May 13, 1941. A. J. McMASTER 2,241,670

ELECTRIC TARGET RANGE

Filed March 12, 1938 6 Sheets-Sheet 1

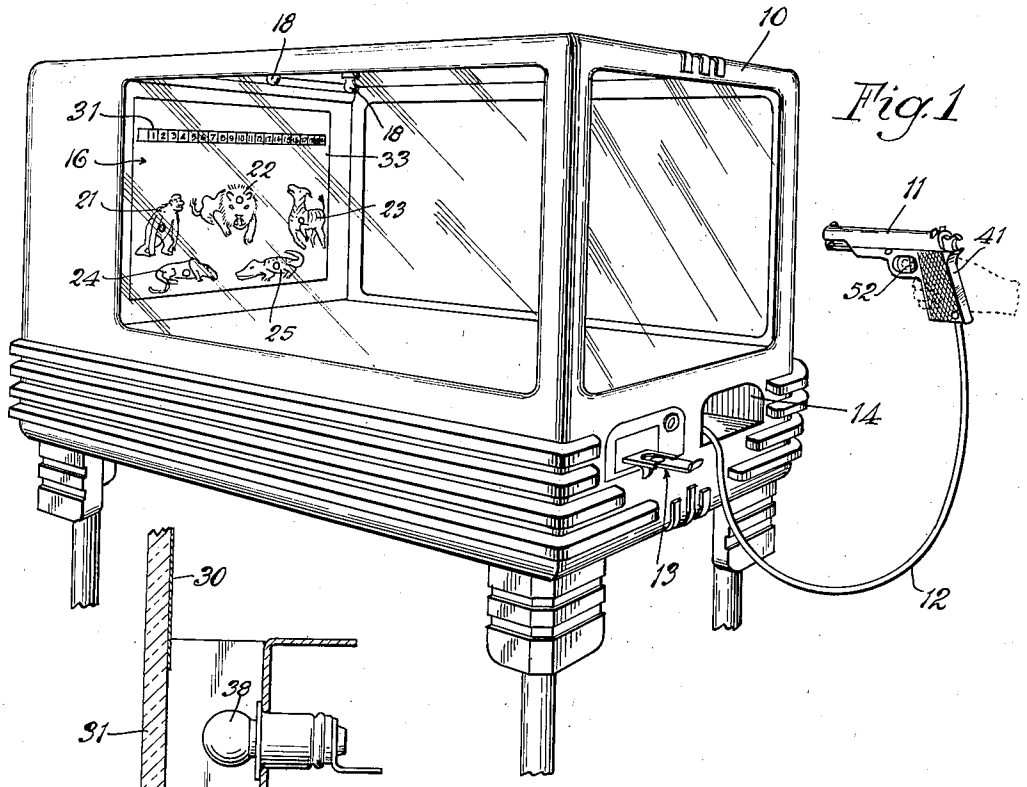

Fig. 1

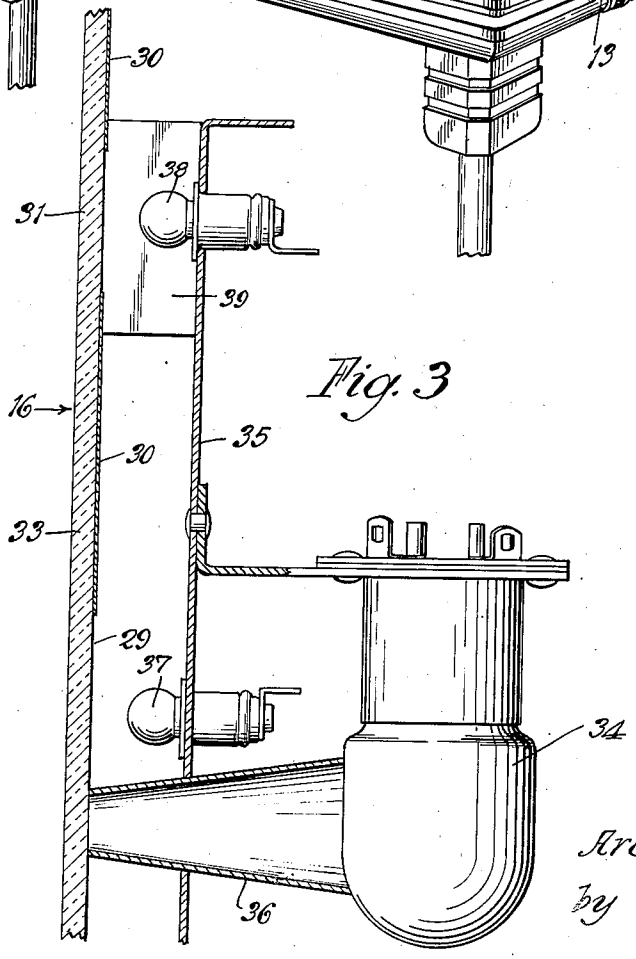

Fig. 3

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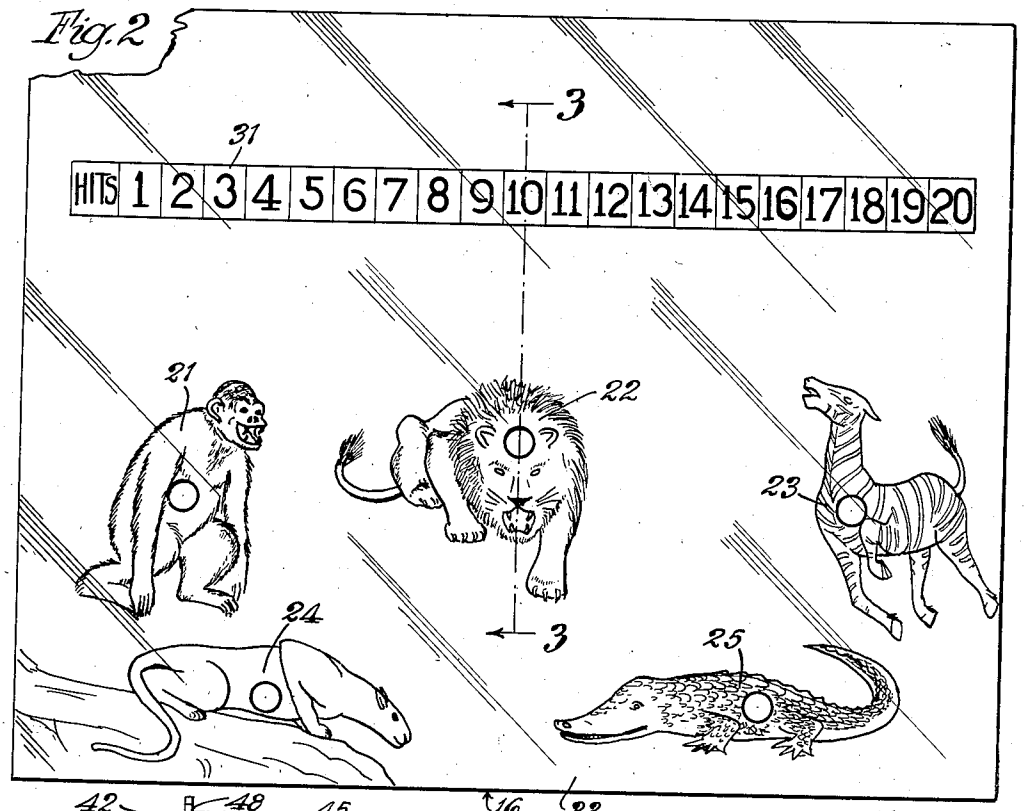
Fig. 2



