

[54] **TARGET HOLDER RIGIDLY
SECURING SMALL ARMS TARGET
AND TRANSDUCER MOUNTED
THEREON**

[76] Inventor: Lindsay Charles Knight, 426
Tarakan Avenue, Wales, Australia

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Primary Examiner—Richard C. Pinkham

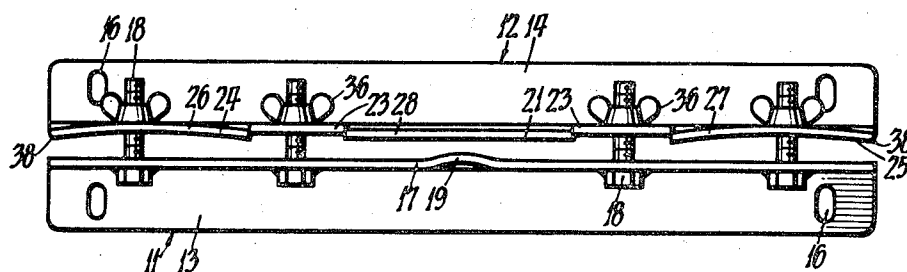
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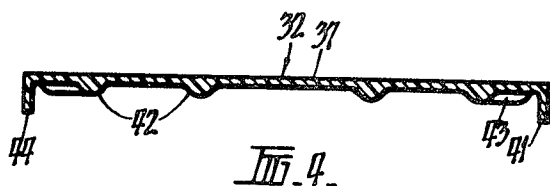
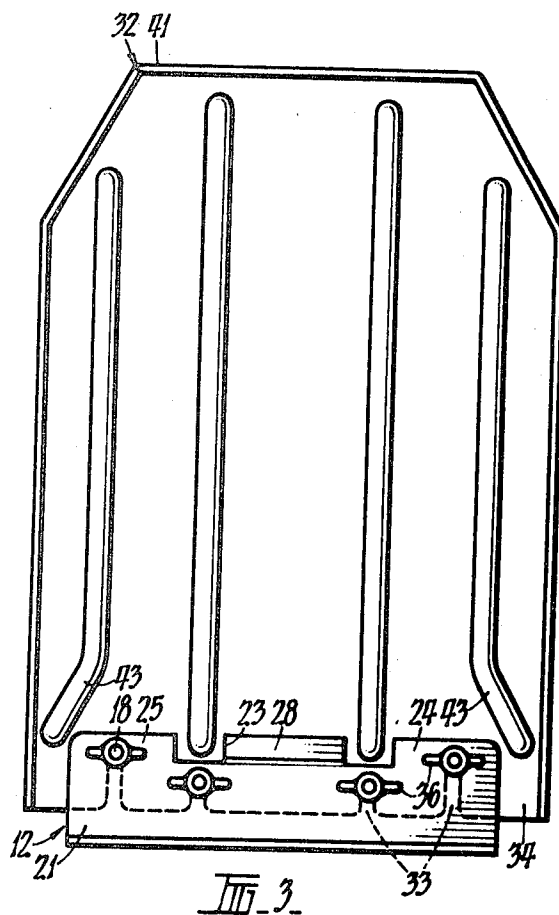
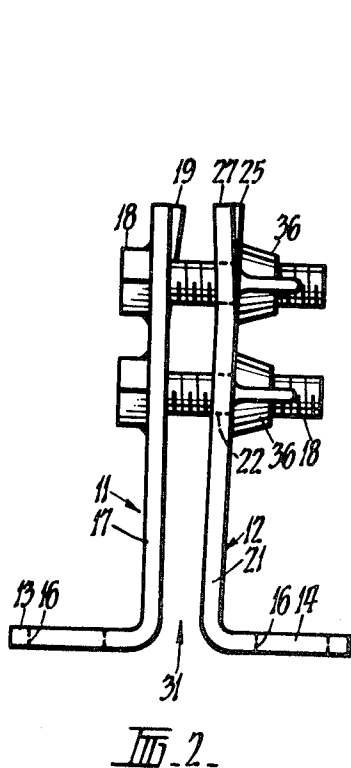
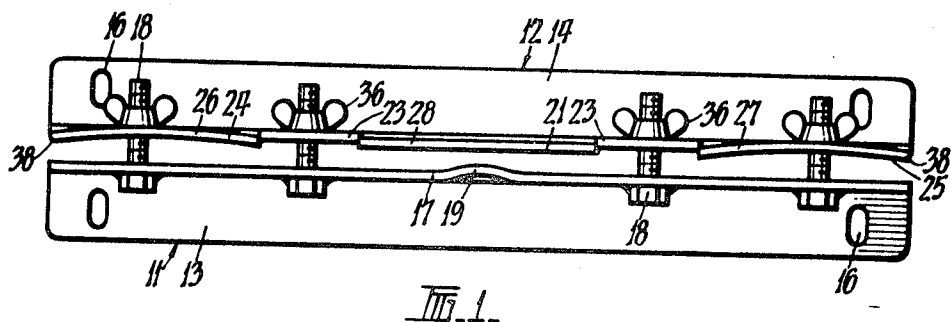
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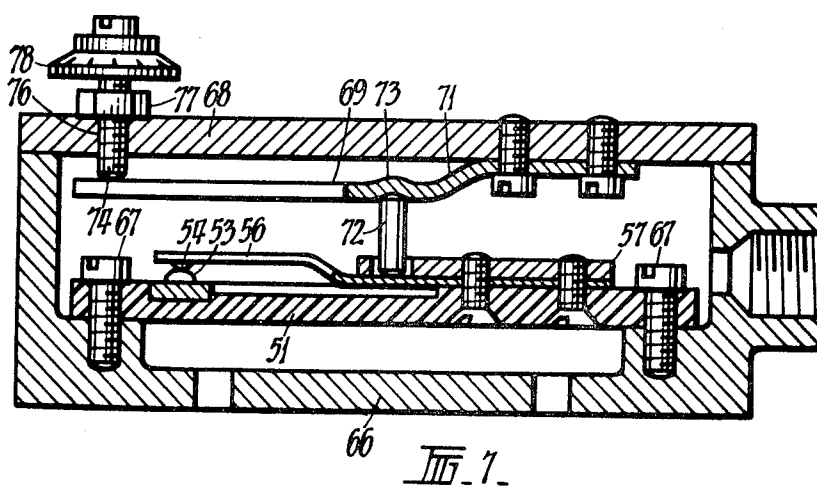
