

[72] Inventor **Arthur J. Tickell, Jr.**
Branford, Conn.
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 [73] Assignee **Realistic Target Corporation**
 Substitute of abandoned Ser. No. 453,051,
 May 4, 1965.

[56]

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Primary Examiner—Richard C. Pinkham

Assistant Examiner—Theatrice Brown

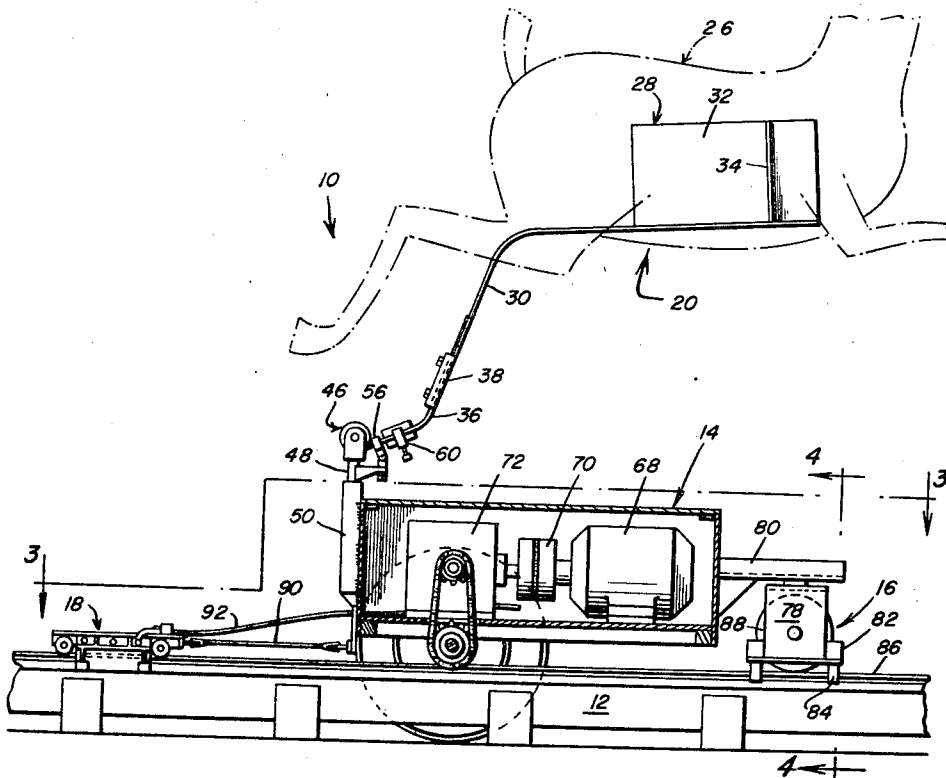
Attorneys—Clarence O'Brien and Harvey B. Jacobson

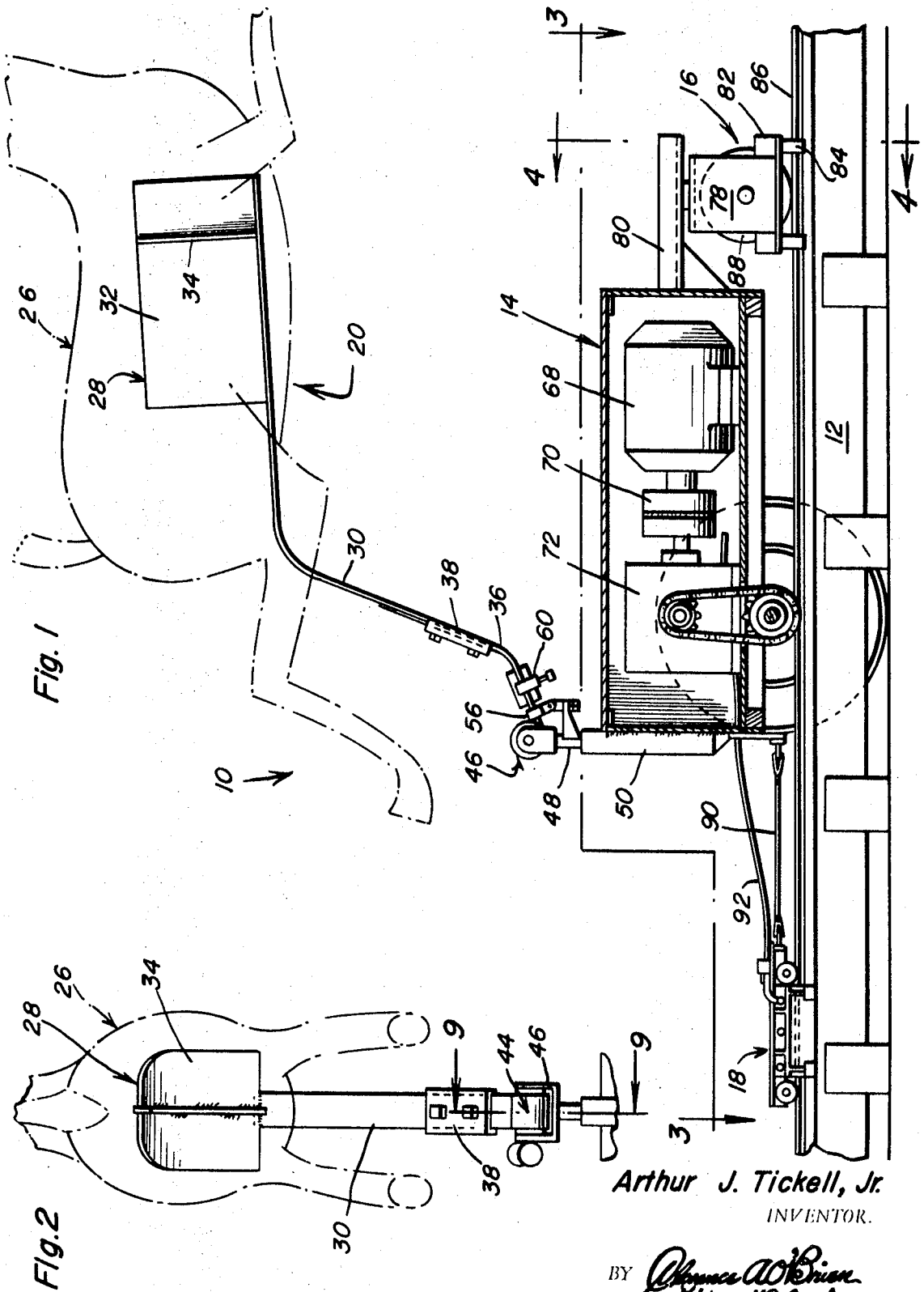
[54] THREE DIMENSIONALLY OPERATIVE TARGET SYSTEM

