

United States Patent
Schärz et al.

[15] 3,690,661
[45] Sept. 12, 1972

[54] AUTOMATIC HIT INDICATING SHOOTING TARGET

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[22] Filed: Feb. 1, 1971

[21] Appl. No.: 111,313

[30] Foreign Application Priority Data

Feb. 12, 1970 Switzerland 2068/70

[52] U.S. Cl.273/102.2 R, 310/8.6, 73/133 D
[51] Int. Cl.F41j 5/00
[58] **Field of Search** ..273/102.2 R, 102.2 A, 102.2 S;
310/8.3, 8.4, 8.5, 8.6; 340/323; 73/133 D

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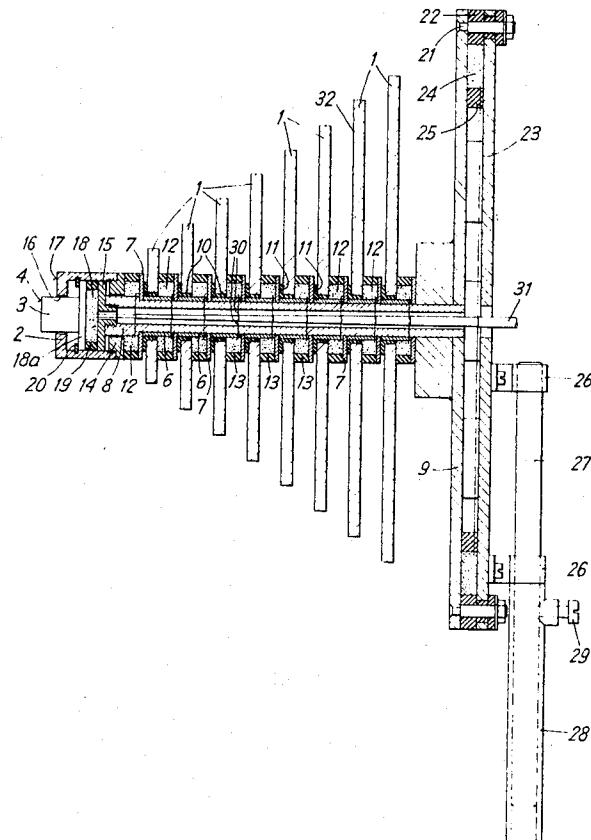
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[57] ABSTRACT

There is disclosed a shooting target for the automatic indication of hits, comprising a number of different size target bodies having impact surface for the fired projectiles, a base plate, and a central column for mounting said target bodies behind one another and independently movable with respect to one another to a limited extent at said base plate. Sensing elements responsive to the relative movement of the target bodies serve to influence an electrical current flowing in a current circuit associated with each target body, said sensing elements being arranged between said individual target bodies. An intermediate plate is mounted to be movable to a limited extent relative to the base plate and is arranged between the target bodies and the base plate. Additional sensing elements are arranged substantially along a circular path between said intermediate plate and said base plate for indicating the position of the fired shot.