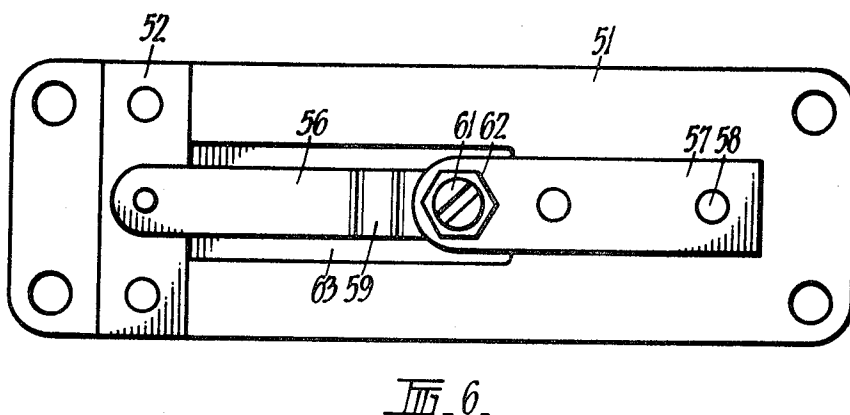
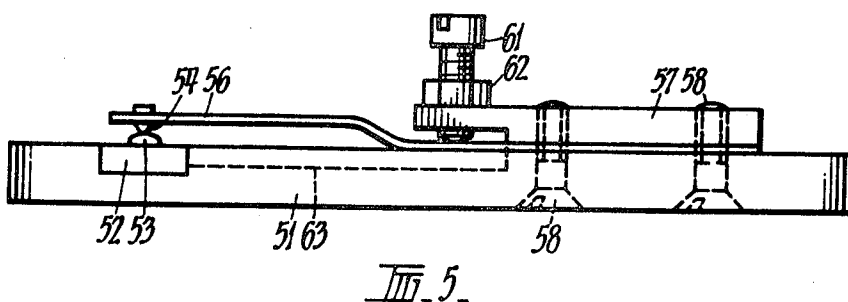
[57] **ABSTRACT**

A target holder and transducer for rigidly holding a small arms target and registering the number of projections accurately hitting the target. The holder comprises elongated front and rear members having projections extending therefrom to secure and deform the target mounted therebetween in such a manner that the shock waves of a projectile hitting the target can be sensed by the transducer which is mounted on the target holder. The transducer includes an adjusting screw to vary the force necessary to close its contacts and signal a hit.