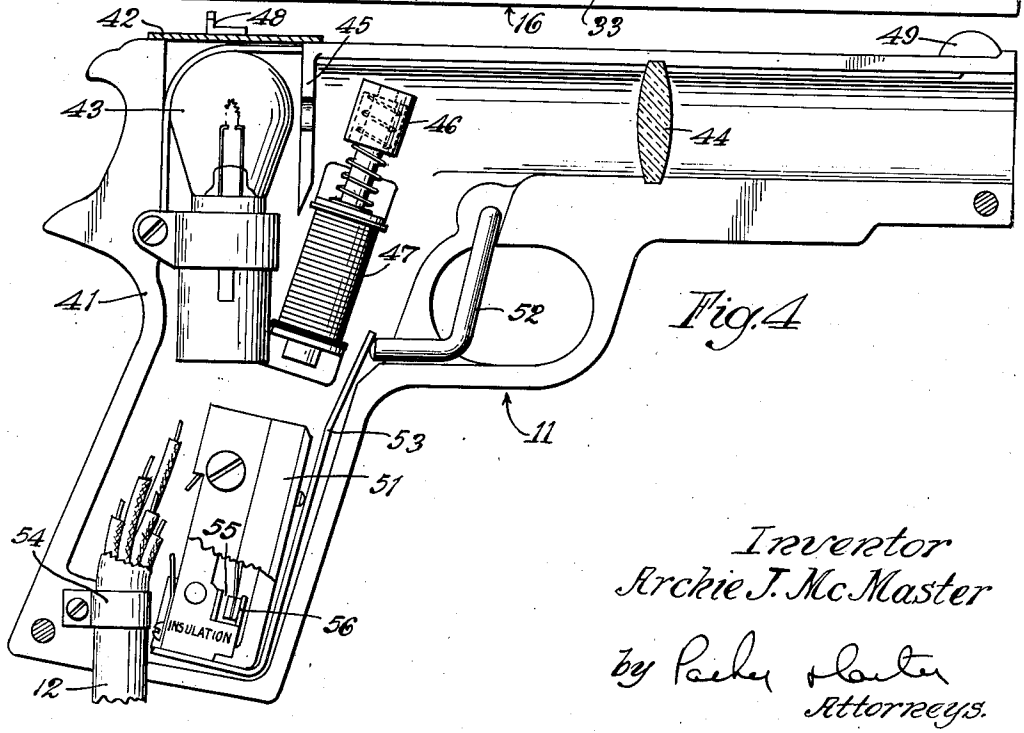


Fig. 4

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Fig. 5

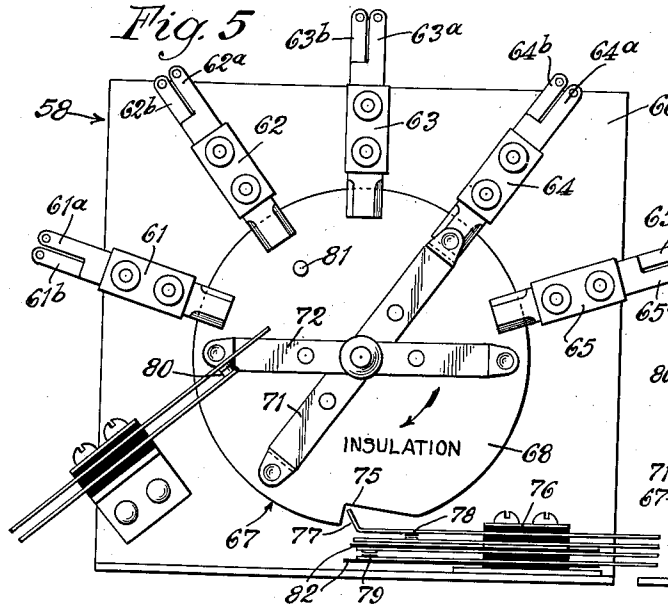


Fig. 6

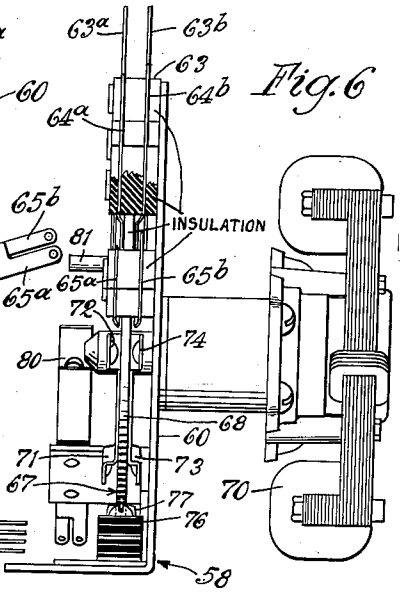


Fig. 7

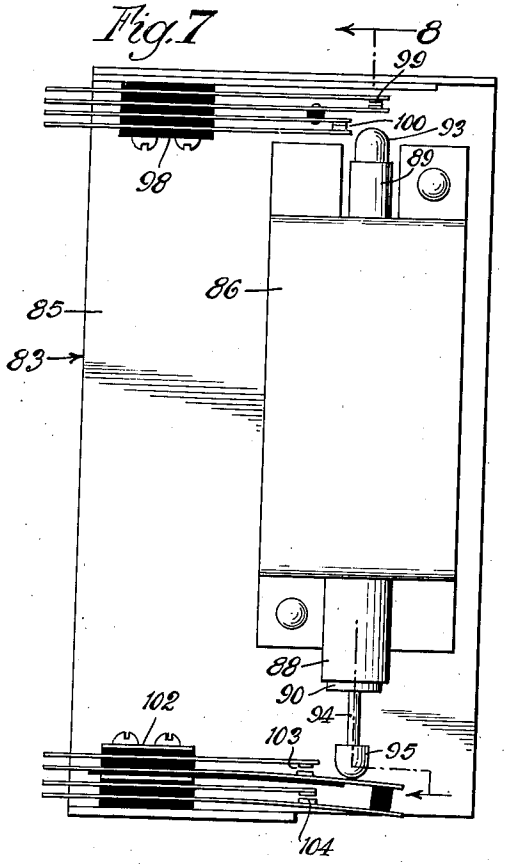
