manufacture. Although the target structure disclosed in the instant application does not have the same high scoring density capability as the construction revealed in the prior application for letters patent, the instant design suffices in a great many training situations.

One of the objects of this invention is the provision of a target which is capable of being punctured by bullets a large number of times without substantial damage so that the target has an exceptionally long life.

Another object of this invention is to provide a target so constructed and arranged as to eliminate the hazard of deflected or ricocheting bullets.

Another object of this invention is to provide an electrically scoring target which is not affected by humidity, rain and other influences of the weather.

A further object of this invention is the provision of a target which provides instantaneous indication of a hit at a remote location.

A further and other object of this invention is the provision of a target in which hit detection is achieved with utmost reliability and by the use of simple electrical circuit means.

A still further object of this invention is to provide a target which is insensitive to and does not score upon gun blast only.

Still another object of the invention is the provision of a target which does not score erroneously due to earth or stones sprayed into the target caused by hits on the ground near the target.

Another and further object of the invention is the provision of a target characterized by light weight yet stable when standing erect and supported only at its base.

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

Figure 1 is a front view of the target;

Figure 2 is a cross sectional view of the target construction;

Figure 3 is a cross sectional view of a modified target construction, and

Figure 4 is a typical electrical scoring circuit employed in connection with the target.

Referring now to Figure 1, numeral **11** identifies a typical scoring target as used for practice on target ranges at a distance of several hundred yards from the firing position. This target is of laminated construction as shown essentially in Figures 2 and 3. Numerals **12** and **13** identify a thin layer of electrically conductive material, such as a thin sheet of aluminum or copper, approxi-

mately 1/64 or 1/32 inch thick. Both layers **12** and **13** are bonded to an intermediate layer **14** which is made of foamed plastic material and which serves as electrical insulation and also to impart strength and rigidity to the target structure. Foamed plastic materials, particularly styrene foam and cellular cellulose acetate, are expanded plastic materials which consist of millions of tiny close-wall cells. The advantage of this material resides in its light weight (approximately 2 to 10 lbs. per cubic foot), high mechanical strength and rigidity, excellent water resistance, and high resistance to the deteriorating influences of the weather. These foamed plastic materials are available in sheet form from the Dow Chemical Corporation, Midland, Michigan, or Strux Corporation, Lyndenhurst, New York, and are more comprehensively described in the Modern Plastics Encyclopedia, 1953 issue, pages 540 to 552, published by the Plastics Catalogue Corporation, 575 Madison Avenue, New York 22, New York.

The three layers **12**, **13** and **14** are bonded to one another by using various commercially known cements, such as compound EC–870 manufactured by the Minnesota Mining & Manufacturing Company, Adhesives and Coatings Division, Detroit, Michigan.

A target structure in accordance with the above description is characterized by extreme light weight yet high mechanical rigidity and substantial inertness to climatic and environmental conditions, particularly moisture and rain.

When using layers **12** and **13** as electrodes and applying an electrical potential therebetween, scoring of a hit is accomplished by virtue of the bullet penetrating through the target and causing a short circuit. It will be apparent that this target will not score upon mechanical vibration or sound waves but only a direct connection between metallic layers **12** and **13** caused by the jacket of the bullet will cause hit registration.

Further, it has been found that the foamed plastic material employed has very little tendency to tear upon penetration of the bullet, a feature which is believed to be caused by the extremely low mechanical resistance which the plastic material offers to the bullet and by the cellular division of the material which results in effective thermal insulation and therefore reduces the melting of material near the bullet hole. Still further the softness of the metal layers **12** and **13** appears significant since the extruded area caused by a bullet passing through decreases with the softness of the metallic material. It has been found advantageous to employ copper or aluminum soft to one-half hard.

Although the target construction in accordance with Figure 2 has a comparatively high scoring density, yet the rear layer of metal has a tendency to tear. Improved results have been obtained by backing the rear layer of metal with a thin layer of wood **15** (Figure 3). This lawer when bonded to the metal serves to support the metallic layer **13** so as to prevent its tearing. It has been found that this wooden layer can be of extreme thinness such as 1/16 inch thick veneer or plywood. This thin layer of wood does not materially increase the cost or weight of the target but by virtue of its preventing the tearing of the metal it has been possible, when using 0.30 inch caliber bullets, to increase the average scoring density of the target from approximately eight to twelve registered hits per square inch, an increase of 50 percent.