6 Claims, 15 Drawing Figs.

[52] U.S. Cl.	273/102.2S, 273/105.2
[51] Int. Cl.	A63b 63/00
[50] Field of Search	273/102.2 S, 105.2

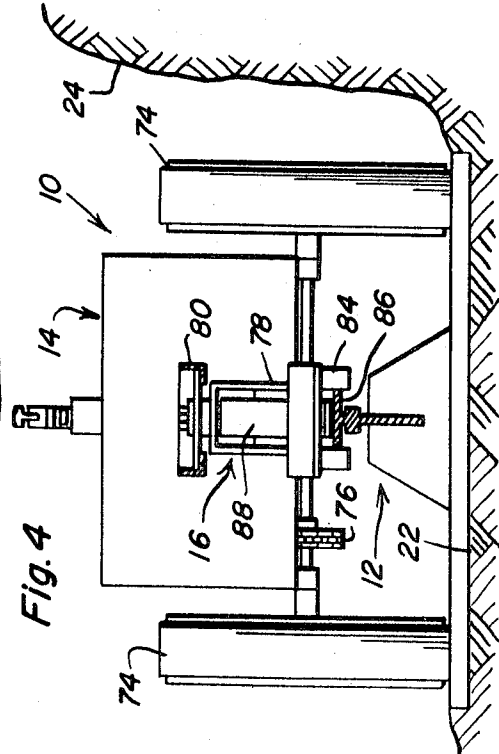
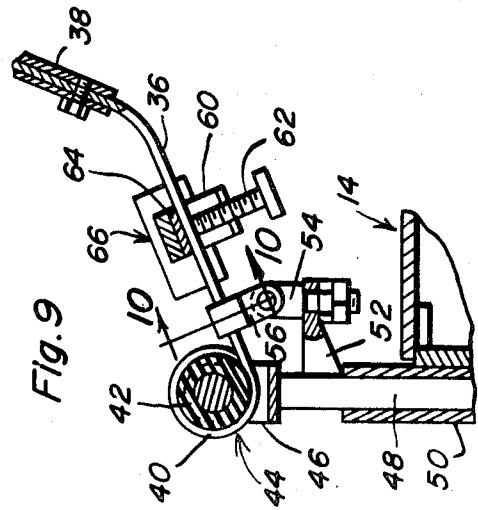
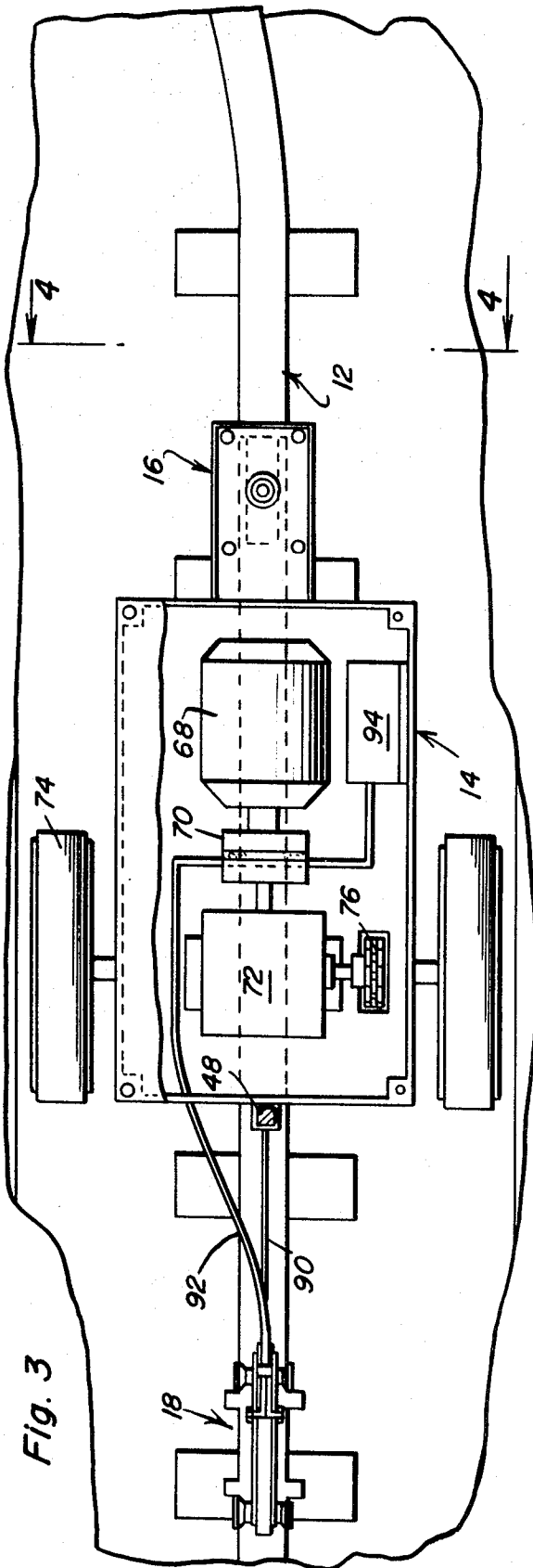
ABSTRACT: A three-dimensional target for marksmen is propelled along a prescribed path by an electrically powered vehicle, the motion of which is changed in response to sensing of vibration by a transducer. Vibrations are induced by impact of a bullet with rigid internal portions of the target having an outer shock absorbing portion offering little resistance to passage of bullets.