5 Claims, 7 Drawing Figures



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FIG. 1

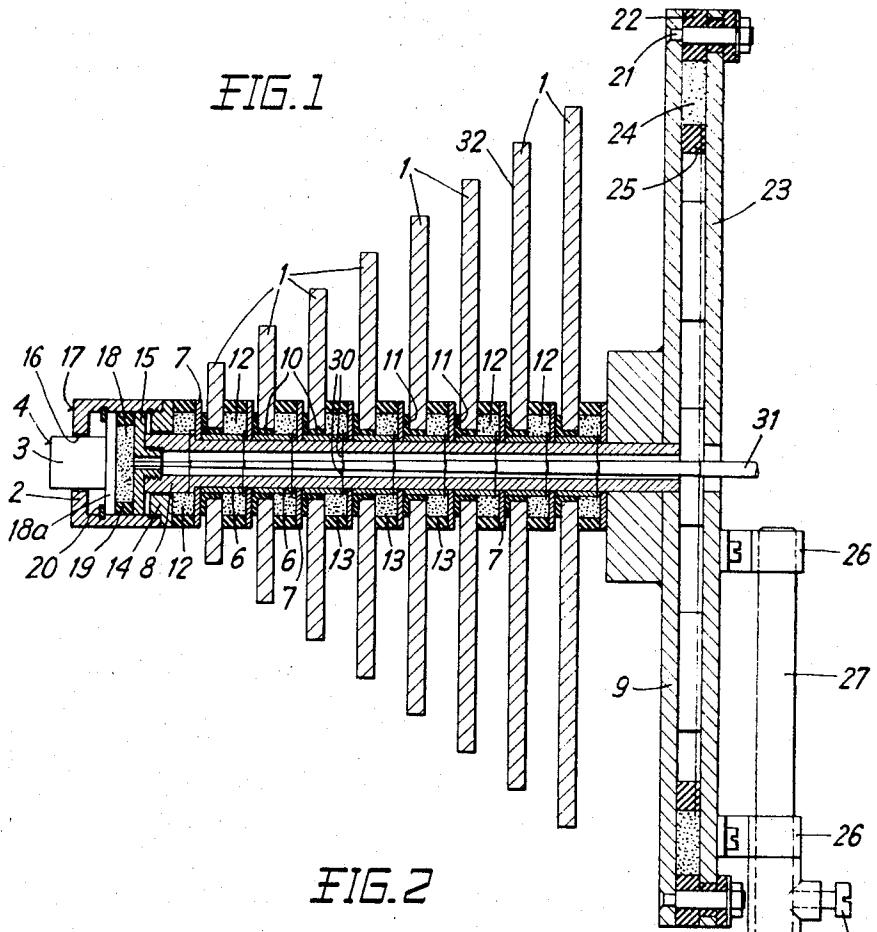
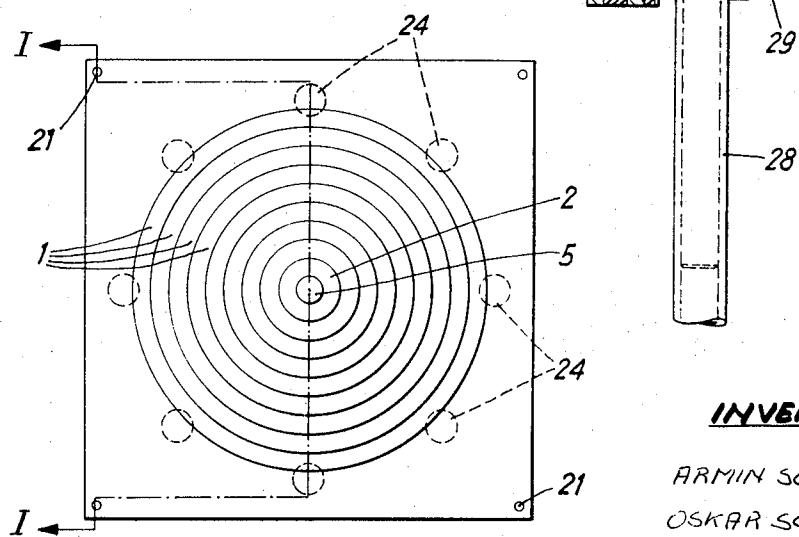