11 Claims, 7 Drawing Figures







TARGET HOLDER RIGIDLY SECURING SMALL ARMS TARGET AND TRANSDUCER MOUNTED THEREON

The present application is a divisional application of my earlier application Ser. No. 795,639, filed Jan. 31, 1969, since matured into U.S. Pat. No. 3,682,478 and entitled "Target Apparatus."

This invention relates to improvements in target apparatus and relates particularly to improvements in apparatus for use with target mechanisms of the type which include automatic hit detecting and hit counting apparatus.

Target mechanisms of this type employ means for detecting and counting the number of hits on a target, usually of ply-wood construction, and have other means for transmitting this information to a control position.

It has been found with target mechanisms presently used that the hit detecting and counting means are erratic and therefore inaccurate. Thus the apparatus either does not count all the hits on the targets or counts as hits, stone showers, muzzle blasts and near misses.

This erratic operation becomes more apparent with changes in climatic conditions, and causes the apparatus to be unsatisfactory in extreme climatic conditions.

It is believed that a factor which contributes to the erratic operation of the apparatus is the mounting used to mount the target on the target apparatus. Normally this mounting consists of a clamp which is fixed to the apparatus and clamps about the base of the target.

Another factor which, it is believed, contributes to the inaccurate counting of hits on a target, is the properties of the material from which the target is made. Requirements of target apparatus of this type is that the target has a relatively long life e.g. that it can take a large number of hits without disintegrating, remains effective in counting whilst in use and is relatively cheap. Targets at presently used, however, do not meet all these requirements.

Additionally, targets generally used on target apparatus having automatic hit detecting, hit counting and target fall facilities have been made of materials having relatively high shock transference characteristics so that relatively simple types of hit detecting transducers, such as microphones, micro-switches and the like can be employed to detect the shock waves set up in the target by the impact of a bullet therewith. The use of a target material which does not have their property of high shock transference has previously created problems of reliable and satisfactory hit detection.

A further factor which it is believed also contributes to the inaccurate operation of the target apparatus is the relatively crude transducer devices and associated circuitry at presently used to detect a hit on the target. Devices now used include inertia and micro switches and microphones.

It is an object of the present invention to provide an improved construction of target apparatus which alleviates the aforementioned disadvantages and overcomes the factors which contribute to the erratic operation of the apparatus.

A further object of the invention is to provide an improved target holder for target apparatus which is relatively simple and economical to manufacture and use.

A still further object of the invention is to provide an improved target for use with the target apparatus.

A still further object of the invention is to provide improved means for detecting a hit on the target.

According to one aspect of the invention there is provided a target holder for mounting a target on a base, said holder comprising an elongated front portion having target engaging member which is formed with at least one rearwardly extending projection, an elongated rear portion having a second target engaging member which extends in a plane adjacent to and parallel, or nearly parallel, to said first target engaging member, the upper edge portion of said second target engaging member having at least one slot therein which divides the edge portion into at least two parts, each part being deformed out of the plane of the member to form further projections and adjustable means coacting with both said front and rear portions to enable a target to be securely clamped between said portions so that said projections engage with and deform the target.

Preferably, the target holder is used with a target comprising a sheet of relatively rigid, ductile synthetic plastic material having low shock transference qualities and being formed with strengthening ribs, flanges or formations to provide a rigid body. The target is also provided on its lower edge portion with means to enable the target to be supported and moved thereby.

It is preferred that the target be moulded of polyethylene sheet of between 80 to 200 thousandths of an inch thickness having longitudinally extending strengthening ribs and a part peripheral flange about the side and upper edge portions.