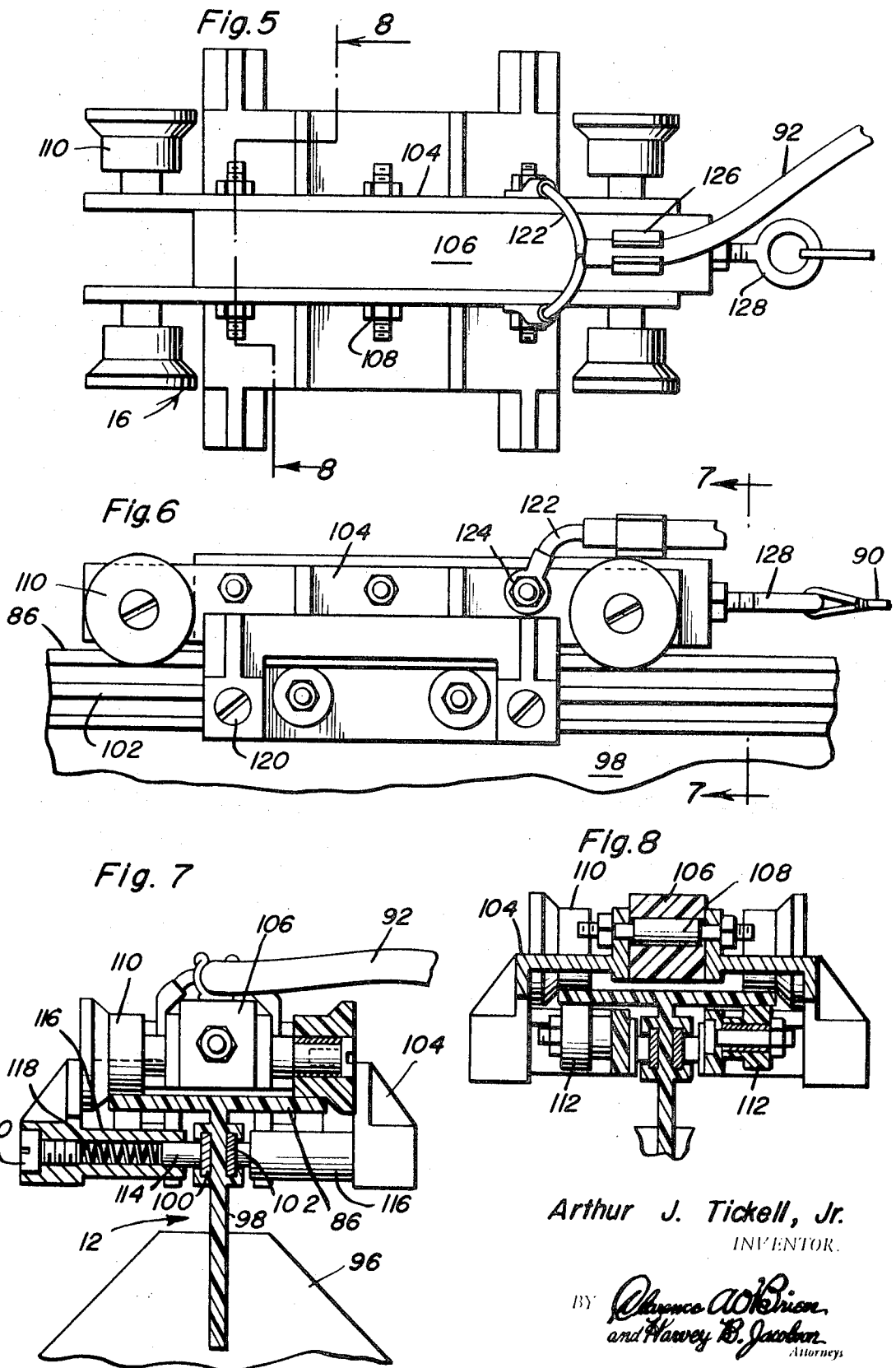
Arthur J. Tickell, Jr.
INVENTOR.