A typical scoring circuit employed in connection with the above target construction is shown in Figure 4. A power supply **41** is connected across the electrodes **12** and **13** of target **11**. The target structure is coupled via a coupling capacitor **42** to the control electrode of a thyratron tube **43**. The anode of thyratron tube **43** is connected to power supply **44** via a relay contact **45** in series with relay coil **46**. Upon the occurrence of a

short circuit between the metallic layers of the target, a pulse is transmitted to the control electrode of thyratron tube 43 which causes conduction of the tube. The current flow in the tube causes relay 46 to be energized and the relay will close contact 47 energizing counter 48 to register a hit. In this position the thyratron is disconnected from the power supply 44 but conduction through relay coil 46 is maintained for a short time until capacitor 49 is discharged. After the capacitor 49 is discharged, the thyratron extinguishes, relay 46 becomes de-energized causing the relay contact to assume its original position by establishing connection with contact 45 thereby applying the power supply 44 to the anode of the thyratron tube to await the next hit signal.

By virtue of the design disclosed hereinbefore it has been possible to construct large targets which are extremely light and stable. A target of 52 inches diameter for instance, which is used in certain applications weighs only twenty pounds. This target when supported at its base only is fully capable of withstanding the forces of driving rain and heavy winds. A prior design of this target used sheet steel 0.078 inch thick reinforced in the center portion with ¾ inch thick plywood to impart sufficient stability, and exhibited a weight of approximately 62 lbs. Aside from this weight consideration, the prior design uses a microphone pick-up connected to the sheet steel so that this particular construction is sensitive to gun blast, pebbles sprayed into the target by near misses, etc. Since this large diameter target is alternately brought from a horizontal to a vertical position by a driving mechanism, the weight and stability factors are of greatest significance and the advantages offered by the structure disclosed in the instant application for letters patent are clearly discernible.

While there have been described and illustrated specific embodiments of the invention, it will be obvious that various changes and modifications may be made therein without departing from the field of the invention which should be limited only by the scope of the appended claims.

What is claimed is:

1. An electrically scoring target of laminated construction comprising; a first substantially thin and flexible layer of electrically conductive material; a second, substantially rigid, layer of non-hygroscopic foamed plastic material; a third substantially thin and flexible layer of electrically conductive material; said layers being bonded to one another to produce a substantially rigid laminated target construction which when supported at its lowermost edge stands self erect, and said layer of plastic material being substantially thicker than the layers of electrically conductive material.

2. An electrically scoring target of laminated construction comprising; a first substantially thin and flexible layer of electrically conductive material; a second, substantially rigid, layer of non-hygroscopic foamed plastic material; a third substantially thin and flexible layer of electrically conductive material; said layers being bonded to one another to produce a substantially rigid laminated target construction which when supported at its lowermost edge stands self erect; said layer of plastic material

being substantially thicker than the layers of electrically conductive material, and an electrical scoring circuit connected to said layers of conductive material.

3. An electrically scoring target of laminated construction comprising; a first substantially thin and flexible layer of electrically conductive material; a second, substantially rigid, electrically non-conductive layer of non-hygroscopic foamed plastic material which is substantially impervious to fungi and vermin; a third substantially thin and flexible layer of electrially conductive material; said layers being bonded to one another to produce a substantially rigid laminated target construction which when supported at its lowermost edge stands self erect and an electrical scoring circuit connected to said layers of conductive material.

4. An electrically scoring target of laminated construction comprising; a first substantially thin and flexible layer of electrically conductive material; a second, substantially rigid, electrically non-conductive layer of non-hygroscopic foamed plastic material which is substantially impervious to fungi and vermin; a third, substantially thin and flexible layer of electrically conductive material; a fourth, substantially thin and flexible layer of wood; said layers being bonded to one another to produce a substantially rigid laminated target construction which when supported at its lowermost edge stands self erect and an electrical scoring circuit connected to said first and third layers.

5. An electrically scoring target of laminated construction comprising; a first substantially thin and flexible layer of electrically conductive material; a second, substantially rigid, layer of styrene foamed plastic sheeting; a third substantially thin and flexible layer of electrically conductive material; said layers being bonded to one another to produce a substantially rigid laminated target construction which when supported at its lowermost edge stands self erect, and said layer of plastic sheeting being substantially thicker than the layers of electrically conductive material.

6. An electrically scoring target of laminated construction comprising; a first substantially thin and flexible layer of electrically conductive material; a second, substantially rigid, layer of cellular cellulose acetate foamed plastic sheeting; a third substantially thin and flexible layer of electrically conductive material; said layers being bonded to one another to produce a substantially rigid laminated target construction which when supported at its lowermost edge stands self erect, and said layer of plastic sheeting being substantially thicker than the layers of electrically conductive material.

References Cited in the file of this patent

UNITED STATES PATENTS

474,109	Vogel	May 3, 1892
2,501,218	Hill	Mar. 21, 1950
2,576,970	McAvoy	Dec. 4, 1951
2,591,016	Schoenherr	Apr. 1, 1952

OTHER REFERENCES

Modern Plastics Encyclopedia, 1954, pages 540 to 552.