Although a number of devices have been proposed for teaching the art of shooting moving targets with a shot gun or the like without actually firing shells, none has provided the right combination of features to be really satisfactory. The demand which has given rise to the past efforts still exists.

Trap shooting and skeet shooting are, of course, fine sports and excellent training. But they are subject to three faults. One is that when the novice misses, as he usually does, he cannot see where the shot went with respect to the target, and does not know how to try to correct his aim on the next shot. Another is the high cost of shot gun cartridges. A great deal of shooting is required to develop maximum skill in anyone, or to develop satisfactory skill with one who does not have exceptional aptitude for it. With practice costingler in the neighborhood of $3.00 for a very quickly passing series of twenty-five shots, many feel they would like to shoot extensively feel they cannot afford to do so. A third difficulty is finding a place to shoot where there is neither a noise nuisance nor hazard.

According to the present invention an effective training device is provided in which no shots are fired but in which actual wing-shot shooting conditions are so accurately duplicated that training in this manner is highly effective. The trainer uses an old expedient of projecting on a wall a moving target spot of light, and having the gun "shoot" another spot of light when the trigger of the gun is pulled. The shooter can judge his marksmanship by the relative position of the moving target spot and the spot projected from the gun.

According to the present invention, the shooter's own gun can be used, and the flash of light is even produced by the firing mechanism of the gun, so that the usual trigger action is present. The light projected from the gun is a single flash immediately after the pulling of the trigger, so that a single spot of light shows where the shot would have struck. The "fired" spot projector can be "sighted-in" with complete accuracy, and can even be adjusted to provide a size of light circle corresponding to the spot pattern which would result from the choke of the gun that would be used in actual shooting.

Furthermore, after being sighted-in, the "fired" spot projector can be set at a given angularity from its sighting-in position so that it will accommodate accurately for "lead." When shooting at a bird, a hunter must aim enough ahead of the bird to be aiming where the bird will be when his shot gets there. With this invention, if the lead compensation is set accurately for the speed of the target spot on the wall, and if the hunter has led the target by the right amount when he pulls the trigger, the flash projected from his gun will fall on the target spot, not on the point on the wall ahead of the target spot at which the gun was properly aimed. A table can be provided for indicating what angularity of lead the "fired" spot projector should be set for, for a given speed of target spot on the wall and a given angularity of the shooter from the wall, assuming a given discharge velocity.

In addition, the target spot projector can be adjusted to provide different paths and different directions for the movement of the target spot, so that practice can be had for a wide variety of flight paths. The speed of the target spot can be changed simply by changing the position of the projector with respect to the wall. The shooter can be remotely positioned with respect to the target spot projector, and hence he can practice in a variety of angles and distances for each flight path duplicated by the target projector.

Both the target projector and the gun projector produce their spots by focusing the hot filament of an incandescent lamp on the wall, so that they can be used and be seen in fairly bright light, for greater realism in the practice. Additional objects and advantages of the invention will be apparent from the following description and from the drawings.

DESIGNATION OF FIGURES

FIG. 1 is a general view representing the use of this invention.
FIG. 2 is a view showing the part of the apparatus which mounts on the gun.
FIG. 3 is a cross-sectional view of the cartridge switch which fits in the gun.
FIG. 3A is an end view of the cartridge switch.
FIG. 4 is a view on larger scale of the apparatus which mounts on the gun for projecting the "fired" spot, being shown largely in vertical cross-section.
FIG. 4A is a corresponding fragmentary view, showing the shutter latched open.
FIG. 5 is for the most part a top view of the "fired" spot projector, but also shows a section through the bracket thereof taken approximately on the line 5—5 of FIG. 6.
FIG. 6 is a vertical sectional view taken approximately on the line 6—6 of FIG. 4.
FIG. 7 is a view mainly in vertical cross-section of the target spot projector.
FIG. 8 is a top view of the target spot projector shown in FIG. 7.
FIG. 9 is a front view of the target spot projector shown in FIGS. 7 and 8.
FIG. 10 is a circuit diagram for the apparatus.

INTENT CLAUSE

Although the law requires a full and exact description of at least one form of the invention, such as that which follows, it is, of course, one purpose of a patent to cover each new inventive concept therein in no matter how it may later be disguised by variations in form or additions or further improvements; and the appended claims are intended to accomplish this purpose by particularly pointing out the parts, improvements, or combinations in which the inventive concepts are found.