BY *Alvin A. O'Brien*
and Harvey B. Jackson
Attorneys



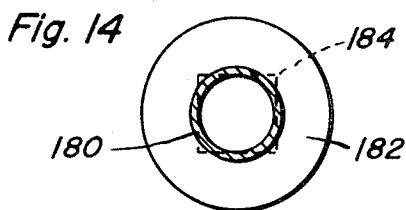
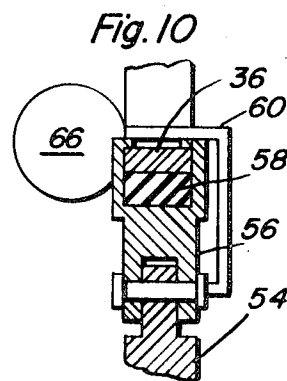
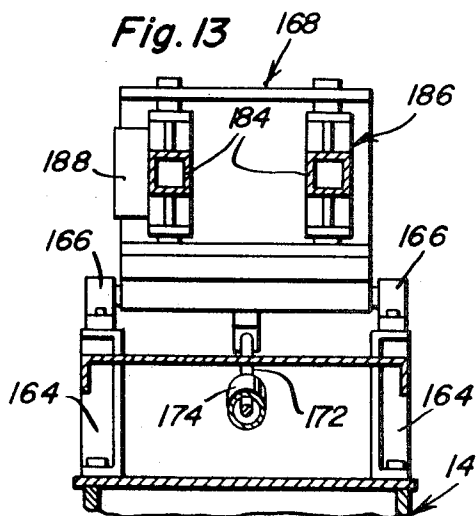
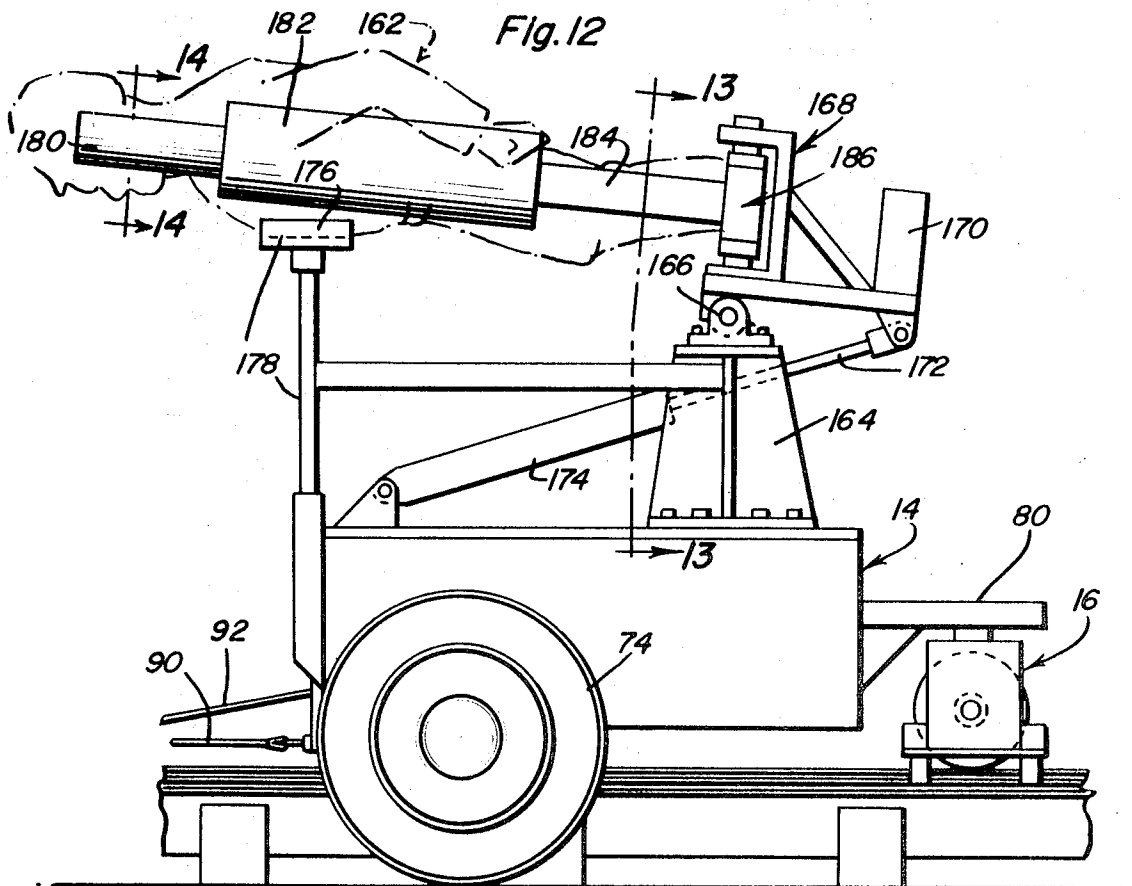
Arthur J. Tickell, Jr.
INVENTOR.

BY *Oliver A. O'Brien*
and *Henry B. Jackson*
Attorneys



Arthur J. Tickell, Jr.
INVENTOR.

BY *Charles A. O'Brien*
and *Harvey B. Jordan*
Attorneys



Arthur J. Tickell, Jr.
INVENTOR.

BY *Thomas A. O'Brien*
and *Harvey B. Jacobson*
Attorney.

Fig. 11

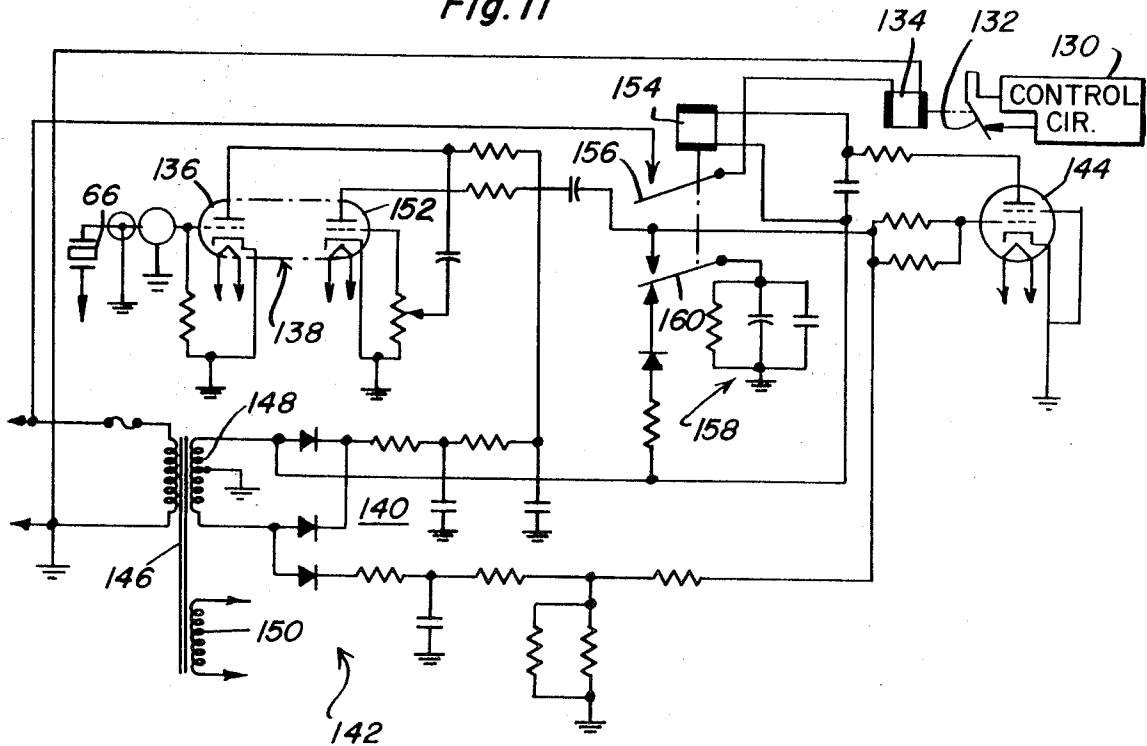
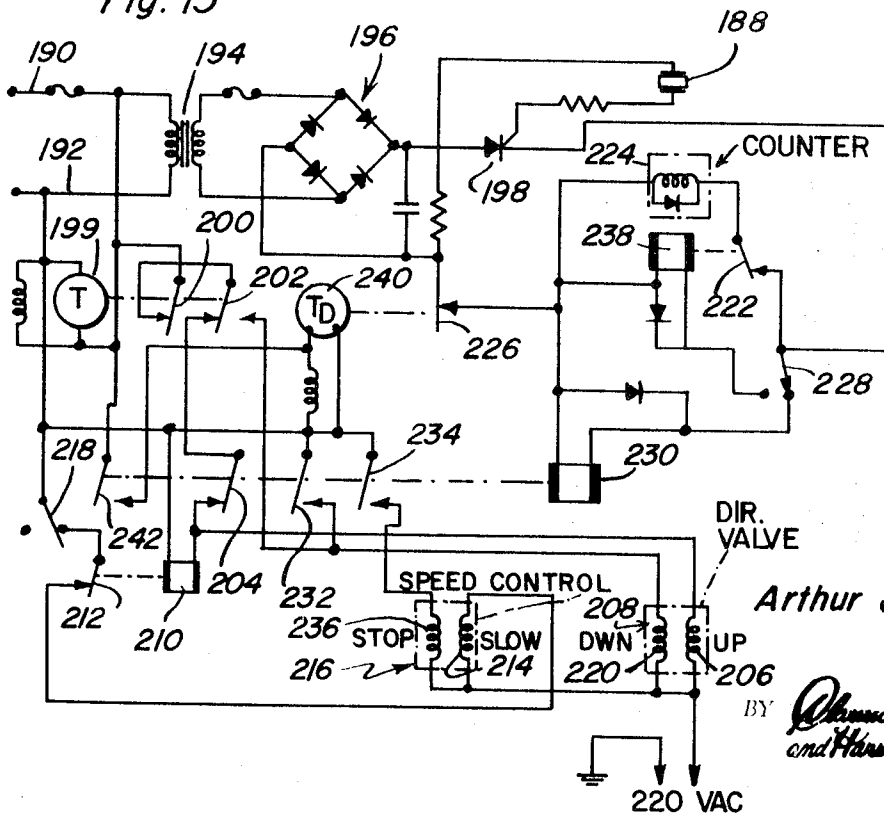