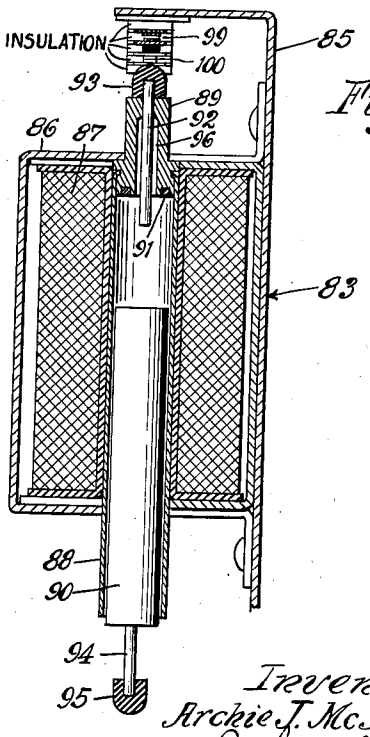


Fig. 8



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ELECTRIC TARGET RANGE

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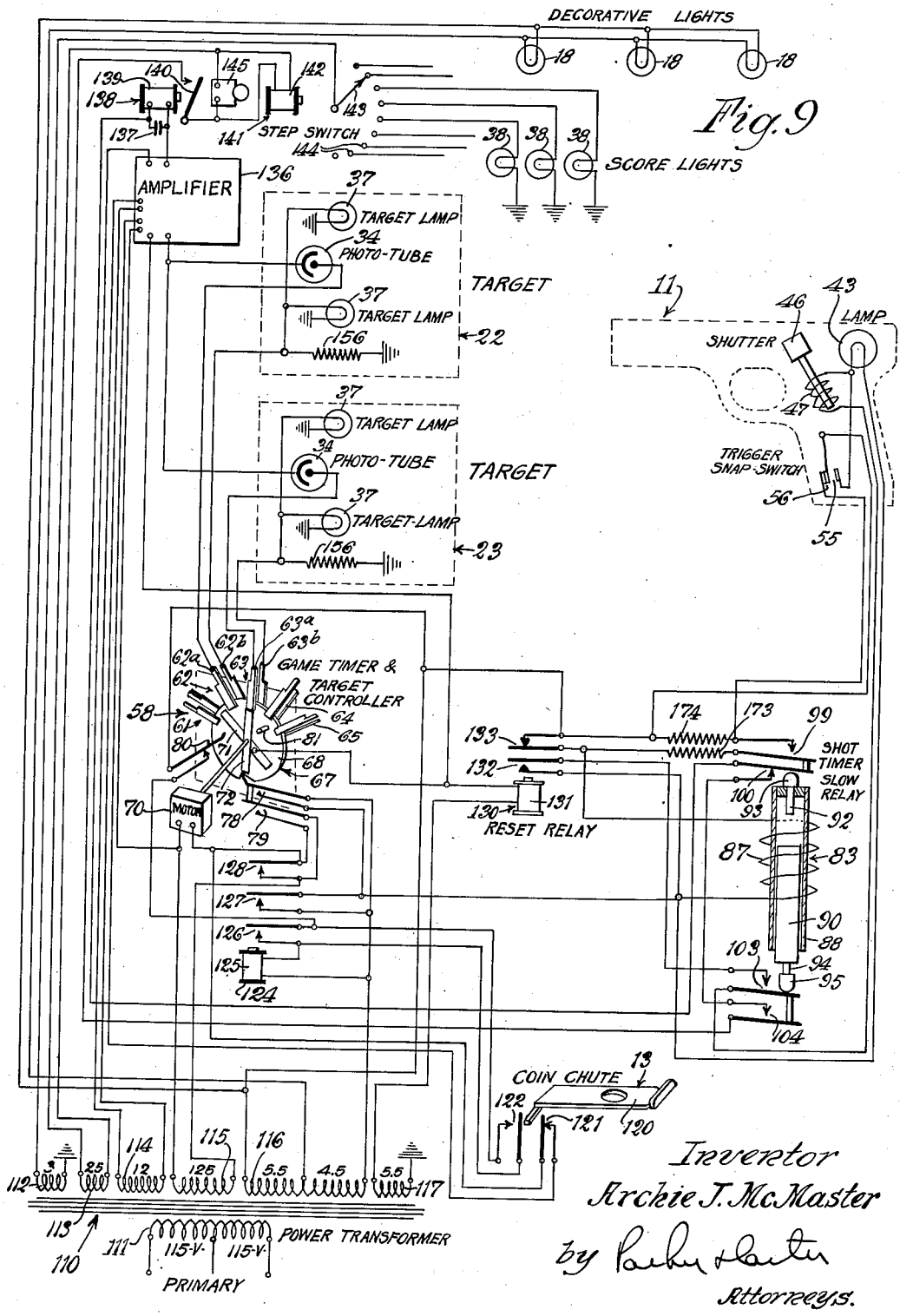