FIG. 2



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PATENTED SEP 12 1972

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FIG. 3

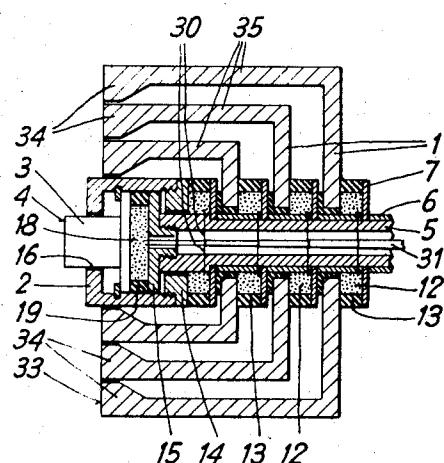


FIG. 4

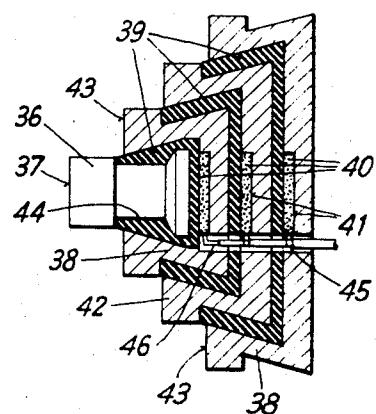


FIG. 5

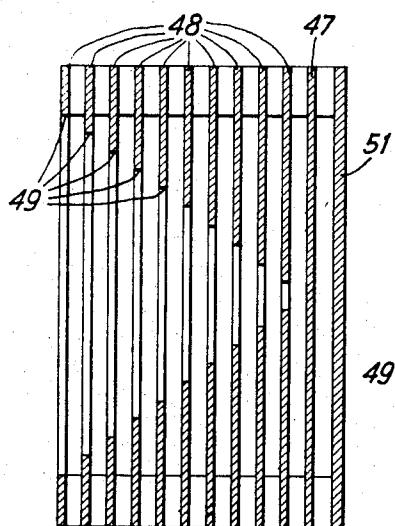
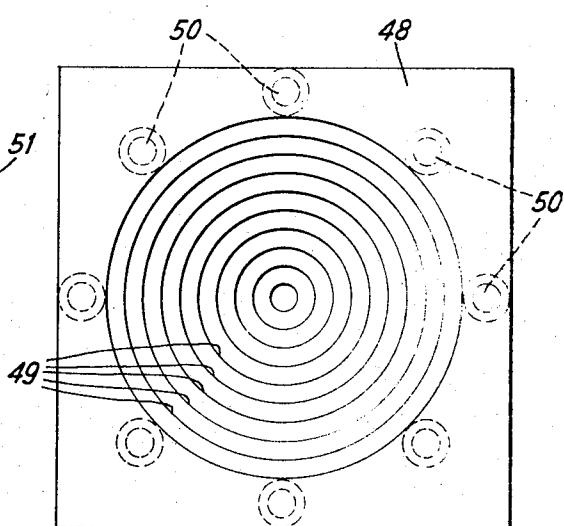


FIG. 6



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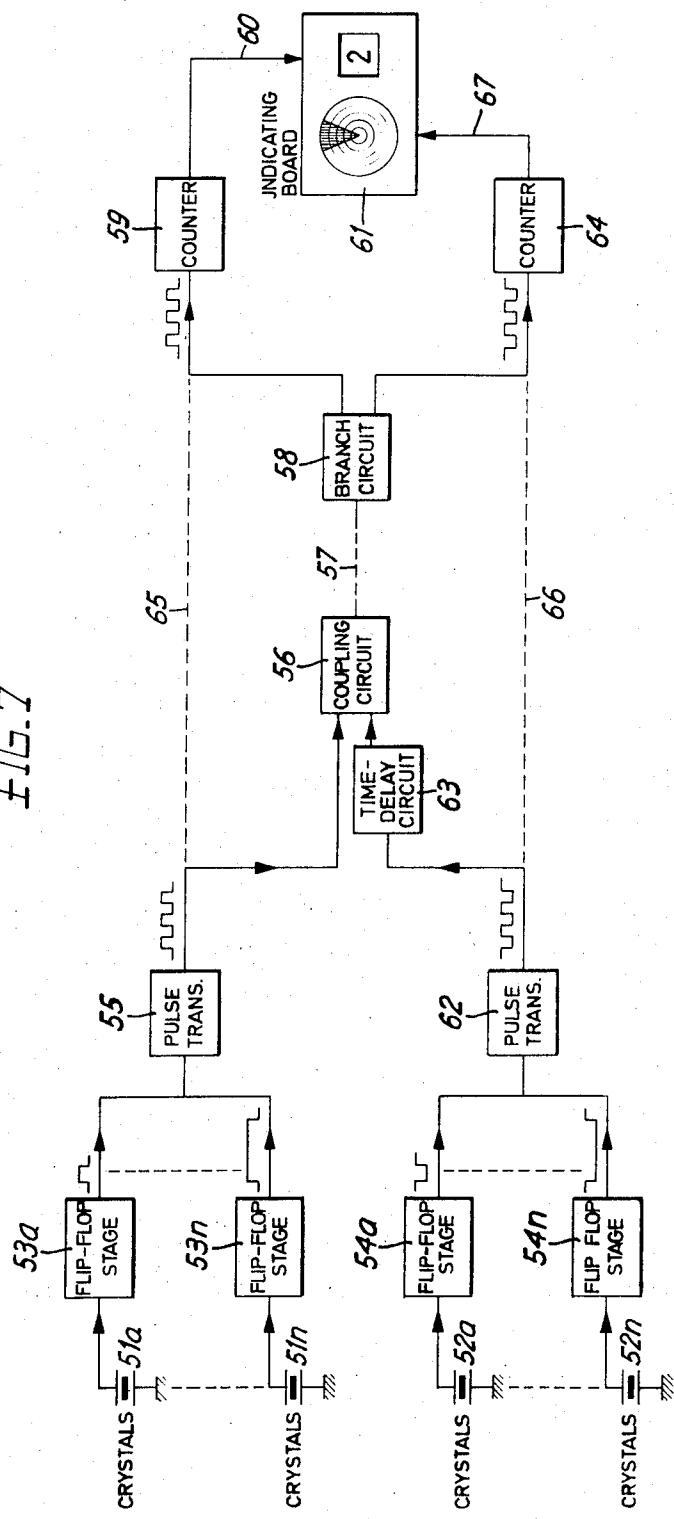
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FIG. 7



AUTOMATIC HIT INDICATING SHOOTING TARGET

BACKGROUND OF THE INVENTION

The present invention relates to a new and improved shooting target for the automatic indication of hits and which is of the type consisting of a number of different size target bodies having impact surfaces for the projectiles or bullets, these target bodies being arranged behind one another or in tandem and independently of one another for limited movement at a base plate. The target of the invention further incorporates elements responsive to the relative movement of the target bodies for influencing an electrical current in a current circuit associated with each target body.