GENERAL DESCRIPTION

The general use of the invention can be described with reference to FIG. 1. A target spot projector 11 is placed on a suitable pedestal or table 12 and connected to a source of power. It projects a spot of light 13 on a wall and moves this spot along a chosen path to simulate the flight of a bird or a clay target. The gunner uses a conventional gun 14, preferably his own, to which is attached a "fired" spot projector 16. The gunner tries to aim his gun as he would aim it at a moving target represented by the target spot 13. When he thinks the gun is properly sighted for a hit, he pulls the trigger. Thereupon, the "fired" spot projector 16 projects a momentary flash of light which appears on the wall as a "fired" spot 17. If this "fired" spot 17 lies in part on target spot 13, the gunner has scored a hit. In FIG. 1, the "fired" spot 17 lies above target spot 13, showing the gunner that he aimed too high. Even if a hit had been scored, the relative positions of the "fired" spot 17 and target spot 13 will tell the gunner whether he is aiming just right, or if not, the direction he is off center, and how much.

The target spot projector 11 is preferably adjustable for a wide variety of flight paths, so as to give the gunner...
training in following different movements. Also the gunner can preferably be located at a substantial distance from the target spot projector, so that he can assume different arrangements with respect to the path of the target spot on the wall and can set the target spot projector at different distances from the wall. In foreign countries, a rotating frequency is little different, for a similar correlation by their units of measure, may be preferred. The frequency should equal the number of smaller units of distance (feet) required to have a large unit (mile) divided by 2 pi (using for frequency the time unit with respect to which the larger unit is commonly used for speed of flight). It is also desirable that the frequency be in the 7–16 r.p.m. range to give usable speeds at reasonable distances.

Although a device of this type will be beneficial to a novice in helping him train his muscles for following the various flights, it could be worse than useless in other respects, as it is accurate in the deviation from a hit. Even the muscle training might be inferior, unless the balance and action of the gun in actual use are closely simulated.

"FIRED" SPOT PROJECTOR AND SWITCH

As seen best in FIG. 4, the "fired" spot projector includes an incandescent bulb 21 having a filament 22 which is approximately focused by a lens 23 on the wall to provide the "fired" spot. The lens 23 is mounted in a telescopically adjustable tube 24 for moving the lens toward and from the filament 22 to control the size of spot on the wall so that it will have the desired size representing the size of the shot pattern to be simulated. It is preferred to use the filament itself as the light source directly focused (approximately) on the wall so as to have adequate brightness for use in moderately good light, in spite of keeping the projecting apparatus light in weight, to minimize its effect on the balance of the gun.

It is important that the light flash be very brief, and occur as close as possible to the instant that the trigger pull is completed to actuate the firing pin of the gun. In the illustrated form of the invention, this is accomplished with the aid of moving shutter 26. The shutter has an aperture 28 which is normally out of line with a corresponding aperture 28, the latter being on fixed wall 29 and being properly aligned between the filament 22 and the lens 23. As the aperture 27 is moved rapidly across the aperture 28, a very brief flash of light is projected through lens 23 to the wall.

Shutter 26 is actuated by solenoid 31, which may include a return spring 32 and a magnetic plunger 33 besides the solenoid coil. When the solenoid 31 is energized, magnetic plunger 33 is drawn into the solenoid until further movement is limited. The base 34 may serve as a stop for the solenoid movement when it strikes the top 36 of the solenoid case. At this time, the aperture 27 is entirely below the aperture 28. When the solenoid 31 is de-energized, spring 32 thrusts plunger 33 upwardly until the top of shutter 26 strikes upper wall 37 of the projector housing. At this time, the aperture 27 should be entirely above the aperture 28. The upper end of shutter 26 is shaped to contact case 37 at a point on the center line of pin 73. This prevents the shock of repeated shutter actuations from altering the vertical "signatures" of the "fired" spot projector.

With some projector designs, the wall having aperture 28 can be omitted, it being sufficient that the opaque portion of shutter 26 lies across the beam being focused by the lens to provide the "fired" spot and preferably that unfocused light be sufficiently subdued.

Probably lighter shutter mechanism than that illustrated will be developed, and other "quick flash" devices could be used. A "quick sharp flash" may be defined as 11 so that even without a speed change incorporated therein, the speed of movement of the target spot on the wall can be changed.

Preferably, the target spot projector is driven at a speed of 14 r.p.m. The speed of its spot on the wall in miles per hour at the part of the wall perpendicular to the beam is then indicated by its distance from the wall in feet. In foreign countries, rotating frequency is little different, for a similar correlation by their units of measure, may be preferred. The frequency should equal the number of smaller units of distance (feet) required to have a large unit (mile) divided by 2 pi (using for frequency the time unit with respect to which the larger unit is commonly used for speed of flight). It is also desirable that the frequency be in the 7–16 r.p.m. range to give usable speeds at reasonable distances.

Whether it is most desirable to have the pulling of the trigger cause the energization or the de-energization of the solenoid 31 may depend on a variety of factors. In the illustrated form, de-energization by trigger pull is provided. FIG. 3 illustrates a form of "fired" spot control switch whereby this can be accomplished. This type is most dependable when the firing pin causes a break of timing, and this occurs upon the very first movement of the switch part.