Fig. 9

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ELECTRIC TARGET RANGE

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Fig. 10

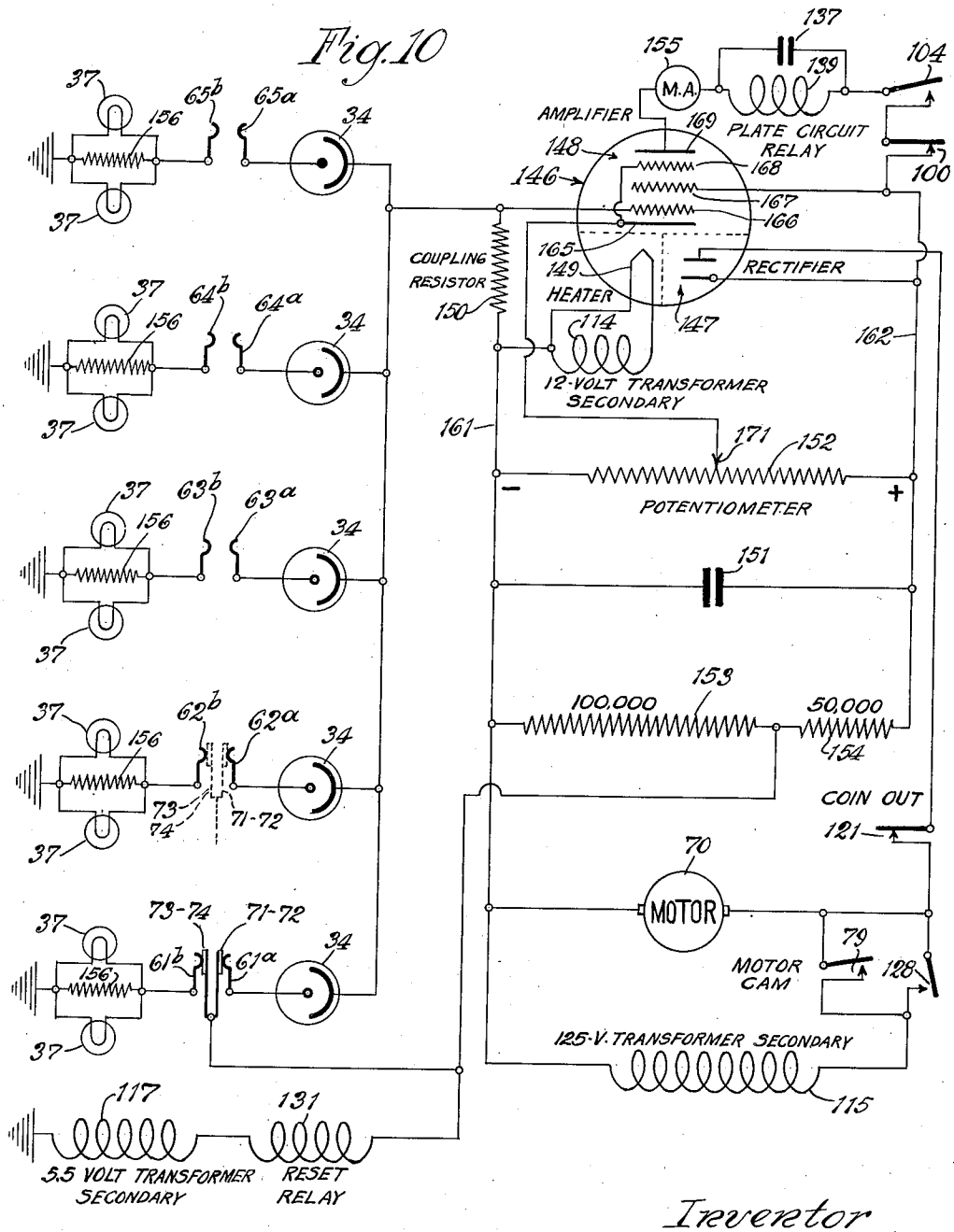

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Fig. 11

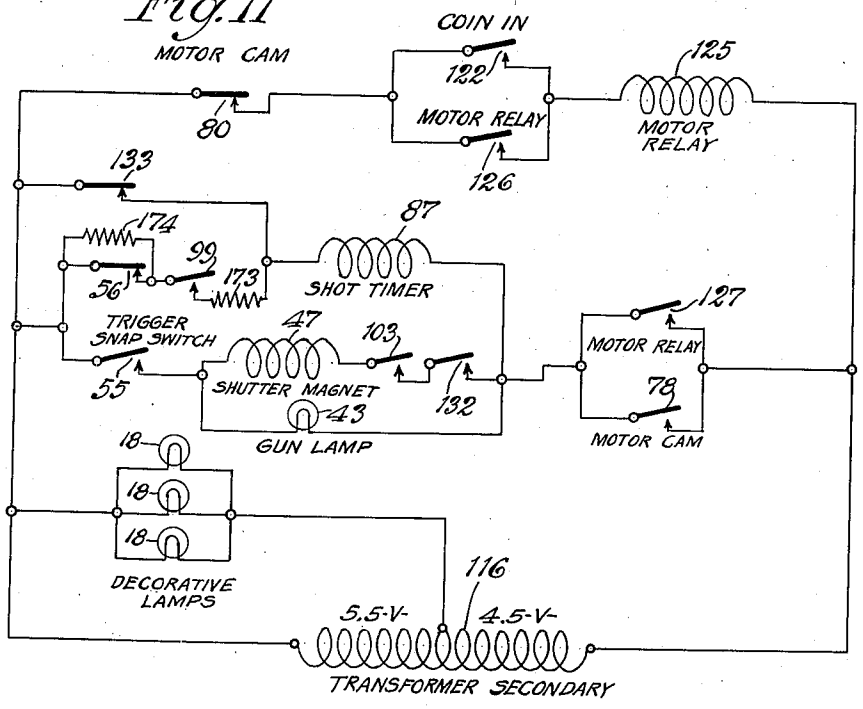

Fig. 12

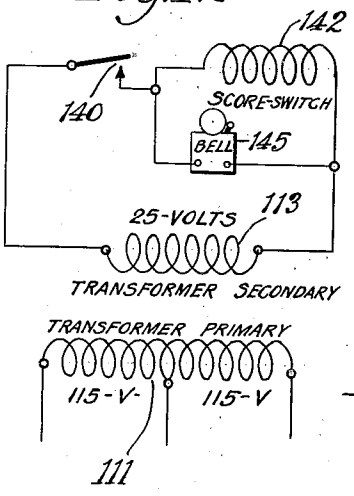

Fig. 13

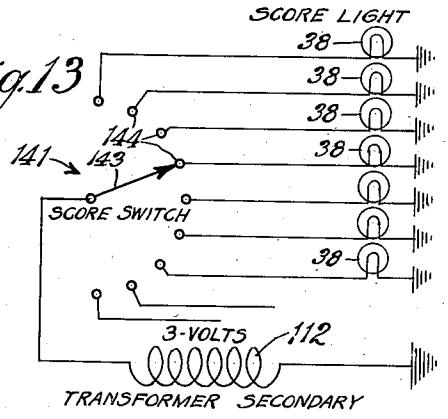

Fig. 14

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UNITED STATES PATENT OFFICE

2,241,670

ELECTRIC TARGET RANGE

Archie J. McMaster, Highland Park, Ill., assignor to Rayolite Rifle Range Company, Chicago, Ill., a corporation of Oklahoma

Application March 12, 1938, Serial No. 195,443

14 Claims. (Cl. 273—101.1)

The present invention relates generally to amusement devices and more particularly to target ranges employing light projecting guns and photoelectric ranges.

An object of the present invention consists in the provision of new and novel target arrangements for target games.

Another object consists in the provision of a target game apparatus which presents a realistic game to the player and which simulates actual situations in which firearms are used.

A further object consists in the provision of target game apparatus which requires the player to change his aim for each shot and which prevents the player from attempting to correct an erroneous aim by taking repeat shots at the target.

A further object is the provision of target game and apparatus therefor which emphasizes skill and marksmanship.

A further object is the provision of apparatus for presenting to a player a number of targets, one at a time, and for brief intervals, and for requiring the player to take his aim and fire quickly.

A further object of the present invention consists in the provision of apparatus for presenting a number of targets, one at a time, in such a manner that the targets are made to appear to be presented at random.