Targets for the automatic indication of the point of entry of a projectile have already been proposed in the art. Such known shooting targets typically possess at least two foils arranged behind one another perpendicular to the path or flight of the bullet and electrically insulated from one another, these foils being formed of a suitable conductive material. The projectile or bullet penetrates these foils and as a result both foils are briefly electrically coupled with one another through the action of the metallic projectile. An electric current surge or spike then appears at one current circuit coupled with both foils, and which current circuit is equipped with a suitable voltage source. The current surge is then evaluated at a suitable electronic device and the point of penetration of the bullet or projectile at the target is indicated. To this end, different sectors of the target are advantageously formed of conductive foils so that the position of the shot or bullet is faultlessly indicated.

Such type targets are especially suitable for projectiles which are shot at the target by means of relatively large caliber firearms or rifles. Projectiles fired from relatively small caliber firearms are not capable of penetrating these foils in all instances such that an electrical contact is always positively provided. Furthermore, the scoring or target circles for shooting targets used with small caliber firearms are generally situated so close to one another that manufacture becomes difficult and a large number of welding operations are required. Additionally, the size of the foils which are subdivided into sectors have a lower limit. Thus, this known construction of target is not suitable for small size targets, as such for instance are typically used in small caliber shooting stands.

It has also already been proposed to provide a substantially cone-shaped body formed of separated layers and serving as the target bodies. The individual layers forming the cone are attached in such a manner that if hit by a projectile they are placed into movement and thereby trigger the target hit-indicating operation. To render this possible the individual target bodies are subdivided into a number of sectors, contacts being arranged behind these individual sectors.

Furthermore, a target construction is also known to the art for the automatic indication of hits which resorts to the use of a truncated cone consisting of a number of target bodies and an impact body arranged behind such truncated cone which serves to indicate the position of the hit. The target bodies are arranged so as to be individually movable at a central support rigidly coupled with a stationary base plate. The move-

ments of the target bodies are transmitted to an electrical switch located behind the base plate through the intermediary of a rod member associated with each target body. The electrical switch then indicates the hit.

These known shooting targets possess the drawback that they are extremely sensitive to malfunction owing to the rod members necessary for motion transmittal. Further, an additional expenditure of hardware is necessary to indicate the position of the hit.

SUMMARY OF THE INVENTION

Hence, there is still present a real need in the art for automatic hit-indicating targets which are not associated with the aforementioned drawbacks of the prior art constructions. Thus a primary objective of this invention relates to the provision of just such type target which effectively and reliably fulfills the existing need in the art.

Another and more specific object of the present invention relates to an improved construction of shooting targets which can be used for small caliber projectiles having a lower penetration or puncture force and which is more operationally reliable than the previously known targets of this type.

Still a further significant object of the present invention relates to an improved target construction of relatively simple design, one which is reasonably economically feasible to manufacture, not readily subject to breakdown, and provides for positive indication of both the hit at the target and the location thereof.

Now, in order to implement these and still further objects of the invention which will become more readily apparent as the description proceeds, the target construction of the invention contemplates arranging the aforementioned elements for influencing an electrical current in a current circuit associated with each target body between the individual target bodies. Furthermore, between the arrangement of the target body and the base plate, there is provided an intermediate plate

which is movable to a limited extent with respect to such base plate and wherein the central axis of the arrangement of the target bodies is rigidly connected with the intermediate plate. Further, additional elements for influencing appropriate current circuits are arranged at a circle in order to indicate the position of the hit, these further elements being located between the intermediate plate and the base plate.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and objects other than those set forth above, will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

FIG. 1 illustrates in longitudinal sectional view a shooting target designed according to the concepts of the invention and serving to automatically indicate hits and the location or position of the hits;

FIG. 2 is a top plan view of the target of FIG. 1 on a somewhat reduced scale;

FIG. 3 is a fragmentary sectional view of a second embodiment of inventive shooting target;

FIG. 4 is a fragmentary sectional view of a third embodiment of inventive shooting target;

FIG. 5 is a sectional view of a fourth embodiment of inventive shooting target;