The casing 41 is of the same diameter as a conventional cartridge for the gun being used. It may conveniently be the same length also. Alternatively, it may be of a smaller size and provided with adapters to fit different guns. The shell 41 is maintained at a proper position in the gun by rim portions 42. It should be noted that the rim portions 42 do not extend all the way around the cartridge switch or shell 41, but are omitted on opposite sides 43 or elsewhere, so that the switch cartridge will not be ejected by the ejector action of the gun. In installing the cartridge switch, the flat portions 43 are placed on the sides, if that is where the ejector hooks are located.

The shell 41 is a metal (such as aluminum) and is grounded to the barrel of the gun by contact therewith. The barrel is in turn connected to the circuit as by a contact clip 44 shown in FIG. 2 around the barrel of the gun. It may be around any other metal portion of the gun mechanism, such as the magazine tube.

The cartridge switch includes a contact 45 which seats on a contact face 46. The contact 45 is connected by spring 47 and spindle 66 to terminal post 48 to which a terminal 49 of insulated conductor is connected. A conductor or wire 51 extends out through the barrel of the gun and is connected to lead 53 by a separable connector 52 (which may be a simple snap connector). Lead 53, as seen in FIG. 4, extends to solenoid 31. A manual switch 54 may connect the other lead of solenoid 31 (and also a lead to the center terminal of socket 56) to lead 57 which may be connected to the circuit by another snap connector 58.

When the trigger is pulled, the firing pin strikes a plastic insert 61 in stem 62 of contact 45. Neoprene rubber has been found to be a suitable material for this insert. This rubber serves to insulate the firing pin from contact 45 to avoid a short circuit and to protect the firing pin and the cartridge switch parts. The stem 62 slides smoothly in a bore of insulating bushing 63. If spring 47 bears on a contact member 64 which is not mounted rigidly on terminal post 48, this contact member 45 may be carried by a spindle 66 sliding in a bore in stem 62. Terminal 48 is carried by an insulating bushing 67 which may be secured in place by spinning the edge 69 of shell 41 over the end of insulating bushing 67.

When the firing pin strikes insert 61 it presses contact 45 away from contact seat 44 shown in FIG. 2 around the barrel of solenoid 31. Spring 32 immediately ejects plunger 33 and operates shutter 27 to provide a very brief flash of
light, or in other words to project a "fired" spot 17 (FIG. 1) on the wall.

**SIGHTING-IN AND LEAD**

Although the structure already described produces a properly timed flash of light as the "fired" spot, accuracy of positioning of that spot with respect to the aim of the gun is important. To this end, a two-way type of adjustment is provided between the "fired" spot projector 16 and the mounting clamps 71 by which it is secured to the gun. It is important that this mounting have its two movement bases 74. As seen in FIG. 4, the vertical adjustment is provided about bushing 76 and pin 72, and horizontal adjustment by pin 73. Pin 72 should be at the bottom of the gun barrel. A user may judge this by having the body of projector 16 hang straight down, or suitable visual aids may be provided. For example, the clamp 71 may be so designed that hinge 75 will be just below the sighting line when pin 72 is at the proper angle.

As seen in FIG. 6, pin 72 is a part of thumb screw 74. The pin 72 is surrounded by bushing 76 which is firmly clamped between the ends of brackets 71 by the action of thumb screw 74. Proper frictional resistance to the pivoting of the "fired" spot projector on bushing 76 is provided by a suitable set of washers 77. One of the washers, preferably the middle one, is a spring washer, so that resilient frictional pressure is exerted on the link or block 78 which carries the pin 73 and on it the "fired" spot projector. In a similar manner, resilient friction is provided to properly resist turning of "fired" spot projector casing 37 on pin 73. In other words, the series of washers 79 includes a spring washer. The spring is maintained under tension by a lock nut pair 81.

From the foregoing it can be seen that the "fired" spot projector 16 can be tilted up or down or right or left to adjust its beam until it points exactly at the spot at which the gun is aimed. Ideally, this "sighting-in" is accomplished by sighting through the barrel of the gun to determine its exact aim. The projector should be adjusted until the spot of light it projects is centered around the spot toward which the gun is aimed, which may be determined by "sighting-in" through the barrel.

It can also be accomplished by "patternning" the gun by firing at a large sheet of paper and noting how the shot pattern centers with respect to a mark at which the gun had been aimed by its sights. The projector should then be set for the spot it will combine with the aim of the gun. This "sighting-in" is aided by a latch 82 for holding shutter 26 in the open position, as seen in FIG. 4A. The latch will spring out when solenoid 31 is energized. This latch may also be useful for preliminary training when it is sometimes advantageous for the student to learn to sight and to follow the target with the "fired" spot constantly showing. The latch 82 may be provided with a head overhanging shutter 26 to make sure the latch does not spring back.