Still a different object of the present invention consists of the provision of an improved electrical control system for a target game for accomplishing the above enumerated objects. It includes the provision of a shot control relay which requires resetting after each shot. It includes the provision of a game and target control timer for controlling the presentation of targets, for turning the targets on and off and for controlling the resetting of the shot control relay. It includes also the provision of target indicating lamps controlled by the game and target control timer for indicating the on and off conditions of the targets as well as a reset relay in the circuit to said lamps to reset the shot control timer during the off conditions of the targets and to permit shots to be made only during the on conditions of the targets.

These and other objects of the present invention will appear as the description proceeds.

In order better to acquaint those skilled in the art with the teachings and practice of my present invention, I now shall describe a specific embodiment of the same, reference being had to the accompanying drawings, which form a part of this specification and in which:

Figure 1 is a general view in perspective of a game apparatus embodying my present invention;

Figure 2 is a view of the target field thereof;

Figure 3 is a side elevation in section illustrating the construction of one of the individual photoelectric targets, the same being taken along the line 3—3 in Figure 2;

Figure 4 is a sectional view showing the mechanism of the light projecting gun;

Figures 5 and 6 respectively are front and side elevations of a motor driven target control and game control timer included in the apparatus of my present invention;

Figures 7 and 8 are front elevation and side sectional views of the shot control timer used in the apparatus of my present invention, Figure 8 being a section along the line 8—8 of Figure 7 taken in the direction indicated by the arrows;

Figure 9 is a schematic diagram showing the complete electric circuit connections; and,

Figures 10, 11, 12, 13 and 14 are "across the line" diagrams of the circuit connections shown schematically in Figure 9.