FIG. 6 is a plan view or front view of the shooting target shown in FIG. 5; and

FIG. 7 is a block circuit diagram of an electronic device for indicating the hits and the position of such hits at the target.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawings, in the exemplary embodiment of shooting target illustrated in FIGS. 1 and 2 there are provided a group of eight similar substantially circular shaped target bodies 1 and a substantially pot-shaped target body 2 as well as a cylindrical target body 3 which is equipped with the smallest impact surface 4. All of these target bodies 1, 2 and 3 are arranged so as to be movable relative to one another and to a central support 5 where such bodies are arranged. Support rings 7 arranged at a spacing from one another by spacer sleeves 6 at the central support are fixedly clamped between the widened head portion 8 of this central support 5 and an intermediate plate 9. All of the substantially circular-shaped target bodies 1 will be seen to possess a central bore 10, the diameter of which is greater than the outer diameter of the spacer or distance sleeves 6, yet smaller than the external or outer diameter of the support rings 7. The marginal portion of the circular-shaped target bodies 1 surrounding the bores 10 extends into the grooves limited by the support rings 7, the circular ring-shaped target disks being retained, by a respective elastic holder or retainer ring 11 possessing an angle-shaped cross-section, concentrically with respect to the central support 5.

A suitable piezoelectric crystal 12, having a substantially ring-shaped configuration, is arranged between each respective circular-shaped target body 1 and a support ring 7. By virtue of the elastic pressure ring 13 surrounding each crystal 12 the associated target body 1 is retained in its rest or initial position.

The pot-shaped target body 2 will be seen to be equipped with a radially inwardly protruding rocker or balance 14. The latter engages into a groove formed by a disk-shaped closure element 15 threaded onto the end face of the central support and the support ring 7 bearing against the head 8 of the central support 5. Further, one side of this rocker element 14 bears against the associated crystal 12. Also, in this case, the ring-shaped crystal 12 is surrounded by a pressure ring 13, the outside diameter of which at best is equal in size to the outside diameter of the pot-shaped target body 2. At the base of the pot-shaped target body 2 there is provided an opening 16 for the cylindrical target body 3. The outside surface which remains at the base or floor of target body 2 provides the second smallest impact surface 17. The cylindrical body 3 possesses a collar 18a which is arranged within the pot-shaped target body 2 for limited movement in relation to the lengthwise axis of the central support 5. A further disk-shaped crystal 18 is located between the inner end surface of the cylindrical target body 3 and the closure element or piece 15. This last-mentioned crystal is likewise surrounded by a pressure ring 19 which, together with a spring clip or circlip 20, or equivalent structure, serves to retain the cylindrical-shaped target body 3 in its rest position.

The intermediate plate 9 is arranged for limited movement with respect to a base plate 23 by means of the screws 21 and the rubber elements 22. Now between both plates 9 and 23 there are arranged along a circle at a uniform spacing from one another eight further disk-shaped crystals 24. These crystals are likewise surrounded by elastic support rings 25 maintaining intermediate plate 9 at a fixed spacing from base plate 23. A bolt 27 is attached by a clamp means 26 to the rear face of the base plate 23. Bolt 27 has a lower portion which is inserted into a stationary tubular member 28. An adjustment screw 29 serves to fix the bolt 27 within the tubular member 28 so that the base plate 23 is supported against movement.

The central carrier or support 5 is of hollow construction and the closure element 15 as well as the intermediate plate 9 and the base plate 23 are provided at their central region with a respective throughpassage opening so that the connection wires 30 of the crystals can be grouped together into a cable 31 departing from the rear face of the base plate 23 as best shown in FIG. 1.

Although the above-described target of the invention appears from the side to possess a pine or fir tree-like configuration, the shooter when shooting at the target sees a normal target image of the type indicated in FIG. 2. This shooting target provides a 10-point target for small caliber shooting stands. The target bodies 1, 2, 3, and 9 consist of a high grade steel and are sufficiently stable in design to resist impact of the projectile. It is here expressly mentioned that the bullets or projectiles do not penetrate the target bodies rather, as experiments have shown, upon impact practically disintegrate or laterally rebound.

Since the target bodies are mounted to be limited in movement upon impact of the projectile such target bodies are briefly pressed against the restoring force of the elastic support rings in a direction towards the base plate 23. Consequently, the corresponding crystal 12 or 18 is briefly stressed or compressed. Hence, a voltage pulse or spike appears at the connection wires 30 of the relevant crystal. This voltage pulse or possibly a number of such are then delivered via the cable 31 to an electronic device which will be described more fully hereinafter.

The voltage pulses or signals generated by the crystals 12 or 18 associated with the target bodies 1, 2 and 3 serve to indicate target hits. Thus, for instance, a voltage pulse produced by for instance the crystal 12 associated with the pot-shaped target body 2 will indicate the score "9" because a projectile has impacted against the impact surface 17.

The shooter however is not only interested in an indication of the target hit rather he is also interested in knowing where at the target the hit has occurred. This is important so that when aiming at the target he knows how to carry out necessary firing corrections and in which direction in order to place the shot in the center of the target. Now, for the purpose of indicating the location of position of the hit, there are used the aforementioned crystals 24 arranged between the intermediate plate 9 and the stationary base plate 23.