The invention further provides an improved inertia switch type transducer comprising an elongated base of electrically insulating material having an electrical contact point fixed thereto at one end thereof, a leaf spring having a second electrical contact point attached to one end thereof said spring being mounted by its other end to the base so that said contact points are engaged and adjusting means engaged with said leaf spring part way along its length to vary the tension on the spring and the force holding said contact points in engagement. The adjusting means may comprise a bracket extending portion of the length of the spring and a screw threaded through the bracket and arranged to bear on the spring.

Alternatively, the adjusting means may be incorporated in a casing in which the transducer is mounted. The casing, comprising a metallic box having a removable lid, has an elongated bracket fastened by one end of the lid and extends over the spring in the same direction thereof. Means are provided for moving the free end of the bracket towards or away from the lid and further means are provided to transmit this motion to said spring to decrease or increase the tension in the spring.

In order that the invention may be more readily understood and put into practical form, embodiments thereof will now be described with reference to the drawings wherein:

FIG. 1 is a plan view of a target holder made according to the invention;

FIG. 2 is an end elevation of the target holder of FIG. 1;

FIG. 3 is a rear elevation of the target holder of FIG. 1 and having a target mounted therein;

FIG. 4 is a sectional plan view of a target made in accordance with the present invention;

FIG. 5 is a side view of an inertia switch type transducer made according to this invention;

FIG. 6 is a plan view of the transducer of FIG. 5; and

FIG. 7 is a sectional side view of a modified construction of transducer.

Referring to FIGS. 1 to 3 of the drawings, the target holder comprises two elongated members 11 and 12 each having a base portion 13 and 14 respectively with slots 16 therein to receive mounting bolts for mounting the members on a target mounting base. The member 11 which is the front portion of the holder, has a target engaging part 17 extending upwardly from and at right angles to the base portion 13, and is provided with four studs 18 which are fixed to and extend rearwardly from the part 17.

A rearwardly extending deformation 19 is formed in the upper edge portion of the part 17 approximately mid-way between the side edges thereof. The deformation 19 is of semi-circular shape and projects from the plane of the part 17 at the upper edge thereof a distance equal to approximately half of the thickness of the part 17.

The rear portion of the holder has a second target engaging part 21 extending upwardly from the base portion 14 and makes an angle with the base portion 14 which is less than a right angle. Four holes 22 are formed in the part 21 through which the studs 18 pass.

Two slots 23 are formed in the upper edge portion of the part 21 and the sections 24 and 25 between the slots 23 and the ends of the part 21 are bent forwardly so that the upper edge 26 and 27, in plan view, form an arc of a circle. The center part 28, between the slots 23 is also bent forwardly at a small angle so that the upper edge thereof projects from the plane of the part 21 a distance approximately equal to half the thickness of the part 21.

The two members are arranged to be mounted back-to-back on a target mounting base and spaced apart at their base portions a distance approximately equal to the thickness of a target to be mounted therebetween. A target 32 is inserted in the wedge shaped space 31 between the two upwardly extending parts 17 and 21, the target having slots 33 formed or cut in the base portion 34 thereof cooperating with the studs 18. Wing nuts 36 are screwed onto the studs 18 and are tightened to clamp the target 32 between the parts 17 and 21. The projection or deformation 19 is impressed into the front face 37 of the target 32 and the edges of the sections 24 and 25, and the center part 28 of the rear part 21 are firmly impressed into the rear surface of the target 32. The outer corners 38 of the sections 24 and 25 may be relieved to prevent stress points being set up in the side portions of the target 32.

The target 32, as shown in FIGS. 3 and 4, comprises a sheet of relatively ductile polyethylene which has a low shock transference quality moulded to form a rigid self-supporting body.

The target 32 is moulded from sheet polyethylene of between about 0.050 to 0.150 inches thick. The side or peripheral edges 41 of the target 32, except at the base thereof, are formed at right angles to the plane of the target 32 to provide strengthening flanges. Further stiffness or rigidity is provided by four longitudinally extending ribs 42, the outer pair of which angle outwardly at the bottom thereof, as shown at 43. These ribs may vary in shape and position from those shown to increase the longitudinal and/or lateral bending

strength of the target as, for example, a relatively tall target known as "standing-man" targets, so that the target may be quickly moved from an upright, operative position to a horizontal, inoperative position by suitable known target moving mechanisms.