Fig. 15



Arthur J. Tickell, Jr.
INVENTOR.

BY *Alvin A. O'Brien*
and *Harvey B. Jordan*
Attorneys

THREE DIMENSIONALLY OPERATIVE TARGET SYSTEM

This invention relates to a moving target system for marksmen disclosed in my prior application, Ser. No. 453,051, filed May 4, 1965, now abandoned.

An important object of the present invention is to provide a moving target for marksmen arranged to continuously vary the impact area presented and thereby provide more difficult and realistic target practice.

Another object of the present invention is to provide a target for rifle practice involving the embedment of a three-dimensional impact surface within a material through which missiles or bullets may pass without resistance, thereby concealing the impact surfaces so as to induce marksmen to seek vital areas of the target.

A further object of the present invention is to provide a target system in which there is a continuous variation in the target movement and position and a change in movement for a predetermined period after the target is hit.

Yet another object of the present invention is to provide a target system by means of which the number of hits may be recorded.

A still further object of the present invention is to provide a target system in which control over the movement and/or position of the target is exercised by an impact sensing transducer.

Another object of the present invention involves the propulsion of a target along a prescribed path by a wheeled carriage guided by a track through which power is supplied to propel and control movement of the target.

In accordance with the foregoing objects, the path along which the target of the present invention is moved, is prescribed by a track straddled by the traction wheels of the target carrying carriage, the carriage being guided along the track by a guiding wheel assembly pivotally connected to the forward end of the carriage. Connected to the rear end of the carriage and supported on the track for movement in trailing relation to the carriage, is a power supply device which is in electrical contact with conductors mounted on the track so as to transmit electrical energy from these conductors to the power operated mechanism within the carriage. The power operated mechanism within the carriage includes facilities for propelling the carriage as well as stopping movement thereof under control of an impact sensing transducer. The transducer is so mounted, so as to pickup vibrations produced by impact between a three-dimensional rigid body embedded in the target figure and a bullet passing through the target figure. The target figure is made of a shock absorbing material offering little resistance to the passage of the bullet therethrough, this shock absorbing material completely embedding the rigid three-dimensional body which thereby defines an internal volume representing the vital portion or "kill" areas of the target figure. The impact sensing transducer is operative through a control system to change movement of the carriage when the target is hit at a vital area as for example by stopping the movement, this change in movement being effected for a predetermined delay period after which normal movement of the target is resumed. In one form of the invention, the target figure is mounted in such a manner that it will vibrate in spaced relation above the carriage while in another form of the invention, the position of the target figure relative to the carriage is varied by power operated facilities. In each case, however, the target figure is formed from a shock absorbing material such as urethane embedding a rigid body to define an internal volume presenting impact surfaces to the marksmen of different extent depending on the angular position assumed by the target figure relative to the marksmen as the target is propelled along its prescribed path by the carriage.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described

and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIG. 1 is a side elevational view of one form of a track mounted target assembly constructed in accordance with the present invention.

FIG. 2 is a partial rear elevational view of the target assembly shown in FIG. 1.

FIG. 3 is a top sectional view with parts broken away, taken substantially through a plane indicated by section line 3-3 in FIG. 1.

FIG. 4 is a transverse sectional view taken substantially through a plane indicated by section line 4-4 in FIG. 3.

FIG. 5 is an enlarged top plan view of the track mounted power supply device of the present invention.

FIG. 6 is a side elevational view of the device shown in FIG. 5.

FIG. 7 is a transverse sectional view taken substantially through a plane indicated by section line 7-7 in FIG. 6.

FIG. 8 is a transverse sectional view taken substantially through a plane indicated by section line 8-8 in FIG. 5.

FIG. 9 is an enlarged partial sectional view taken substantially through a plane indicated by section line 9-9 in FIG. 2.

FIG. 10 is an enlarged partial sectional view taken substantially through a plane indicated by section line 10-10 in FIG. 9.

FIG. 11 is an electrical circuit diagram corresponding to the control system associated with the form of the invention shown in FIGS. 1-10.

FIG. 12 is a side elevational view of another form of target assembly constructed in accordance with the present invention.

FIG. 13 is a partial sectional view taken substantially through a plane indicated by section line 13-13 in FIG. 12.