As already indicated above, the entire group of target bodies, the central support 5 and the intermediate plate 9 are arranged or mounted so as to be movable to

a limited extent in relation to the base plate 23. Thus, upon impact of a projectile, for instance at location 32 of FIG. 1, the corresponding target body 1, in this case the second largest target body or disk, is pressed in the direction of the base plate 23. This causes the associated crystal 12 which is under stress to deliver a voltage pulse or spike representative of the hit score "2". This impact further causes the central support 5 to be slightly upwardly rocked in clockwise direction about a difficult to define axis, resulting in the intermediate plate 9 also carrying out this slight rocking movement because it is rigidly connected with the central support 5. Consequently, the three crystals 24 located uppermost in the showing of FIGS. 1 and 2 and between the intermediate plate 9 and the base plate 23, will be compressed or stressed, the largest pressure being applied to the centrally located crystal 24. As a result, this crystal will produce a voltage pulse or spike having the largest amplitude. This largest magnitude voltage pulse is evaluated in the above-mentioned electronic device and indicates the corresponding hit position.

In the event a projectile fails to hit any of the target bodies 1, 2, or 3, rather only impacts against the intermediate plate 9, then only the hit position will be indicated not the hit itself.

In FIG. 3, there is illustrated a second embodiment of target design through the use of the teachings of the invention. The impact surfaces 33 of the target body 1 are arranged in one plane. These impact surfaces are defined by the radially extending end surfaces of the target rings 34 rigidly connected via support elements 35 with the respective circular-shaped target bodies 1. The support elements 35 represented in FIG. 3 are in the form of hollow cylinders which are welded to a respective one of the circular-shaped target bodies 1. The remaining portions of this shooting target are similarly constructed as was the case for the target of FIG. 1, and thus the same reference characters have generally been conveniently used for similar or analogous components.

FIG. 4 illustrates a third embodiment of shooting target designed according to the teachings of the invention with the exception that apart from target body 36 having the smallest impact surface 37 all of the other target bodies 38 possess a substantially pot-shaped or bowl-shaped construction and are stacked within one another. Between each smaller target body and the next larger target body partially enclosing such smaller target body there is arranged an elastic layer 39, as shown. By virtue thereof, the individual target bodies are movable to a limited extent relative to one another. Between the inner end face of the cylindrical-shaped target body 36 or the outside face of the base or bottom of the remaining target bodies 38 and the inner face of this base or bottom there is arranged a respective disk-shaped piezoelectric crystal 40, preferably located within an associated recess 41.

The inside and outside surfaces of the jacket of the pot-shaped target bodies 38 extend conically and the opening of each such pot-shaped target body is provided with a radially outwardly protruding marginal portion or skirt 42 which, however, does not protrude past the largest diameter of the base. The radially extending end faces of such marginal portions or skirts 42

form the impact surfaces for the target, as indicated by reference character 43. Owing to the conical construction of the jacket or outside surface of the pot-shaped target bodies 38 which are telescopically fitted or stacked within one another, after application of the elastic layers 39 such pot-shaped target bodies 38 cannot fall out of the associated or next neighboring target body partially surrounding such. The cylindrical target body 36 possesses a notched portion or recess 44 which, when such is filled with the layer 39, prevents this cylindrical target body 36 from dropping out of the next successive or neighboring target body 38.

Now, at the base of the pot-shaped target bodies 38 and at the elastic layers 39 there are provided aligned recesses or notches 45 for passage of the connection wires 46 of the crystals 40. The largest pot-shaped target body 38 is connected with an intermediate plate, as previously explained, and therefore to preserve clarity in illustration has not particularly been shown in FIG. 4. This intermediate plate, it is here mentioned, can be constructed just as the intermediate plate 9 of FIG. 1. Also, such intermediate plate is connected in the same manner as discussed before with the base plate, and 25 wherein for the purpose of indicating the position or location of the hit likewise a number of further crystals are arranged in a circle between these plates.

A fourth embodiment of shooting target has been schematically illustrated in FIGS. 5 and 6. With the exception of the target body 47 possessing the smallest impact surface all other target bodies 48 possess a central circular and different size opening 49. Here instead of using a central support as discussed above, there are now provided, for instance eight supports or carriers arranged in a circle. Each of these carriers 50 possesses the same construction as the central carrier 5 depicted in FIG. 1, whereby however only one of these carriers is associated with a respective crystal (not visible in FIGS. 5 and 6) cooperating with one of the target bodies. Only between the target body 47, which in this embodiment also functions as the intermediate plate, and the base plate is there provided for each carrier 50 a non-visible crystal for the purpose of indicating the position of the hit.