If one were to shoot at a stationary target, this is the "sighting-in" that might be used. For shooting at a moving target, however, there is a different requirement.

As is well known, a hunter who is shooting at a flying bird does not aim directly at the bird. He aims enough ahead of the bird so that if his judgment is right, the flying bird will move into the path of his shot just as the shot exits the path of the bird. This is called "leading." The required angle can be accurately calculated for a given velocity of the shot and a given speed and angularity of the flight of the bird. If we assume conditions such that the practicing hunter knows that he needs a 2° horizontal lead, this can be provided according to the present invention quite easily with the aid of adjustable lead gauge 83. This gauge is secured to the top of "fired" spot projector housing 37.

After the accurate "sighting-in" above described, so that the "fired" spot appears exactly where the gun is aiming, lead gauge 83 is adjusted until its zero point or center demarcation is aligned with needle or pointer 84. This pointer is fixedly carried by block 78. Pointer 84 is shown extending a little to the left so as to bring it out from under the center of the gun barrel for better visibility. Once adjusted to this zero position the lead gauge 83 is not again touched, at least not until another occasion for "sighting-in" of the projector and gun. The lead gauge 83 accordingly maintains its positions with respect to projector housing 37, and if found necessary a spring washer or the like may help hold it in position. To provide the 2° of horizontal lead, the projector housing 37 is swung on pivot pin 73 in the direction from which the target spot is moving until it indicates a 2° deflection in that direction. Now, if the gunner pulls the trigger while he has the gun aimed 2° ahead of the moving target spot, the flash of the "fired" spot from the projector on the gun will fall on the target on the wall. Thus the gunner knows he has scored a hit. If the "fired" spot falls ahead of the target spot he knows that he led the target by too much.

For practicing with flight paths that are horizontal or nearly so, this horizontal lead gauge 83 is all that is required. For greater accuracy with steeper or even vertical flight paths a vertical lead gauge is desirable. For an inclined path, the required angle of lead as to that path can be provided by the combined effect of one component of horizontal lead and another component of vertical lead. These can be determined mathematically, but in ordinary practice will be read from a table such as tables given below. The illustrated form of vertical lead gauge includes a pointer 130 and a lead gauge plate 132. Either of these could be adjustable with respect to its mounting, in the manner of adjustment of horizontal lead gauge plate 83. In the illustrated form, it is assumed that the pointer 130 is adjustable by virtue of fitting resiliently into the bore which has been provided for it in block 78. The Shank of pointer 130 fitting within the bore may be slightly crimped to insure resilient friction so that it will retain its adjusted position. The gauge plate 132 can be rigid on clamp 71.

It will be apparent that with the speed of rotation of the projector previously indicated the speed of the target spot along a portion of a wall perpendicular to the target beam is readily determined. Although the speed at portions of the wall more remote from the portion that is perpendicular to the beam are not so easily determined, they do not usually need to be known.

It has been found that when a gunner is firing at a target spot with the device of this application, which has been set for any given situation, he will generally fire each time when the target spot has reached approximately the same position with respect to the gunner and the target spot projector. This makes it easy to estimate with suitable accuracy, the speeds and angles required for using the tables shown below.

If the projector is placed so that its beam will strike the wall perpendicularly near the zone towards which the gunner finds he shoots, the speed of the spot at that zone will be quite simply determined and the tables can be easily used with good accuracy.

Under conditions of normal firing, the gunner swings the gun along the flight path of the target and "lead" is required to compensate for the time interval, from "fire" to "lead time," to "target impact," of which the shooter has no control over the projectile path. This time interval is determined by the projectile velocity and the target range. It will encompass the time required for the projectile to travel from the gun muzzle to the target path. Since this device fires a beam of light, having practically infinite velocity, there is essentially no time interval during which the shooter has to wait over the projectile path. This permits simulating "leads" as hereinafter described.

Targets following steeply rising or descending paths
require the gunner to shoot above or below the elevation of the target at the instant of firing. For example, if a target requires a “vertical” lead of 1° and a “horizontal” lead of 2°, the “horizontal” lead is set as described above, and in the same manner, the “vertical” lead is set by swinging the projector assembly about pin 72 until pointer 130 indicates the proper lead on “vertical” lead scale plate 132.

It will be understood from the explanation of horizontal lead gauge 83 and 84 that immediately after “sight-in” the fired spot projector, the lead gauge pointer 130 will have been set to the zero position so that swinging the projector assembly about pin 72 will move it away from the vertical zero position and the amount it is swung away from the vertical zero position will be indicated by the scale on vertical lead gauge plate 132.

It is preferred that the equipment be provided with tables such as the following, which can be mounted on the target spot projector assembly 11. These tables are based on a muzzle velocity of 1,000 feet per second which is commonly approximated in shot guns. Table No. 1 is for an essentially horizontal flight path.