FIG. 14 is a sectional view taken substantially through a plane indicated by section line 14-14 in FIG. 12.

FIG. 15 is an electrical circuit diagram of a control system associated with the form of the invention illustrated in FIGS. 12-14.

Referring now to the drawings in detail, and initially to FIGS. 1-4, it will be observed that one form of target assembly generally referred to by reference numeral 10, is mounted for movement along a prescribed path determined by a track 12. The target assembly includes a wheeled carriage generally referred to by reference numeral 14 guided for movement along the track by means of a forward guide assembly 16. Power for operating the power operated components of the target assembly is derived from conductors mounted on the track 12 and supplied to the carriage by means of a power supply device generally referred to by reference numeral 18 which is connected to the carriage and supported by the track in trailing relation to the carriage. Power for propelling the carriage 14 is thereby provided in order to move the target FIG. 20 along the prescribed path defined by the track 12.

As more clearly seen in FIG. 7, the track is mounted on the ground surface 22 adjacent to an embankment 24 or any other suitable landscaping that may be resorted to in order to conceal both the track and the carriage from the marksmen's view, exposing only the target FIG. 20 as it is propelled along the prescribed path by the carriage 14.

With continued reference to FIGS. 1 and 2 in particular, it will be observed that the target FIG. 26 may be in the form of an animal made of a suitable self-sealing, shock absorbing material such as urethane which offers little resistance to the passage of a bullet or missile therethrough. Embedded within the figure material, is a rigid body 28 which is three-dimensional in extent so as to define internally of the figure, a vital volume which when intersected by the path of a bullet will offer resistance to the passage of the bullet through the target resulting in impact vibrations transmitted from the rigid body 28 along the leaf spring mounting member 30 to which the body is connected. The body 28 may be formed from a rigid

plate portion 32 which substantially defines a "kill area" within a longitudinal plane extending through the target figure. Secured to the plate portion 32, are a pair of laterally extending flange portions 34 defining "kill" areas within a plane extending substantially perpendicular to the longitudinal plane of the plate portion 32. Accordingly, the body 28 will offer impact surfaces in at least two intersecting planes in order to present "kill areas" to the marksmen of different extent depending upon the angular position of the target figure relative to the marksmen. The angular position of the target figure is therefore suitably varied by the curvature of the track defined path along which the target is propelled by the carriage 14.

Referring to FIGS. 1, 2, 9 and 10 it will be observed that the mounting leaf spring member 30 to which the rigid body 28 is connected, is adjustably secured to an angled anchor member 36 by means of the fastener assembly 38. The member 36 includes an end portion 40 which encircles the annular shock absorbing element 42 of a shock anchor assembly 44 having a mounting bracket 46 on which the shock absorbing member 42 is mounted. The bracket 46 is secured to the upper end of a noncircular rod 48 slidably received within the tubular member 50 secured to the rear end of the carriage 14. A bracket 52 extends forwardly from the rod 48 so as to limit downward movement of the rod 48 and thereby position the anchor assembly 44 in spaced relation above the top of the carriage 14. A pivotal supporting member 54 is secured to the bracket 52 to which the pivotal support member 56 is connected. The pivotal support member 56 receives the angled anchor member 36 which rests on the shock absorbing pad 58 so as to support the target figure at a predetermined angular position relative to the carriage. Also mounted on the anchor member 36 adjacent to the support member 56 is a clamp member 60 having a lock screw 62 adapted to clamp a tab 64 which extends laterally from an impact sensing transducer 66 thereby mounted by the clamp on the anchor member 36. Accordingly, vibrations induced as a result of impact between the body 28 and a missile fired by a marksman, will be transmitted through the mounting leaf spring member 30 to the anchor member 36 and through the tab 64 to the transducer which is thereby operative to develop a signal for controlling movement of the carriage.

As more clearly seen in FIGS. 1 and 3, the carriage encloses therewithin a propelling motor 68 coupled by means of a drive release brake mechanism 70 to a reduction gear assembly 72. The output of the reduction gear assembly drives a pair of traction wheels 74 through a chain sprocket drive 76 which extends through an opening in the bottom wall of the carriage. The traction wheels straddle the track 12 so that a certain amount of lateral movement of the carriage relative to the track is permitted. The carriage is however guided for movement along the track by means of the guide assembly 16 which includes a wheel mounting member 78 pivotally connected about a vertical axis to a connecting bar 80 secured to the forward end of the carriage 14. Connected to the lower end of the wheel mounting member 78, is a roller mounting member 82 which rotatably mounts two pairs of rollers 84 about vertical axes so that the rollers engage the upper flange portion 86 of the track 12 on either side thereof as more clearly seen in FIG. 4. A guiding wheel 88 rides on top of the flange portion 86 of the track and is rotatably mounted about a horizontal axis by the wheel mounting member 78. Also supported on the track and connected to the rear end of the carriage by the cable 90 is the power supply device 18 as aforementioned. An electrical power cable 92 therefore extends from the power supply device into the carriage for controlling energization of the propelling motor 68. Control over energization of the propelling motor 68 is exercised through a control circuit housed within the control box 94 to which the electrical cable is connected.

The track 12 is made up of a plurality of interconnected sections and as more clearly seen in FIG. 7, each track section is mounted on a supporting block 96. The top flange portion 86