FIG. 7 illustrates a block circuit diagram of the above-mentioned electronic device which evaluates the voltage pulses generated by the crystals and accordingly indicates the hits or the position of the hits. In this block circuit diagram the piezoelectric crystals associated with the individual target bodies have been referenced by reference characters 51a to 51n and the piezoelectric crystals arranged between the base plate and the intermediate plate have been referenced by 55 reference characters 52a to 52n.

A monostable flip-flop stage 53a to 53n or 54a to 54n is electrically coupled with each of these crystals. The voltage spikes generated by the crystals are delivered to the input side of the corresponding flip-flop stage. Such respond to positive or negative voltage spikes or peaks which exceed a predetermined threshold value and generate a pulse at their output side.

The flip-flop stage 53a generates a positive pulse of short duration, for instance of 10 ms. upon the occurrence of a positive voltage spike. The non-illustrated flip-flop stage 53b generates a positive pulse of 20 ms.

(milliseconds) duration. Each subsequent flip-flop stage 53c, 53d . . . 53n in each case produces a positive pulse which is longer by 10 ms. than the pulse generated by the preceding flip-flop stage. From what has been just explained, it will be apparent that a positive pulse of different duration will be generated depending upon the hit.

Preferably, the flip-flop stage 53a which produces the shortest positive pulse is connected with that crystal associated with the largest size target body, in other words the target body indicative of the lowest hit score or number. The flip-flop stage 53n which produces the largest positive pulse is connected with that crystal associated with the smallest target body, in other words that target body which is indicative of the highest hit score or number. In this manner, if a bullet only glancingly passes or slightly touches a target body and thereafter impacts against the next larger size target body, two positive pulses will be produced, whereby however both pulses will begin almost at the same time and the longer duration pulse, correspondingly to the higher hit score, will outlast the shorter duration pulse causing the higher hit score to be indicated. This is correct since also at a standard target the higher hit score is given to the shooter if a target circle is hit.

The outputs of the flip-flop stages 53a to 53n are all in parallel and coupled electrically with the input of a pulse sender or transmitter 55. The latter produces, as a function of the duration of the positive pulses delivered thereto, a corresponding number of shorter positive pulses of constant duration, the number of these shorter pulses being proportional to the hit score.

This group of short positive pulses is delivered to a transmission line 57 through the agency of a coupling circuit 56, transmission lines 57 being placed between the target stand and the shooting stand. This group of short positive pulses arrives at a first pulse counter 59 through the agency of a branch circuit 58 at the shooting stand, and the pulse counter 59 then counts the incoming positive pulses. In accordance with the count the score number is rendered visible at an indicating board 61 coupled with the counter 59 by means of the conductor or line 60.

The monostable flip-flop stage 54a generates a relative short negative pulse of about, for instance 10 ms. duration when the crystal coupled therewith, which for instance may be assumed to be uppermost crystal 24 of the arrangement of FIG. 2, generates a voltage peak or spike exceeding a predetermined threshold value. Each successive flip-flop stage 54b, 54c . . . 54n produces a negative pulse which is longer than the next preceding pulse by 10 ms., so that depending upon the position or location of the hit or shot the length of the generated negative pulse varies. All outputs of the flip-flop stages 54a to 54n are connected in parallel and coupled with the input of a second pulse transmitter 62. Depending upon the length or duration of the negative pulses delivered to this second pulse transmitter 62 such generates a number of shorter negative pulses of constant duration in such a manner that the number of these short negative pulses contain information as regards the position of the shot.

From the second pulse transmitter 62 the group of negative pulses arrive via a time delay circuit 63 at the coupling circuit 56. At this time delay circuit 63, the

negative group of pulses is stored at least so long until the positive group of pulses produced by the first pulse transmitter 55 has been delivered to the coupling circuit 56. Only thereafter do the negative pulse groups arrive via the coupling circuit 56 at the transmission line 57 and via the branch circuit 58 at a second pulse counter 64. Counter 64 controls by means of the line 67 the indication of the position of the shot or hit at the indicator board 61. For this purpose the indicator board has shown symbolically thereon a target which illuminates in sectors depending upon the location where a projectile has impacted at the corresponding sector of the target of FIG. 1.

It will be recalled that during the preceding discussion it was assumed that a projectile impacted at location 32 of the second largest target body 1 of FIG. 1. The indicator board 61 of FIG. 7 indicates the data regarding this fired shot, namely the score number "2" and the sector where the hit occurred lights up at the board 61, which in this case is exactly vertically above the target center, as shown.