### Table No. 1.—(Vertical lead angle zero)

<table>
<thead>
<tr>
<th>M.p.h. (also Ft. from target)</th>
<th>15°</th>
<th>30°</th>
<th>45°</th>
<th>60°</th>
<th>75°</th>
<th>90°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degrees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>2</td>
<td>4</td>
<td>7</td>
<td>10</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>20</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>30</td>
<td>6</td>
<td>12</td>
<td>18</td>
<td>24</td>
<td>30</td>
<td>36</td>
</tr>
<tr>
<td>40</td>
<td>8</td>
<td>16</td>
<td>24</td>
<td>32</td>
<td>40</td>
<td>48</td>
</tr>
<tr>
<td>50</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
<td>60</td>
</tr>
</tbody>
</table>

Table No. 2 shows typical settings of vertical and horizontal “lead” angles for a target which is following a path which rises or falls at an angle of 30° to the horizontal.

### Table No. 2.—(Target path 30° from horizontal)

<table>
<thead>
<tr>
<th>M.p.h. (also feet from wall)</th>
<th>30°</th>
<th>60°</th>
<th>90°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal, Vertical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Lead Angle” setting at indi-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cated horizontal gun-to-wall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>angle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Lead Setting”</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>25°</td>
<td>25°</td>
<td>25°</td>
</tr>
<tr>
<td>20</td>
<td>40°</td>
<td>40°</td>
<td>40°</td>
</tr>
<tr>
<td>30</td>
<td>55°</td>
<td>55°</td>
<td>55°</td>
</tr>
<tr>
<td>40</td>
<td>70°</td>
<td>70°</td>
<td>70°</td>
</tr>
</tbody>
</table>

The angle between the wall and a line from the gunner to the target position on the wall at the instant of firing, is the angle to be used in the table. The angular deviation of the target path, from the horizontal, can readily be read from scales provided on the target spot projector as hereinbefore described.

As previously pointed out, the horizontal lead gauge 83 will alone take care of the nearly horizontal flight paths. If for reasons of economy in manufacture only this gauge is provided, a user who so desires may set the device on his gun at an angularity corresponding to a non-horizontal flight path. Thus the clamp 71 may be tilted on the gun so that the horizontal lead adjustment will swing the beam parallel to a non-horizontal flight path.

As has been pointed out before, the speed of the spot on the wall can be easily determined in the area of the wall where the wall is perpendicular to the beam. As the spot moves along the wall, the speed increases. When desired, a practitioner can use this advantageously because it simulates the natural flight of a bird soon after starting from rest. Such a bird is usually gaining speed as the hunter gets his gun on it. Of course, the opposite effect can be obtained too, which simulates a Clay target that is naturally decreasing in its speed. For this effect, the gunner would have the projector placed so that he will begin sighting on the target as it is approaching the area where the wall is perpendicular to the beam.

This effect of increasing speed at areas remote from the point of impact can also be used. When it is desired to get relatively high speeds in a fairly small room to give a hunter practice in exceptionally fast angular movement. In fact, a manual of instructions could include tables which would enable the shooter to know the actual speed of movement of the clay target under such conditions. Such tables would also include the appropriate lead gauge settings.

Although it is desirable to be able to know the speed of the target, it is sometimes desirable to set the lead gauges for a considerably higher speed. For example, in a small room a spot speed of 30 m.p.h. would probably be too hard to follow. Yet a hunter who expects to shoot birds would sometimes want to practice with the lead for a bird moving at 30 m.p.h. or even faster. Accordingly, a hunter may find it desirable to set the lead gauges at the angularity to which he wants to train to that of a particular speed of bird flight. As a matter of fact, he will be enough closer than normal to his target so that the angular speed at which he swings a gun may be comparable to a 30 m.p.h. bird even though the target spot is moving considerably slower. If he chooses to make the target spot quite small so that it will appear to him to be at about the size of a bird at a more normal range, the visual effect will also be similar to a bird moving at 30 m.p.h. or faster. When used in this manner, the device loses some of the particular type of precision described with respect to the other uses. But it can still be quite precise in indicating to the gunner whether, had the target been moving at the speed he assumed in setting the lead gauges, he would have hit the target.

Instead of having a zeroing adjustment for the lead gauges, they could be made fixed and the “sight-in” could be accomplished by moving the filament 22 or the lens 23 while the lead gauges are both set at zero. This would be preferred if it is found that clamp 71, or perhaps some other form of such clamp extending a greater length along the barrel, can be removed and the unit reapplied on a drive shaft 107 which is turned by a drive unit 108 preferably comprising a motor and gear
The motor of drive unit 108 is preferably a synchronous or substantially constant speed motor, so that the projector tube 101 will make a given number of revolutions per minute. Accordingly, the speed of the target spot will depend on the distance of the projector from the wall and can be adjusted simply by moving the projector closer to the wall or further from it.