Referring to Figures 1 and 2, the apparatus of the present invention includes a cabinet 10 which houses the targets and the control mechanism, and includes also a light projecting gun 11 connected thereto by an electric cable 12. The gun 11 is adapted to be held in the hand of the player of the apparatus and is of such size, shape and appearance as to simulate an ordinary pistol. An open compartment 14 is provided for receiving the gun 11 when the machine is not being played. The cabinet is equipped with a coin chute 13 into which a coin may be inserted for setting the apparatus into operation. The cabinet is equipped with front and side glass panels enclosing an empty space, at the back of which is located a target field 16.

Preferably the target field 16 includes a glass panel having painted thereon a number of representations of individual animals constituting parts of individual targets 21 to 25 inclusive.

The painted animals of the target field 16 are set in a decorative background (background detail not shown) and on each animal is painted the outline of a bulls-eye, the center of which is left unpainted. The pictures of the animals are painted with translucent paint while the background preferably is made opaque (as by backing with opaque paint or the like) so as to prevent light from being transmitted therethrough. The targets are intended to be shot at in turn (as will be explained hereafter) and to this end electric lamps are located behind the individual pictures of the animals and are adapted to be controlled to illuminate the animals one at a time for indicating the times at which the various targets are to be shot at. A photo tube is located behind each target and is adapted to respond to the light beam projected by the gun 11 to actuate a signal device such as a bell (not shown in Figure 1) provided for indi-

cating hits. In addition, a series of painted translucent numbers or legends 31 are located across the upper portion of the target field for indicating the total number of hits or the score of the player during each game. A series of electric lamps, called score lamps, are located behind the individual numbers and are adapted to be lighted one at a time to illuminate the number which represents the player's score at any particular time. These lights, like the bell, are controlled by the photo tubes of the targets. Additional lamps 18 are provided in the cabinet to illuminate the target field from the viewing side.

The gun 11, the photo tubes of the targets and the score lamps and bell are controlled to permit each photo tube to control the score lamps and bell only while its particular target is on, to permit only one shot each time a target is presented and to define each shot. The details of the apparatus for accomplishing this control and its mode of operation will be described more fully hereinafter.

The machine is intended to be played and operated by the player as follows: The cabinet lamps 18 burn continuously to illuminate the target field 16 at all times. When the machine is idle, one of the targets in the field may be brightly illuminated from behind by its own target lights, this being the last target which was presented to the last person playing the machine. In addition, the light behind one of the numbers in the score register 31 will be lighted showing the final score made by the previous player. The player will take the light projecting gun 11 out of the compartment 14 and will insert a coin into the coin chute 13 to set the apparatus into operation. Immediately the hit register will return to zero. That is, the light indicating the previous score will be extinguished and the character zero or the word "hits" will be illuminated instead. Also, the single target which remained lighted from the previous game will be darkened and presently another one of the targets will be illuminated and will remain so for a few seconds after which it will be darkened. Presently, still another one of the targets will be illuminated for a similar period of time. This continues until the end of the game, at which time each of the five targets 21 to 25 inclusive will have been illuminated four times, making a total of 20 targets presented to the player. Each time one of the targets is illuminated in the manner described above it is also put in condition to be shot at with the light projecting gun 11. That is, it is "turned on." If the gun 11 is properly aimed at the marked bull's-eye on the illuminated target and fired by pulling the trigger, a hit will be made. This will cause the bell to be sounded inside the cabinet, and the light on the hit register 31 will change to indicate the additional hit. That is, each time a hit is made a number one unit greater will be illuminated. Thus, the first hit will cause the numeral 1 to be illuminated; the second, the numeral 2; etc. The player is given only one shot at each presentation of a target. That is, when one of the animal targets, 21 to 25, is illuminated it is put in condition to be shot at and the shooting control apparatus is put in condition for operation. After each shot is taken the shooting circuit is left in inoperative condition and is reset so as to operate only when the next target is illuminated, that is, turned on.

Thus the player has 20 targets presented to him to be shot at and he is permitted one shot each time a target is presented. After the 20th target has been presented, the apparatus returns to its idle condition, leaving illuminated the number of the score register 31 which indicates the player's final score. Twenty hits constitutes a perfect score.

Referring to Figure 3, the various targets include portions of the glass panel 33 of the target field 16 already referred to upon which the animal illustrations are painted.

The section of Figure 3 is taken through the target 22. The target 22 includes the animal illustration and the bull's-eye painted on the glass panel 33. The translucent portion which constitutes the animal illustration is indicated by the reference numeral 29. The opaque background surrounding the animal illustration is indicated by the reference numeral 30.

The target 22 includes also a photoelectric tube or photo tube 34 and a pair of target illuminating lamps 37 of which only one is shown in Figure 3. The photo tube 34 is mounted on a steel panel 35 which is spaced behind the glass panel 33 and has an aperture approximately in register with the bull's-eye of the target, the photo tube 34 being located behind the steel panel 35 in alignment with the bull's-eye and the aperture of the steel panel. A light tunnel 36 constructed of paper or thin fiber sheet and formed into a truncated conical shell conducts the light from the bull's-eye of the target through the steel panel 35 to the front of the photo tube 34, and shields the photo tube from extraneous light, such as from the lamps 37 which serve to illuminate the target illustration. The lamps 37, of which there are two for each target (only one being shown in Figure 3), also are mounted in the steel panel 35 and are located behind the translucent portion 29 of the glass panel 33 which carries the illustration of the animal.

