June 7, 1960 N. N. SKAREDOFF 2,939,706

TARGET AND INDICATOR MEANS

Filed Feb. 26, 1958

2 Sheets-Sheet 1

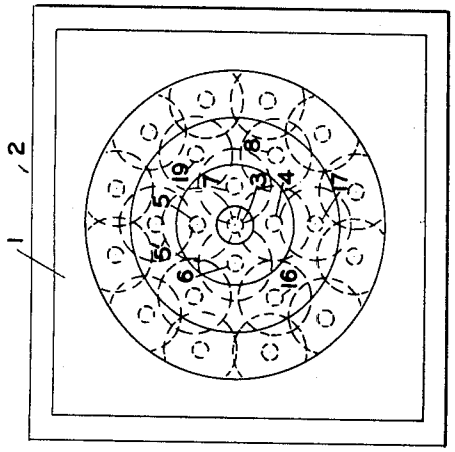


FIG. 3

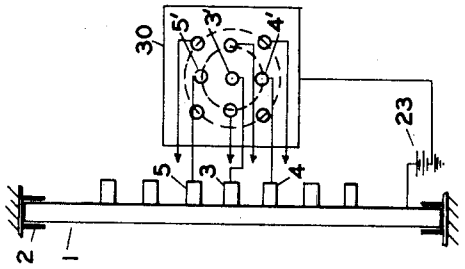


FIG. 2

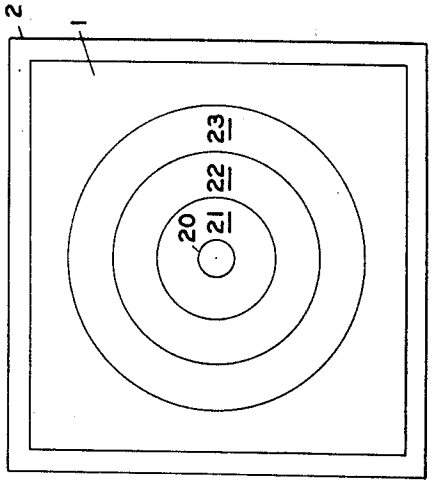


FIG. 1

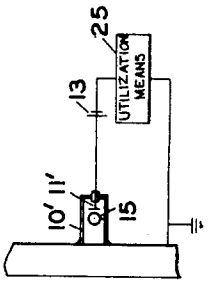


FIG. 5

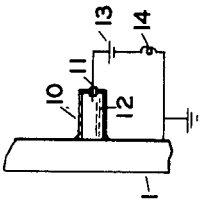


FIG. 4

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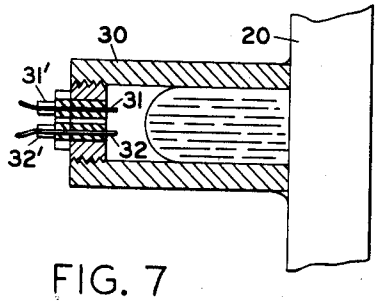