The polyethylene target material is formed to provide a double target over a temperature range of between about -50°F and 130°F and which resists cracking and breaking when a bullet, or other projectile, passes therethrough. The target has a "memory" so as to tend to restore itself to its original condition after the passage of a bullet through the target. Thus, when a bullet passes through the target the bullet initially deforms the target material and forms a flanged opening. When the bullet has passed through the flanged hole the flanges tend to close around the hole to restore the target to its initial condition. Any bullet passing through or adjacent that hole will then be registered by hit detecting means associated with the target apparatus. The "memory" effect of the target material also increases the life of the target as the target is not removed by the passage of a bullet therethrough.

In use, the target is suitable for use at low and high temperatures without splintering or cracking when struck by bullets of size ranging from 0.223 to 9mm and 0.38 military type ammunition, and impact transference is satisfactory to permit use of the target on known target apparatus. In particular, the use of the target in conjunction with the improved hit detecting transducer of the present invention produces excellent results of hit counting.

The transducer, as shown in FIGS. 5 and 6, comprises an elongated base 51 of rigid electrically insulating material having a transversely extending electrically conducting strip 52 mounted in a groove formed adjacent one end thereof. The conducting strip 52 carries a first electrical contact point 53 in the middle thereof. A second contact point 54 is mounted on one end of an elongated electrically conducting leaf spring 56 which is clamped by its other end between a bracket 57 and the base 51 by screws 58. The leaf spring 56 is formed with an offset 59 in approximately the middle thereof which raises the plane of the first end portion away from the plane of the base 51.

At one end of the bracket 57, adjacent the offset 59 in the leaf spring 56, there is formed a threaded hole, and a spring tensioning screw 61 having a locknut 62 is threaded therein. The end of the screw 61 engages with the leaf spring 56 and applies pressure thereto to cause the second contact point 54 to engage with the first contact point 53. Further pressure applied by the screw 61 increases the spring force holding the contact points engaged.

The base 51 has a longitudinal groove 63 extending between the first groove containing the strip 52 and the bracket mounting screws 58 underneath the leaf spring 56 so that the spring 56 may be urged into the groove 63 by the adjusting screw 61 to increase the pressure in the contact points 53 and 54.

In use, the transducer is mounted in a casing which is attached to the front of a target holder so that the base 51 is adjacent the target holder and the leaf spring 56 is forwardly thereof. When the target mounted in the target holder is struck by a bullet, the impact is transferred to the transducer which moves with the target holder. The inertia of the impact determines the rate of movement of the transducer. As the base 51 be-

gins to move at the rate determined by the impact the contact points tend to open due to the inertia of the leaf spring 56. Thus the resistance across the points increases. By adjustment of the tension in the leaf spring the amount of resistance increase for a given impact can be controlled so that an electrical circuit connected with the contact points may be activated when the resistance rises to a predetermined level. The impact of a bullet on the target may then be arranged to activate the electrical circuit whereas the impact of a near-miss (the shock-wave produced in the air by the bullet) or of a stone shower produced when the bullet falls short of the target do not activate the electrical circuit.

In the embodiment shown in FIG. 7 the transducer switch is of the same construction as that described above except that the leaf spring tensioning screw 61 and locknut 62 are omitted. The switch is mounted in a cast metal casing 66 and is held in place by screws 67. A lid 68 is provided for the casing 66 with an elongated bracket 69 mounted by one end to the inside surface of the lid 68. The bracket 69 is provided with an offset 71 so that the other end of the bracket extends in a plane substantially parallel to but spaced from the lid inner surface.

A pin 72 is positioned in a hole formed in the end of the leaf spring clamping bracket 57 and engages with the leaf spring 56 and an indentation 73 formed in the bracket 69.

An adjusting screw 74 threaded through a hole 76 in the lid 68 engages with the free end of the bracket 69 in a manner such that the bracket is moved with movement of the screw 74. A locknut 77 is provided for the screw 74. Also, an indicator dial 78 may be provided on the adjusting screw 74.

It will be seen that the transducer switch of this embodiment may be adjusted externally of the casing 66 thus permitting adjustment to be made during use of the target apparatus on which the switch is mounted without disassembling any of the apparatus.