The projector and motor are jointly mounted on a tilt shelf 111 which is pivotably carried by a pedestal 112. It may be locked in any position by tightening thumb nut 113 on bolt 114 which provides the pivoting axis. Pedestal 112 and the upright 116 of shelf 111 has provided a scale and pointer combination by which the tilt of the tilt shelf 111 can be read. Thus in FIG. 8, it is seen that the pointer 117 points to zero, indicating that the shelf 111 is horizontal. This in turn indicates that the path of the target spot on the wall will be horizontal. If it is desired to have the path of the target spot slope at a 20° angle, it is merely necessary to loosen the thumb nut 113, swing the tilt shelf 111 until pointer 117 points to 20° and retighten the thumb nut 113.

To reverse the direction of flight, it is merely necessary to invert the tilt shelf 111, in which event the pointer 118 will indicate the slope of the path of the target spot.

If it is desired to have the target spot higher on the wall than the level of the projector tube 101, this can usually be accomplished by turning the side of the projector 108 away toward the wall and tilting the tilt shelf 111 to a suitable angle. It is even possible to simulate the path of a bird which rises from the ground and then flies off, by a quartering position of the target spot projector assembly 12.

A suitable stop not shown, can be provided for limiting the pivoting movement of tilt shelf 111 to slightly less than 360° so that it will not twist the electrical connections excessively. Even if movement is limited to 180°, probably the same results can be achieved with some minor inconvenience such as having to turn the pedestal 112 end for end to get some variations of flight path inclinations.

The base of light bulb 102 will be grounded through its socket to tube 101, shaft 107, and the housing of drive unit 108. The other terminal for lamp 102 can be grounded through a spring contact 120. The other end of spring contact 120 can be secured to upright 116, where it may also be connected into the power circuit.

**ELECTRICAL CIRCUIT**

A suitable circuit for the illustrated form of invention is shown in FIG. 10. The device may be plugged into a conventional home 110 volt A.C. outlet. This may immediately energize a transformer 121 which may conveniently be carried by the base of target spot projector assembly 12. A manual switch 122 may connect a 110 volt supply to the motor 108 of drive unit 108.

Transformer 121 is provided chiefly to have a safe low voltage available for the exposed circuit elements, including the gun, and other metal parts. 16 v. is appropriate. The 16 v. secondary is connected through spring contact 120 to light bulb 102 of the target spot projector. It is connected to the remaining elements of the circuit through separable connector 58 and clamp 44. When switch 54 is closed, as is the case during operation, the circuit through separable connector 58 is connected to the light bulb 21 of the "fixed" spot projector and to solenoid 31, the latter connection depending on the cartridge switch 40.

Clamp 44 is not essential, as the wire to it could be grounded to frame 37 of the "fixed" spot projector 16, and through it to the gun. At present, however, clamp 44 is desired anyway for relieving projector 16 of the load or tug of the long connecting wire which might change its adjustment. This would be less necessary if the projector 16 were provided with means for locking its adjustment, or if it were energized by a local battery or by a lead extending from the gunner.

**FURTHER DISCUSSION**

Some of the advantages of the invention can be achieved with a simulated gun, and hence it should be understood that the invention is usable with any gun-like device. However, full advantages of this invention involve use of a gun such as the townsie will use in shooting, and, simulating actual shooting conditions as nearly as possible. A "quick sharp flash" is very important. In fact, most of the practice advantages can be attained, if improperly, by a "quick sharp flash" even if not produced by the firing pin, if produced by the trigger. Since actuation by the firing pin is ideal, it may be noted that it is made possible by electrical actuation. In fact, it is important that only a very small and light part needs to be moved by the firing pin, and hence in most guns there is no substantial time delay, or failure, due to inertia.

The effective weight of the moving switch piece 45, 62 (including a portion of spring 47) is only about 2.4 grams in one form found satisfactory in several makes of guns. The spring force is about 80 gm. On the gun this does not work well at least with a neoprene insert 61 and so changes to ensure operation with all guns are preferred. For example, there may be further reduction of the combined opposition of inertia (weight) and spring force, and a harder material, such as nylon, used for insert 61. Also, with guns in which the firing pin recedes at once after firing, some device to prevent reactivation of the solenoid (which produces a second "fired" spot flash) is preferred.