FIG. 7

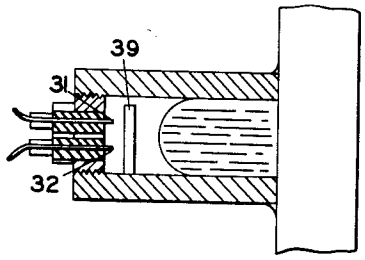


FIG. 9

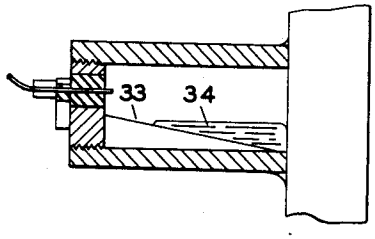


FIG. 8

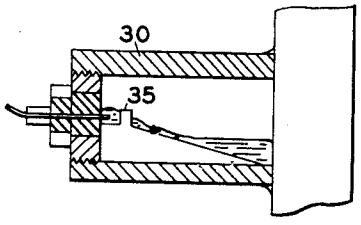


FIG. 10

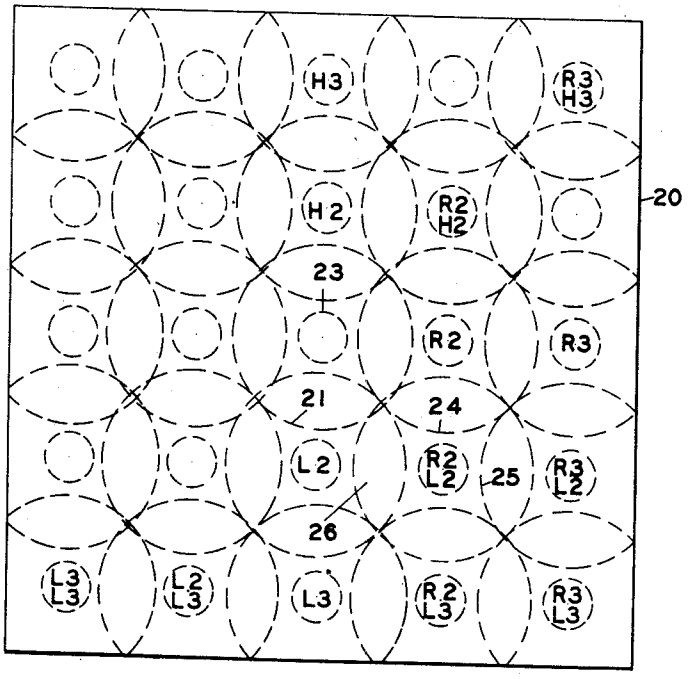


FIG. 6

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TARGET AND INDICATOR MEANS

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1 Claim. (Cl. 273—102.2)

This invention relates to targets for marksmen and more particularly to such means having means to automatically indicate and record hits on said target.

One of the primary problems in the operation of target ranges for pistols or rifles is the expense of scoring. Target ranges generally use separate paper targets for each shooter, which must be taken down and inspected by a man stationed at the target, who must then install another paper target for the next shooter. This is a very time-consuming and expensive procedure, as it involves a delay between each person shooting and it is also dangerous since the man changing the targets is periodically in the shooting range.

Various attempts to solve this problem have been made. Many of them use segmented targets, that is, the bull's-eye and the separate rings being separately mounted so that movement of one of the segments caused by the bullet hitting may be picked up and transmitted to an indicator or recorder. Where the segments are not in the same plane, there are errors caused by ricocheting of a bullet from one segment to another. Where the segments are mounted in the same plane with slight spacings, whenever a bullet hits a spacing, it effectively disables the target since it effectively welds the two segments together.

Another method used in the prior art has been the double screen method using two conducting layers separated by an insulator and arranged so that as the bullet passes through, it momentarily establishes a circuit between the two conducting layers. This type target does not have any permanency and must be periodically replaced.

The present invention provides a permanent target having suitable pickup means for indicating or recording the score. The target of the present invention is a solid impermeable plate, for instance, of steel, and pickup means are mounted on the rear side of the plate. The target is painted or otherwise placed on the front side of the plate, and the pickups are arranged on the back in positions corresponding to the bull's-eye and the various rings, or in a rectangular grid or other arrangement. When the bullet strikes the front of the plate, it sends a shock wave through the plate which is picked up by the closest pickup, or if it is equidistant, by the closest two pickups. The pickups may comprise electrical switches, for instance, of the mercury type.

The purpose of this invention is to develop a remote indicating and registering target that will be simple, durable, foolproof in its operation and economical to construct, and also to be capable of being used with military weapons of any reasonable caliber without any structural damage to its operating mechanism.

To satisfy all these conditions the impact face of the target is preferably constructed of steel armor plate. The composition and thickness of the armor plate is to be such for any given caliber, that the projectile fired against it will destroy itself without leaving any permanent deformation on the face of the target. In other words the stress

induced by the projectile at the point of impact shall be below the elastic limit of the material of the armor plate.

It is also a well known physical fact that deflection occurs when force is applied to any structural member, the bullet striking the plate in our case. When stress is below the elastic limit, the deflection is momentary and is not apparent to the eye. But it is there anyway, radiating in a semi-spherical pattern, as is well illustrated by the appearance of weak targets, stressed beyond their elastic limit, when permanent deformation and some degree of penetration takes place.

This minute and localized elastic deformation of the target plate is used in this invention to actuate the sensitive element, "energy cell," or signal pickup as it will be referred to from now on in this specification.

The energy cell is securely attached to the back surface of the target armor plate, where it is subject only to the elastic shock transmitted through the body of the plate and is completely protected from any damage by the projectile.

The purpose of the energy cell is to receive the filtered portion of the energy of the projectile and convert it into usable motion for actuating the electrical contacts. This is accomplished by imparting certain motion to the mass contained within the cell.

Physically it can take many forms, some of the more practical ones being as follows:

(1) A heavy ball rolling against a spring and closing flexible electrical contacts at the end of its travel.