The score register 31 also is painted on the glass panel 33 and is illuminated by a series of lamps such as the lamp 38. Light baffles, such as the baffle 39, consisting of pieces of dark felt or the like, are positioned between the separate lamps 38 so as to prevent each lamp from illuminating any number or character of the score register 31 other than the one behind which it is located.

The light projecting gun 11 is illustrated in detail in Figure 4. It includes two hollow castings (only one being shown in Figure 4) which constitute the case for the gun mechanism and which are shaped to represent a pistol. The mechanism is mounted in the casting 41, shown in Figure 4. The other casting is similar in shape and fits onto the casting 41 to completely enclose the mechanism and complete the representation of the pistol. Included in the gun 11 are a lamp 43 and a lens 44, the filament of the lamp and the axis of the lens being located on the approximate axis of the simulated gun barrel. A baffle 45 formed in the casting 41 and located in front of the lamp 43 has an aperture just large enough to accommodate the beam required to illuminate the entire face of the lens 44. Located just in front of this aperture in the baffle 45 is a shutter 46 which is adapted to be removed from the path of the light beam by means of a solenoid magnet having a coil 47. The lamp 43, lens 44 and shutter 46 constitute the light projecting apparatus of the gun.

The gun also includes a small single pole dou-

ble throw snap switch 51. This snap switch includes a normally open contact gap 55 and a normally closed contact gap 56. It is operated by a pivoted trigger member 52 through a suitable lever 53. Preferably, the lever 53 consists of a cantilever spring adapted to provide an even tension of sufficient strength on the trigger member 52 so that the same feels firm and comfortable in the hand of the player. Conveniently, the trigger snap switch 51 may be of the type shown and described in U. S. Patent 1,960,020. This switch is small and compact and can be operated with a slight motion of its actuating member. The cable 12, which includes the several conductors required for making the necessary electrical connections to the gun, enters the gun near the heel of the butt and is firmly anchored to the casting 41 by means of a clamp 54.

The two castings of the gun 11, when riveted together make the entire interior mechanism of the gun inaccessible for tampering, excepting only the lamp 43. The lamp is enclosed by a formed metal hood 42 which fits over the two main castings after they have been fitted together. Gun sights 48 and 49 are provided to assist the player in aiming the gun at the target. Strips of felt are laid over the joint between the two castings of the gun (of which casting 41 is one) to prevent light from emerging from the crack between them.

The machine embodying my present invention utilizes a target and game control timer 58 illustrated in Figures 5 and 6. It includes a steel plate 60 upon which are mounted a series of contact stacks 61, 62, 63, 64 and 65 which are disposed in a radial pattern about a rotating contactor assembly 67. The several contact stacks 61, 62, etc., are spaced 36° (1/10 of a circle) apart. Each contact stack carries two stationary contacts such as the contacts 61—*a* and 61—*b* carried by the stack 61. One contact of each stack lies on each side of the disk 68 of the rotating contactor assembly 67. The disk 68 on each face thereof carries two double ended, resilient, contactor strips (four in all) 71, 72, 73 and 74. The two contactor strips on each side of the disc 68 (such as the strips 71 and 72) cross each other at an angle of 54° (3/10) of a circle).

These resilient contactor strips 71 etc., are adapted to slide over the stationary contacts carried in the stacks 61, etc., and make electrical connections or engagements therewith. Corresponding contactor strips such as 71 and 73 on the opposite faces of the disc 68 are aligned with each other so that the two contacts of a single contact stack, such as the contacts 64—*a* and 64—*b* of the stack 64, are engaged simultaneously by two of the rotating contactors such as 71 and 73. The two stationary contacts of a single contact stack, such as the contacts 64—*a* and 64—*b* of the stack 64, are assigned to the control of the photo tube and the illuminating lamps respectively of a single target and serve to close the circuits to the photo tube and lamps of a single target simultaneously. This will be explained more in detail presently. The arrangement of the two contactors, such as 71 and 72 at an angle of 54°, as shown, causes these two contactors to engage the several stationary contacts of the stacks 61, 72, etc., in an irregular order simulating a random order of engagement. The order of engagement of the contacts of the various stacks 61, 62, etc., as the contactor assembly 67 rotates clockwise from the position in which it is shown in Figure 5, is as follows: 61, 65, 62, 61, 63, 62, 64, 63, 65, 64. These ten enumerated engagements result from a 180 degree rotation of contactor assembly 67. These same ten engagements are repeated in the same order during each successive 180 degree rotation.

The contactor assembly 67 is adapted to be rotated by an electric motor 70. Preferably this motor is of small size and of the split phase, self-starting, induction type, and includes a geared speed reducer for driving the contactor assembly 67 at a low speed, such as, for example, the speed of one revolution per minute.

The contacting surfaces of the stationary contacts carried in the stacks 61, 72, etc., and the contactors 71, etc., are of such size that, as the contactor assembly 67 rotates, the moving contactors 71, etc. do not simultaneously engage contacts in two of the stacks 61, 62, etc., but rather leave short periods during which none of the stationary contacts are engaged. For example, as the contactor assembly 67 is rotated by the motor 70 at a speed of one revolution per minute in a clockwise direction out of the position in which it is shown in Figure 5, the contactors 71 and 73 will disengage the contacts 64—*a* and 64—*b* of the stack 64 substantially simultaneously. Half a second thereafter, the contactors 72 and 74 will engage the contacts of 61—*a* and 61—*b* of the stack 61 and will continue in engagement therewith for a period of two and one-half seconds when they will disengage. Another half a second later the contactors 71 and 73 will engage the contacts 65—*a* and 65—*b* of the stack 65, etc.