If there are available two transmissions lines 65 and 66 as shown in broken lines in FIG. 7, then it is possible to dispense with the time delay circuit 63, the coupling circuit 56 and the branch circuit 58. The respective groups of pulses produced by the pulse transmitters 55 and 62 can then be simultaneously transmitted and without interfering with one another to the pulse counters 59 and 64, respectively. In this case, the monostable flip-flop stages 53a . . . 53n and the monostable flip-flop stages 54a . . . 54n can be identical.

Since for small caliber shooting installations, the shooting stand and the target stand are relatively close to one another, it is possible to use instead of a two conductor transmission line also a single conductor line, whereby ground serves as the common return line.

The shooting targets illustrated in FIGS. 1 to 6 all have been shown to possess substantially circular-shaped impact surfaces, yet it however is expressly mentioned that the target bodies can possess practically any optionally desired shape. Further, it is here stated that the subdivision of the impact surfaces can be as fine or small as desired.

While there is shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims. Accordingly,

What is claimed is:

1. A shooting target for the automatic indication of hits, comprising a number of different size target bodies having impact surface means for the fired projectiles, a base plate, means for mounting said target bodies behind one another and independently movable with respect to one another to a limited extent at said base plate, a current circuit operably associated with each target body, sensing element means responsive to the relative movement of the target bodies for influencing an electrical current flowing in said current circuit associated with each target body, said sensing element means being arranged between said individual target bodies, an intermediate plate mounted to be movable to a limited extent relative to said base plate arranged between said target bodies and said base plate, addi-

tional sensing element means arranged substantially along a circular path between said intermediate plate and said base plate for indicating the position of the fired shot, one of said target bodies possessing an impact surface defining the second smallest impact surface means for the target, said one target body being substantially pot-shaped and having a base portion equipped with an opening for partially receiving a further one of said target bodies possessing the smallest impact surface, the outside surface of said base portion serving as the impact surface means for said one target body, the remaining target bodies being in the form of substantially circular-shaped discs each having a central bore, said mounting means for said target bodies comprising a central support extending through said bores, support rings spaced by spacer sleeve members at a predetermined distance from one another fixedly mounted at said central support, and wherein at least respective ones of said sensing element means responsive to the relative movement of said target bodies are mounted to bear against a target body and a support ring, and resilient element means for retaining an associated target body in its rest position provided between each such target body and the associated support ring.

2. A shooting target as defined in claim 1, wherein at least some of said target bodies are defined by substantially circular-shaped members having their impact surface means arranged in a common plane, and wherein radially extending outside surfaces thereof are defined by concentrically arranged target rings coupled via support elements with the circular-shaped target bodies.

3. A shooting target as defined in claim 1, wherein said target bodies are all of substantially pot-shaped configuration with the exception of the smallest size target body, and wherein all such target bodies with the exception of said smallest size target body are equipped with a radially outwardly protruding margin having an end face serving as impact surface means, said pot-shaped target bodies partially being stacked within one another and spaced from one another by elastic layer means, and wherein said sensing element means responsive to movement of the target bodies are arranged between the base portions of neighboring ones of such target bodies.

4. A shooting target for the automatic indication of hits comprising a number of different size target bodies

having impact surface means for the fired projectiles, a base plate, means for mounting said target bodies behind one another and independently movable with respect to one another to a limited extent at said base plate, a current circuit operably associated with each target body, sensing element means responsive to the relative movement of the target bodies for influencing an electrical current flowing in said current circuit associated with each target body, said sensing element means being arranged between said individual target bodies an intermediate plate mounted to be movable to a limited extent relative to said base plate arranged between said target bodies and said base plate, additional sensing element means arranged substantially along a circular path between said intermediate plate and said base plate for indicating the position of the fired shot, the target body having the smallest impact surface means being defined by a first plate member, and wherein the remaining target bodies are defined by plate members possessing substantially circular-shaped central openings of different size with respect to one another, said mounting means comprising at least three support columns for retaining all such plate members at a predetermined spacing with respect to one another, and wherein a number of said sensing element means are provided between said individual plate members.

5. A shooting target for the automatic indication of hits, comprising a number of different size target bodies having impact surface means for the fired projectiles, a base plate, means for mounting said target bodies behind one another and independently movable with respect to one another to a limited extent at said base plate, a current circuit operably associated with each target body, sensing element means responsive to the relative movement of the target bodies for influencing an electrical current flowing in said current circuit associated with each target body, said sensing element means being arranged between said individual target bodies, an intermediate plate mounted to be movable to a limited extent relative to said base plate arranged between said target bodies and said base plate, additional sensing element means arranged substantially along a circular path between said intermediate plate and said base plate for indicating the position of the fired shot, said sensing element means comprising piezoelectrical crystals.

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