If the target, target holder, and inertia switch type transducer are used in combination as part of target hit registration equipment, when the target is hit by a bullet, the inertia switch type transducer generates a suitable signal to operate the hit registration equipment to give an indication that the target has been hit by a bullet. The signal is as suitable for use in hit registration equipment as signals hitherto generated by apparatus associated with conventional targets of high shock transference characteristics.

What I claim is:

1. The combination of a target holder and an inertia switch type transducer, said target holder comprising an elongated front portion having a substantially planar target engaging member with at least one rearwardly extending projection, an elongated rear portion having a second target engaging member which extends adjacent to and is spaced from said first target engaging member, the upper edge portion of said second target engaging member having at least one slot therein which divides the edge portion into at least two parts, each part being deformed forwardly, clamping means engaging both said target engaging members and adapted to clamp a target between said first and second target engaging members so that said projection and deformations are adapted to engage with and deform such target to rigidify the same, said inertia switch type trans-

ducer being mounted on said target holder and comprising an elongated base of rigid electrically insulating material, a first electrical contact mounted at one end thereof, a leaf spring having a second electrical contact fixed to one end thereof, said spring being mounted at its other end to the base so that said contacts are engaged, and adjusting means engaged with said leaf spring adjacent the end mounted on the base and movable to vary the spring tension in said spring thereby to vary the force holding said contacts in engagement.

2. The combination of claim 1, wherein said second target engaging member of the target holder makes an angle less than a right angle with the base section extending therefrom.

3. The combination of claim 1, wherein two slots are provided in the upper edge of the second target engaging member of the target holder, and each of the parts of the second target engaging member between said slots and between said slots and the side edges of the second target engaging member is deformed forwardly.

4. The combination of claim 3, wherein the upper edges of each deformed part of the second target engaging member of said target holder between said slots and the side edges form an arc of a circle.

5. The combination of claim 3, wherein the deformed parts of the target holder extend forwardly of the plane of the second target engaging member a distance at their upper edges at least equal to approximately half the thickness of the second target engaging member.

6. The combination of claim 1, wherein said rearwardly extending projection of the first target engaging member of the target holder is formed by a portion of the upper edge portion of the first target engaging member being displaced rearwardly, said projection being of inverted part conical shape.

7. The combination of claim 1, wherein said base of said transducer is formed with a groove extending longitudinally thereof beneath said leaf spring, and said adjusting means is arranged to deflect said spring into said groove to increase the tension in said spring thereby to vary the force holding said contacts in engagement.

8. The combination of claim 1, wherein said base of said transducer is mounted in a casing which is mounted to said target holder, and said adjusting means includes a threaded screw engaged in a correspondingly threaded hole in said casing, and wherein an elongate bracket is attached by one end to the inner surface of said casing and is arranged so that the other end thereof is engageable by said screw, and wherein a pin extends between said bracket and said leaf spring to transmit movements of the bracket to said spring upon rotation of said screw.

9. The combination of claim 8, wherein an indication dial is carried by the outer end of said screw of said transducer and is adapted to indicate the amount said screw is screwed into the casing.

10. The combination of a target holder and an inertia switch type transducer, said target holder comprising an elongated front portion having a substantially planar target engaging member with at least one integral rearwardly extending projection, an elongated rear portion having a second target engaging member which extends adjacent to and is spaced from said first target engaging member, the upper edge portion of said second target engaging member including at least two integral sections that are deformed forwardly, clamping means en-

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gaging both said target engaging members and adapted to clamp a target between said first and second target engaging members so that said projection and deformations are adapted to engage with and deform such target to rigidify the same, said inertia switch type transducer being mounted on the target holder and comprising first and second electrical contacts which are normally engaged, the first and second electrical contacts being opened consequent to the impact of a projectile on the target and hit shock waves being generated thereby and passing along the target through the target holder to the transducer thereby registering a hit, with lesser impact forces in the target area not disengaging the contacts and thus not registering a hit, and adjusting means associated with said transducer for varying

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the force holding said contacts in engagement thereby permitting the registering of hits only above a predetermined level of impact.

11. The combination of claim 10 further including a one-piece self-supporting target comprising a generally elongated sheet of relatively rigid, ductile, synthetic, plastic material clamped between said first and second target engaging members, said plastic material having low shock transference characteristics and being of a thickness and ductility such that a projectile passing therethrough forms a flanged hole having dimensions less than the corresponding dimensions of the projectile.

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