of the track is connected to the upper end of a web portion 98. The web portion and flange portion of the track are made of nonconductive material and have pockets 100 formed on either side of the web portion just below the flange 86 within which electrical conductors 102 are mounted. The conductors are therefore connected to any suitable source of electrical energy (not shown) so that electrical energy may be transmitted to the power supply device 16 from which the power cable 92 extends to the carriage. As shown in FIGS. 5—8, the power supply device includes a pair of conductive body members 104 which are nonconductively spaced by means of a nonconductive spacer 106 interconnected with the body members by insulated bolt assemblies 108. Rotatably mounted by each of the body members adjacent the opposite ends thereof, are track wheels 110 which ride on the top of the flange portion 86 of the track and prevent lateral displacement of the power device relative to the web portion 98. Also rotatably mounted by the body members 104 intermediate the ends thereof are two pair of rollers 112 engaged with the underside of the flange portion 86 so as to prevent the power device from being lifted off the track. The wheels 110 and rollers 112 therefore support the body members 104 on the track in positions aligning the conductive brush elements 114 with the conductors 102. The brush elements project from opposed inwardly extending tubular formations 116 of the body members 104. Accordingly, each of the tubular formations 116 houses therewithin a spring element 118 reacting against a removable screw member 120 so as to bias the brush elements 114 into contact with the conductors 102. The conductive body members 104 nonconductively spaced by the spacer 106 therefore electrically contact the conductors through the brush elements 114 in order to conduct electrical energy to a pair of sheathed conductors 122 electrically connected to the body members 104 by the terminal fasteners 124. As shown in FIGS. 5 and 6, the conductors 122 extend into the electrical power cable 92 anchored to the forward end of the spacer 106 by the spring clamp 126. Also secured to the forward end of the spacer 106, is the connector 128 to which the pull cable 90 is anchored so as to tow the power device 18 rearwardly of the carriage 14 to which the cable 90 is also connected. The power cable 92 is provided with sufficient slack relative to the tow cable 90 so that no pull will be exerted thereto.

With particular reference to the circuit diagram of FIG. 11, energization and deenergization of the propelling motor 68 is controlled by a motor control circuit 130 which may be normally operative to energize the motor for propelling the carriage when the relay coil 134 is deenergized. As soon as the relay coil 134 is energized, the normally closed relay switch 132 is opened so as to deenergize the motor 68 resulting in the stoppage of the carriage by means of the drive release brake 70. The carriage stopping relay coil 134 is therefore energized for a predetermined interval whenever impact is sensed by the transducer 66 developing a signal applied to the grid of the input section 136 of a signal amplifier tube 138. Power for establishing the proper bias for the signal amplifier tube 138 is derived from the voltage rectifier section 140 of a power supply 142 which also furnishes grid bias for the thyatron tube 142 associated with the control circuit. The power supply therefore includes a transformer 146 the primary winding of which is connected to the source of electrical energy by means of the conductors within the power supply cable 92 aforementioned. The transformer includes a secondary winding 148 connected to the rectifier section aforementioned and a secondary winding 150 forming the voltage supply for the heater elements of the tubes 138 and 144. Whenever a signal is developed in the transducer 66, it is amplified by the signal amplifying tube 138 producing an output voltage from the plate of output section 152 to feed an amplified signal to the control grid of the thyatron tube 144. The tube 144 is thereby rendered conductive so as to supply energizing current through its plate to the relay coil 154. Upon energization of the relay coil 154, the normally opened relay switch 156 is closed so as to connect the power lines to the carriage

stopping relay coil 134 aforementioned. The relay coil 134 remains energized for a predetermined interval determined by the RC network 158 connected to the control grid of the thyatron tube 144 upon actuation of the relay switch 160 at the same time that the normally opened relay switch 156 is closed to energize the carriage stopping relay coil 154. Accordingly, conduction through the thyatron tube 144 is terminated after a delay interval of 5 seconds for example, causing the relay coil 154 to be deenergized to thereby restore the control circuit to its original condition prior to the development of any signal in the transducer 66. Movement of the carriage is therefore resumed after movement of the carriage has stopped for a period sufficient for the marksman to be credited with a "hit."

From the foregoing description, the operation, construction and utility of the target system of the present invention will be apparent. In the form of the invention described, a certain amount of vibratory motion is induced in the target figure because of its resilient mounting on the carriage while movement of the carriage is changed in response to impact by stopping movement for a predetermined interval after which movement is resumed. It is however contemplated that other changes in movement of the carriage may be effected and that the position of the target figure relative to the carriage may be varied in a more deliberate manner. Referring therefore to FIGS. 12, 13 and 14, it will be observed that a different type of FIG. 162 is supported on the carriage 14 by means of a pair of pivot supporting brackets 164. The brackets 164 therefore mount a pair of journal bearing assemblies 166 for pivotally mounting a counterbalanced pivotal supporting assembly 168 therebetween. The pivotal supporting assembly is counterbalanced by a counterbalancing weight 170 and is displaceable between a substantially vertical position between the brackets 164 and a substantially horizontal position as shown in FIG. 12 by means of a piston rod 172 pivotally connected to a lower end of the pivotal supporting assembly and extending from a power operated cylinder device 174 which is pivotally mounted at one end adjacent the rear end of the carriage. Accordingly, introduction fluid under pressure to the opposite ends of the cylinder device 174 will be operative to displace the target FIG. 162 between an upright position, an intermediate crouch position and a horizontal position resting on the rest block 176 connected to the upper end of the rod 178 secured to the rear end of the carriage as shown in FIG. 12.

The target figure 162 may be made of the same material as described in connection with the target figure 26 of FIGS. 1 and 2. However, the material of the target FIG. 162 embeds a different type of rigid body which includes a relatively small diameter tubular head portion 180 connected to a larger diameter tubular trunk portion 182 as shown in FIG. 12 and 14. The trunk portion 182 is connected to a pair of parallel spaced tubular leg portions 184 as shown in FIGS. 12 and 13. Each of the leg portions are mounted on the pivotal supporting assembly 168 by a shock absorbing anchor device 186. Secured to one of the leg portions 184 as shown in FIG. 13, is an impact sensing transducer 188 which is operative to control movement of the carriage through a propelling motor as described in connection with FIGS. 1-11, and is also operative to control the position of the target figure through the power operated cylinder device 174.