I claim:

1. The combination of a rotating target spot projector adapted to focus the image of an incandescent filament on a wall and a "fired" spot projector assembly adapted to be secured to a gun and flashed as the gun would be fired, to project on the wall an image of an incandescent filament; said "fired" spot projector assembly including a clamp unit for securing the projector assembly to the body of a gun, a link pivoted to the clamp approximately about an axis tangent to a circle concentric with the gun bore but retainable in any position of adjustment, a projector pivoted to the link approximately about a gun bore radius but retainable in any position of adjustment a pointer carried by the link, a scale plate carried by the projector housing adjacent to the pointer and pivotable with respect to the housing but retainable in its position of adjustment with respect to the housing so that after the housing has been sighted in with respect to the gun barrel, the scale can be set to zero with respect to the pointer, and upon pivoting the housing about said radius the pointer will indicate the angle of lead for which the housing is set; an incandescent lamp carried by the housing, a lens adjusably carried by the housing for controlling the size of spot projected, an aperture between the lamp filament and the lens, an aperture through the barrel of the gun to a switch mounted in a cartridge-simulating carrier and actuated by the firing pin of the gun to break the circuit when the trigger is pulled as in firing the gun.

2. The combination of a target spot projector adapted to produce a moving spot of light on a wall and a "fired" spot projector adapted to be secured to a gun and flashed as the gun would be fired, to project on the wall a "fired" spot of light; said "fired" spot projector including a clamp unit for securing the projector to the body of a gun, means to adjust the beam of the latter projector in a normally vertical plane but retainable in any position of adjustment, means to separately adjust the beam in a normally horizontal plane but retainable in any position
of adjustment, gauge means for at least one of said adjustments settable to zero, when the beam is aligned with the
gun aim, without changing said adjustments and retainable in its position relative to said latter adjustment to change as that adjustment is changed, to indicate the angle of lead for which the "fired" spot projector is set; a shutter associated with the "fired" spot projector for producing a very brief flash of its beam, and an elec-
trical means for controlling the shutter including a wire extending through the barrel of the gun to a switch mounted in a cartridge-simulating carriag and actuated by the firing pin of the gun to cause a flash when the trigger is pulled as in firing the gun.

3. A "fired" spot projector adapted to be secured to a gun and flashed as the gun would be fired, to project on a wall a "fired" spot of light; including a clamp unit for securing the projector to the body of a gun, means to adjust the beam of the projector in a normally vertical plane but retainable in any position of adjustment; means to separately adjust the beam in a normally horizontal plane but retainable in any position of adjustment; gauge means for at least one of said adjustments settable to zero, when the beam is aligned with the gun aim, without changing said adjustments and retainable in its position relative to said latter adjustment to change as that ad-
justment is changed, to indicate the angle of lead for which the "fired" spot projector is set; a shutter associated with the "fired" spot projector for producing a very brief flash of its beam, and an electrical means for con-
trolling the shutter including a wire extending through the barrel of the gun to a switch mounted in a cartridge-
simulating carriag and actuated by the firing pin of the gun to cause a flash when the trigger is pulled as in firing the gun.

4. A "fired" spot projector adapted to be secured to a gun and flashed as the gun would be fired, to project on a wall a "fired" spot of light; including a clamp unit for securing the projector to the body of a gun, means to adjust the beam of the projector in a normally vertical plane but retainable in any position of adjustment; means to separately adjust the beam in a normally horizontal plane but retainable in any position of adjustment; gauge means for at least one of said adjustments settable to zero, when the beam is aligned with the gun aim, with-
out changing said adjustments and retainable in its posi-
tion relative to said latter adjustment to change as that adjustment is changed, to indicate the angle of lead for which the "fired" spot projector is set; control means adapted to be mounted in the cartridge chamber of a gun and to be instantly actuated by the firing pin thereof when released; said "fired" spot projector being electrically con-
ected to said control means and being adapted, upon actuation of the control means to produce a "quick sharp flash" of its beam.

5. The combination of means for simulating a moving target and a "fired" spot projector adapted to be secured to a gun and flashed as the gun would be fired, to project on a wall a "fired" spot of light; including a clamp unit for securing the projector to the body of a gun, means to adjust the beam of the projector in a normally vertical plane but retainable in any position of adjustment; means to separately adjust the beam in a normally horizontal plane but retainable in any position of adjustment; control means adapted to be mounted in the cartridge cham-
er of a gun and to be instantly actuated by the firing pin thereof when released; said "fired" spot projector being electrically connected to said control means and being adapted, upon actuation of the control means to produce a "quick sharp flash" of its beam.

6. A "fired" spot projector adapted to be secured to a gun and flashed as the gun would be fired, to project on a wall a "fired" spot of light; including a clamp unit for securing the projector to the body of a gun, means to adjust the beam of the projector in a normally vertical plane but retainable in any position of adjustment, means to separately adjust the beam in a normally horizontal plane but retainable in any position of adjustment; gauge means for at least one of said adjustments settable to zero, when the beam is aligned with the gun aim, without changing said adjustments and retainable in its position relative to said latter adjustment to change as that adjustment is changed, to indicate the angle of lead for which the "fired" spot projector is set; control means adapted to be instantly actuated upon the pull of the gun trigger; said "fired" spot projector being electrically connected to said control means and being adapted, upon actuation of the control means to produce a "quick sharp flash" of its beam.