(2) Free piston bouncing in the hollow cylinder filled with gas. The piston is to compress the flexible electrical contacts at the end of its travel or operate pressure switch by compressing the gas at the head end.

(3) A small body of mercury to be driven up the incline on top of which open contact points are located. When the latter are submerged by the mercury, the electrical circuit is completed.

In each case the momentary completion of the electrical circuit is to operate the remote indicator or recorder such as lamp, an annunciator drop or some other more complicated device.

There are two methods available for the control of the resolution or sensitivity of the target.

Method A.—The thickness of the plate, over that of the necessary minimum, can be varied. As was stated previously, the lines of force radiate from the point of impact with rapidly diminishing intensity. Since it takes certain minimum amounts of transmitted energy to operate the energy cell, it follows that the thicker the plate, the smaller is the effective area behind each point of impact containing enough energy to operate the cell. It may be noted at this point that the effective operating area of each cell is several times the face area of the cell itself, the ratio depending on the thickness of the plate.

Method B.—The strength of the returning medium can be varied, be it compression constant of the spring, the compression ratio of gas, or the angle of the inclined plane that mercury must travel.

Accordingly, a principal object of the invention is to provide new and improved target and indicating means.

Another object of the invention is to provide new and improved target means, indicating means and recording means.

Another object of the invention is to provide new and improved permanent target and indicating means eliminating the use of disposable paper targets.

Another object of the invention is to provide new and improved target and indicating means eliminating the need for a target keeper at the target.

Another object of the invention is to provide new and improved target and indicating means comprising a single impermeable plate with target rings painted on its front

surface and a plurality of pickup means mounted on the other side of said plate and arranged to correspond with the target rings.

These and other objects of the invention will become apparent from the following specification and drawings, of which:

Figure 1 is a front view of an embodiment of the invention;

Figure 2 is a side view of the embodiment of Figure 1 with a schematic electrical diagram illustrating the operation of the invention;

Figure 3 is a back view of the embodiment of Figure 1;

Figures 4 and 5 are detail views of the pickup means;

Figure 6 is a front view of another embodiment of the invention; and

Figures 7 through 10 are detail sectional views of typical pickup means.

Referring now to the drawings, the invention comprises a plate **1**, for instance, of plate steel which is impermeable to the bullets. The plate is mounted in a stationary frame **2**. On the front surface of the plate is painted, etched, or otherwise placed thereon the bull's-eye **20** and several rings **21**, **22**, **23**, representing the usual target.

Referring to Figure 2 and Figure 3, a series of pickups **3**, **4**, **5** and so forth are fixed to the back surface of the plate **1** and arranged correspondingly behind the bull's-eye and the various rings. For instance, the pickup **3** is placed behind the bull's-eye and the pickups **4**, **5**, **6**, and **7** are equally spaced around the first ring.

The pickups may be electrical switches, for instance, of the mercury type as shown in Figure 4. The pickup comprises a body tube **10** which is fixed to the rear surface of the target, for instance, by welding. The other end of the tube contains an insulated terminal **11**, and the bottom of the tube contains a quantity of mercury **12**. Therefore, when a bullet strikes immediately in front of the pickup **9**, the mercury will be disturbed and splash, thus establishing a circuit between the contact **11** and the mercury **12**. The complete circuit will be from ground to the plate **1**, body **10**, mercury **12**, contact **11**, battery **13** and utilization means **14**, which may be an indicator light, a relay coil, or other utilization means, back to ground.

Alternatively, the pickup may comprise another type of electrical switch **10'**, Figure 5, comprising a fixed contact **11'** and a vibrating contact **15** which may be weighted. This will operate in the same manner as described above. Figure 5 shows a connection to utilization means **25**.

Referring now to Figure 3, the dotted lines define the areas of influence of the respective pickups. For instance, a hit on the bull's-eye will activate pickup **3**, and a hit on the area **5'** will activate pickup **5** and so forth. There are four equally spaced pickups **4**, **5**, **6** and **7** behind the first target ring. Pickups **16**, **17**, **18** and **19** and so forth are placed on a circle behind the second target ring. These pickups are preferably staggered as much as possible between the pickups on the first target ring to minimize interference.

The pickups will give the ring hit and also the approximate angular position, for instance, 90° or three o'clock, 180° or six o'clock. Therefore, the shooter will know how to correct his next sighting.