It will therefore be apparent, that the target assembly described in connection with FIGS. 12-14, has associated therewith with a control circuit which is different from that described in connection with FIG. 11. Referring therefore to FIG. 15, it will be observed that the power lines 190 and 192 are connected to the primary of the input transformer 194, the secondary of which is connected to a full wave rectifier 196 for supplying a positive potential to a silicon-controlled rectifier 198 which normally prevents the flow of current therethrough. The power lines 190 and 192 are connected across a random time cycling device 199 which is operative to actuate the control switches 200 and 202 in at timed intervals. In the normal position of the control switch 200 as shown in

FIG. 15, the power line 190 is electrically connected through the normally closed relay switch 204 to the solenoid coil 206 associated with a solenoid control valve device 208 in order to complete an energizing circuit therethrough. The solenoid coil 206 is operative to effect supply fluid under pressure to one end of the power cylinder device 174 so as to maintain the target figure 162 in an upright position. At the same time, an energizing circuit is completed through the normally closed relay switch 104 to the relay coil 210 so as to open the relay switch 212 associated therewith in order to prevent energization of a slow speed control coil 214 associated with a motor speed control device 216. Energization of the slow speed coil 214 may however be barred by displacement of the selector switch 218 from a slow position illustrated in FIG. 15 to its inactive fast position. Therefore, when the control switch 200 is opened, the relay coil 210 is deenergized so as to complete an energizing circuit for slow speed coil 214 thereby reducing the speed of the propelling motor and the speed of the carriage on which the target is mounted. When the control switch 202 is actuated, the power line 190 is electrically connected to the down solenoid coil 220 completing a circuit therethrough in order to displace the target from its upright position toward its horizontal position. The time cycling device 199 will therefore sequentially actuate the control switches 200 and 202 in order to periodically change the speed of the propelling motor and the position of the target figure. The propelling motor may however be maintained at its fastest speed if the selector switch 218 is moved to its fast position preventing energization of the slow speed control coil 214.

When the transducer 188 senses impact of a "kill" area in the target figure, a signal voltage is developed and is applied to the control electrode of the silicon-controlled rectifier 198 causing it to become conductive to thereby complete a circuit through the normally closed relay switch 222, the counter 224 and the normally closed time delay switch 226. The counter 224 is thereby pulsed in order to record a hit as sensed by the impact sensing transducer 188. At the same time that the counter is pulsed, an energizing circuit is completed through the selector switch 228 and the relay coil 230. Energization of the relay coil 230 opens the normally closed relay switch 204 so as to interrupt any energizing circuit through the up solenoid coil 206 that may be established at that time. On the other hand, the normally opened relay switch 232 is closed so that when the control switch 202 is actuated by the cycling device 199, it will energize the down coil 220 in order to cause displacement of the target figure to its horizontal position. The normally opened relay switch 234 is also closed by energization of relay coil 230 to thereby complete an energizing circuit through the stop coil 236 causing the carriage to be completely stopped. It will of course be appreciated that the foregoing stoppage of the carriage and downward positioning of the target figure occurs when the selector switch 228 is in its illustrated position causing energization of the relay coil 230.

Should the selector switch 228 be displaced to its other position, operation is limited to recordation of "hits" without any change in the normal movement of the target since no circuit is established through the relay coil 230. Instead, an energizing circuit is completed through the relay coil 238 so that after the counter 224 is pulsed, the normally closed relay switch 222 is opened in order to prepare the counter for the recordation of the next "hit." However, when the relay coil 230 is energized with the selector switch 228 in its illustrated position, the counter is prepared for the next count by opening of the time delay switch 226 after elapse of a predetermined interval under control of the time delay relay device 240. The time delay relay device 240 is therefore energized by closing of the normally opened relay switch 242 when the relay coil 230 is energized. Therefore, after the delay interval, opening of the switch 226 will also deenergize the relay 230 so that movement of the carriage and positioning of the target figure under the sole control of the cycling device 199 may be resumed.

It will be apparent from the foregoing description, that the target system of the present invention will offer the rifle marksman a moving target having a three-dimensional impact surface concealed therewithin and representative of vital portions of the target or "kill" areas that must be hit in order to be credited with a successful "hit." Also, the effective impact surfaces exposed to the marksman will vary in extent dependent upon the position of the target as it is propelled along the prescribed path. The marksman is thereby forced to seek a more accurate "hit" and will be so credited with such a hit by response of the target manifested by a change in movement or stoppage of its propelling carriage for a predetermined interval after which normal target movement is resumed. Further, the movement of the target along its prescribed path and relative to its propelling carriage will offer a more realistic situation under which the marksman may practice.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What I claim as new is as follows:

1. In a target system having a carriage movable along a prescribed path and a three-dimensional figure mounted on said carriage, means for propelling said carriage along said prescribed path, said figure being made of a resilient shock absorbing material, a rigid body embedded in said material defining a predetermined internal volume within the figure, mounting means connected to said rigid body for mounting the figure on the carriage, transducer means mounted on the mounting means for sensing impact between the rigid body and a missile moving in a path intersecting said internal volume, and control means connected to the transducer means and the propelling means for controlling movement of the figure in response to said impact of the rigid body, said control means comprising, cycling means connected to the propelling means and the mounting means for intermittently

varying the speed of the carriage and the position of the figure thereon, and time delay means connected to said transducer means and the cycling means for stopping movement of the carriage and holding the figure in a predetermined position in response to sensing of impact by the transducer means.

2. The combination of claim 1 wherein said rigid body comprises a plurality of tubular members of different cross-sectional areas interconnected in endwise relation to each other.

3. The combination of claim 2 wherein said mounting means includes, a positioning assembly pivotally mounted on the carriage, shock absorbing means connected to said rigid body for mounting thereof on the positioning assembly and power operated means connected to said positioning assembly for displacing the figure to a predetermined position in response to sensing of impact by the transducer means.

4. The combination of claim 1 wherein said mounting means includes, a positioning assembly pivotally mounted on the carriage, shock absorbing means connected to said rigid body for mounting thereof on the positioning assembly and power operated means connected to said positioning assembly for displacing the figure to a predetermined position in response to sensing of impact by the transducer means.

5. The combination of claim 1 wherein said target includes, a rigid impact body presenting impact surfaces in at least two intersecting planes, said body being embedded in a shock absorbing material through which said missile may pass without any substantial resistance.

6. In a target system having a carriage, a figure, mounting means mounting the figure on the carriage, transducer means mounted on the mounting means for sensing impact with the figure, means for propelling the carriage and means for controlling movement of the carriage comprising cycling means connected to the propelling means and the mounting means for intermittently varying the speed of the carriage and the position of the figure thereon, and time delay means connected to said transducer means and the cycling means for stopping movement of the carriage and holding the figure in a predetermined position in response to sensing of impact by the transducer means.

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