7. A "fired" spot projector adapted to be secured to a gun and flashed as the gun would be fired, to project on a wall a "fired" spot of light; including a clamp unit for securing the projector to the body of a gun, means to adjust the beam of the projector in a normally vertical plane but retainable in any position of adjustment; means to separately adjust the beam in a normally horizontal plane but retainable in any position of adjustment; gauge means for at least one of said adjustments settable to zero, when the beam is aligned with the gun aim, without changing said adjustments and retainable in its position relative to said latter adjustment to change as that adjustment is changed, to indicate the angle of lead for which the "fired" spot projector is set.

8. A "fired" spot projector adapted to be used with a gun-like device and flashed as the device would be fired, to project on a wall a "fired" spot of light; including means to provide relative adjustment of the device and the beam of the projector in a normally vertical plane but retainable in any position of adjustment, means to separate-
ly adjust the beam in a normally horizontal plane but retainable in any position of adjustment; gauge means for at least one of said adjustments settable to zero, when the beam is aligned with the aim of the device, without changing said adjustments and retainable in its position relative to said latter adjustment to change as that ad-
justment is changed, to indicate the angle of lead for which the "fired" spot projector is set.

9. A "fired" spot projector adapted to be used with a gun-like device and flashed as the device would be fired, to project on a wall a "fired" spot of light; including means to provide relative adjustment of the device and the beam of the projector in a normally vertical plane but retainable in any position of adjustment, means to separate-
ly adjust the beam in a normally horizontal plane but retainable in any position of adjustment; gauge means for at least one of said adjustments settable to zero, when the beam is aligned with the aim of the device, without changing said adjustments and retainable in its position relative to said latter adjustment to change as that ad-
justment is changed, to indicate the angle of lead for which the "fired" spot projector is set; control means adapted to be instantly actuated upon the pull of the trigger of the device; said "fired" spot projector being electrically connected to said control means and being adapted, upon actuation of the control means to produce a "quick sharp flash" of its beam.

10. A "fired" spot projector adapted to be used with a gun-like device and flashed as the device would be fired, to project on a wall a "fired" spot of light; including means to provide relative adjustment of the device and the beam of the projector in a normally vertical plane but retainable in any position of adjustment, means to separate-
ly adjust the beam in a normally horizontal plane but retainable in any position of adjustment; gauge means for at least one of said adjustments settable to zero, when the beam is aligned with the aim of the device, without changing said adjustments and retainable in its position relative to said latter adjustment to change as that ad-
justment is changed, to indicate the angle of lead for which the "fired" spot projector is set; said projector including adjustability for the angular relation of the gauges with the beam to per-
mitt or prohibit movement of the beam of the gun in a manner of the gauges read "O" and the beam is "sighted-in" for the gun aim.

11. The combination of a target spot projector adapt-
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ed to project a moving target on a wall and a “fired” spot projector adapted to be secured to a gun and flashed as the gun would be fired, to project on the wall a “fired” spot of light; said “fired” spot projector including a clamp unit for securing the projector to the body of a gun, means to adjust the beam of the latter projector in a normally vertical plane but retainable in any position of adjustment, means to separately adjust the beam in a normally horizontal plane but retainable in any position of adjustment, gauge means for at least one of said adjustments settable to zero, when the beam is aligned with the gun aim, without changing said adjustments and retainable in its position relative to said latter adjustment to change as that adjustment is changed, to indicate the angle of lead for which the “fired” spot projector is set; and control means adapted to be operated substantially as the trigger is pulled to firing position; said “fired” spot projector being electrically connected to said control means and being adapted, upon actuation of the control means to produce a “quick sharp flash” of its beam.

12. The combination of a target spot projector adapted to project a moving target on a wall and a “fired” spot projector adapted to be secured to a gun and flashed as the gun would be fired, to project on the wall a “fired” spot of light; said “fired” spot projector including a clamp unit for securing the projector to the body of a gun, means to adjust the beam of the latter projector in a normally vertical plane but retainable in any position of adjustment, means to separately adjust the beam in a normally horizontal plane but retainable in any position of adjustment, gauge means for at least one of said adjustments settable to zero, when the beam is aligned with the gun aim, without changing said adjustments and retainable in its position relative to said latter adjustment to change as that adjustment is changed, to indicate the angle of lead for which the “fired” spot projector is set, a shutter associated with the “fired” spot projector for producing a very brief flash of its beam, and an electrical means for controlling the shutter including a wire extending to a switch mounted in a cartridge-simulating carrier and actuated by the firing pin of the gun to cause a flash when the trigger is pulled as in firing the gun.

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