Figure 2 also shows a typical schematic electrical diagram showing how the pickups are connected to the indicator **30**. For instance, pickup **3** behind the bull's-eye is connected to a central indicator **3'**, which may, for instance, be a red light bulb. The circuit through the pickup **3** goes from ground, battery **23**, plate **1**, pickup **3**, indicator light **3'**, back to ground. The other pickups are similarly connected to separate light bulbs, the pickups on the first ring being connected to the light bulbs **4'**, **5'**, **6'** and **7'**. The indicator lights on the same ring should preferably have the same color, for instance, white; and the indicator lights on the next ring another color, for instance, green. Other indicating or recording apparatus may be connected in similar manner.

In operation, if a bullet hits directly on a bull's-eye, the red indicator **3'** will light. If the bullet hits on the first ring, one of the white indicators will light at the approximate angle. If a bullet hits equi-distant between a red and white pickup, both lights will light. In that event, the score is the average between the two. Applicant has found that there is no likelihood of more than two lights indicating at the same time, since the shock waves are absorbed in the steel plate and attenuated very rapidly. The thickness of the plate, of course, is preferably chosen to achieve this attenuation for the size and velocity of the bullets being used. For instance, a plate designed for a .22 caliber bullet at 50 yards would not necessarily have the proper attenuation characteristics for a .45 caliber bullet at the same distance. However, when the thickness of the plate is properly chosen for the size and velocity of the bullet, the target will operate as described. For a .22 caliber pistol at 50 yards, applicant has found that plate steel ¼" in thickness is adequate. Resolution of 2" squares has been obtained in an embodiment of this type. The plate **1** should be firmly mounted in the stationary frame **2** in order to minimize any vibrations set up in the plate.

Instead of a visual indicator as previously described, various other indicators or utilization means **25**, Figure 5, for scoring or providing a permanent record may be used.

Figure 6 shows a front view of a target having the energy cells or pickups arranged in a square pattern. The purpose of this target is primarily for instruction purposes, and the pickups may be labeled high, low, left and right for the purpose of adjusting on the next shot. Specifically referring to Figure 6, there is shown a steel plate **20** on the front of which is placed an aiming circle **21** and on the rear of which are a series of pickups. The pickups, other than the direct hit pickup **23**, are preferably labeled H–**2** and H–**3** for high shots, R–**2** and R–**3** for hits to the right, L–**2** and L–**3** for low hits, and similar nomenclature for the other directions. Pickups that are high and to the right may be labeled H–**1** R–**1** and so forth. The circular areas of influence for each pickup are shown by the dotted lines **24**, **25**, and so forth. Hits in the overlapping areas such as the shaded area **26** will register on two indicators. For instance, hits in the area **26** will register on L–**2** and R–**2** L–**2**. The pickups are connected to any suitable indicator, recorder, or scoring device as previously discussed.

Figures 7 and 8 show detail plan and elevation sectional views of a typical mercury type pickup. The pickup comprises a casing **30**, a pair of contacts **31**, **32**, which are suitably insulated from the casing by insulating sleeves **31'**, **32'**. The casing **30** may be of a suitable material, for instance, steel pipe, which is welded or otherwise rigidly fastened to the back of the target plate **20**.

Referring to Figure 8 the bottom interior surface **33** of the casing is at an angle so that the mercury **34** will not be in contact with the contacts **31**, **32**. However, when the target is struck adjacent the pickup, the mercury will flow towards the contacts completing the circuit between them.

Figures 9 and 10 show detail plan and elevation sectional views of a slightly different embodiment of the pickup. This embodiment is similar to the embodiment of Figures 7 and 8 except that it is arranged to have a delayed action so that the indication will be slow enough for visual observation. This is accomplished by providing a small dam **35** at the top of the interior bottom surface. The dam **35** does not extend completely across the interior, but has an open gateway **36** shown in Figure 9. Therefore, when a hit is made in the area of the pickup, the mercury will collect behind the dam **35** and remain there momentarily until it drains out the gateway **39**. The width of the gateway may be chosen to provide an indication of the desired duration since the mercury will

complete the circuit between the contacts 31, 32 until it drains out of the dam. Only one contact need be used if the casing is made part of the circuit.

The space above the mercury pool can be evacuated or filled with inert gas, before chamber is sealed, to protect mercury from oxidation.

I claim:

Target indicating means comprising an impermeable solid plate rigidly mounted having a smooth face and having a permanent target on the front surface thereof with a plurality of target portions having different scoring areas, a plurality of electrical switches fixedly mounted on the rear of said plate to receive a direct shock wave through said plate and arranged in positions behind said target corresponding to said target portions thereof, each of said switches having two contacts both of which are supported by said target plate, each of said switches being located behind and responsive to different scoring area portions of said target plate, and utilization means connected to said pickup means.

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