Several contactor strips 71, 72 and the corresponding strips on the opposite face of the disc 68 all are grounded to the frame, or plate, 60. The several contacts carried in the stacks 61, 62, etc., are insulated from each other and from the plate 60 by insulating pieces included in the stacks.

The disc 68 of the contactor assembly 67 is of insulating material, is circular and is provided with a notch 75 in its periphery. A stack of contacts 76, consisting of two pairs of engaging contact blades which are adapted to remain open under their own tension to provide contact gaps 78 and 79. These contact blades carry a projection 77 which is adapted to ride against the edge of the disc 68 to hold the contact gaps 78 and 79 closed and to fall into the notch 75 to open the contact gaps 78 and 79. The stack 76 includes two strips of insulating material 82 for insulating the two sets of contacts from each other and also for insulating them from accidental contact with the plate 60. These contacts are utilized for controlling the duration of each game as will be explained more in detail presently. An additional stack of contacts carries a pair of contacts 80, the tension of which is adapted to keep them closed. A pin 81 carried on the insulating disc 68 is adapted to engage these contacts 80 to open them and then disengage the contacts to permit them to close a short time prior to the time at which the notch 75 comes into register with the projection 77 to open the contacts 78 and 79.

Figures 7 and 8 illustrate a shot control timer or slow relay 83. This timer consists of an air dash-pot solenoid magnet, together with various contacts operated by the plunger or core thereof. The whole shot control relay 83 is mounted on a steel panel 85. To this panel is fastened a steel magnet frame 86 containing a coil 87 through which extends a brass tube 88.

The upper end of this brass tube 88 carries an iron plug 89 which directly engages the iron of the frame 86 to provide low magnetic reluctance therebetween. A core 90 fits inside the brass tube 88 and slides therein. It is adapted to be drawn by the pull of the current in the coil 87 up into engagement with the iron plug 89. The plug 89 includes a shading coil 91 of copper or the like so that a continuous pull may be exerted on the core 90 when the coil 87 is energized with alternating current.

The core 90 is only a few thousandths of an inch smaller in diameter than the interior diameter of the brass tube 88 so that the air escapes between the wall of the tube 88 and the core 90 comparatively slowly.

The core 90 is adapted to descend under the action of gravity and to have its descent retarded by the dash-pot action resulting from its close fit in the tube 88. Due to the comparatively great length of the core 90 it provides a better seal against the passage of air than does the pin 92 and its cap 93 in the plug 89. Actually it is desirable to enlarge a portion of the bore of the plug 89 as at 96 to reduce the effectiveness of the seal provided by the pin 92 so as to permit the core 90 to descend sufficiently fast. The time of descent should be in the neighborhood of one-sixth of a second.

The plug 89 has a central bore containing a pin 92 which is capped by an insulating button 93. This pin 92 is adapted to be lifted by the core 90 as it comes to the top of its stroke and stops against the plug 89. A pin 94 carried by the plunger 90 extends axially from the lower end thereof and carries at its lowermost end an insulating button 95.

The top of the panel 85 is bent forward to carry a stack of contact blades 98. These contacts provide a normally open contact gap 99 and a normally closed gap 100 which are adapted to be operated by means of the plunger 92 and insulated button 93 immediately that the core or plunger 90 of the solenoid begins its descent. A stack of contacts 102 is carried on a similar bent portion at the bottom of the panel 85. This stack includes a normally open pair of contacts 103 and a normally closed pair 104. These contacts are adapted to be operated when the plunger reaches its lowermost position, that is, when it finishes its descent. The core 90 is adapted to be raised magnetically by means of the coil 87 and to be lowered by gravity.

The machine embodying my present invention includes the various individual pieces of apparatus just described, together with certain other pieces of apparatus to be mentioned presently which are believed to be individually of such conventional and known construction as to require no individual detailed descriptions.

The entire electric circuit is illustrated schematically in Figure 9. The same electric circuit connections are illustrated in the "across the line" type of diagrams in Figures 10, 11, 12, 13 and 14. The descriptions of apparatus will be directed largely to the schematic diagram of Figure 9 whereas the descriptions of the circuit connections and the operation of the system will be directed particularly to the "across the line" diagrams of Figures 10, 11, 12, 13 and 14. The "across the line" type of diagram (or "line diagram" as it sometimes is referred to) attempts only to show the electrical relations between the various elements of the system and makes no attempt to depict any mechanical relations diagrammatically. Its purpose is to present the electrical circuits in their simplest form. Diagrams of this type are employed here to facilitate the explanation and undertsanding of the operation of the system. In the "across the line" type of diagram mechanical relations may be indicated only by legends. In Figures 10 to 14 inclusive, similar legends and names have been applied to parts which are mechanically related to each other in addition to the reference numerals applied thereto. The same reference numerals, legends and names are used to indicate the same parts in both the schematic diagram of Figure 9 and the several "across the line" diagrams of Figures 9 to 14 inclusive.

Referring particularly to Figure 9, a transformer 110 having a primary winding 111 and secondary windings 112, 113, 114, 115, 116, and 117 supply power to the entire system. The coin chute 13 includes a slide bar 120 and is equipped with contacts 121 which are adapted to be normally closed (that is, closed when the slide bar is withdrawn) and contacts 122 which are adapted to be closed momentarily when the slide bar is moved to its innermost position. A motor maintaining relay 124 having a coil 125 and normally open contacts 126, 127 and 128, is provided for maintaining the motor 70 in operation and for supplementing the contacts 78 and 79 of the target and game control timer 58.

A reset relay 130 having coil 131, normally open contacts 132, and normally closed contacts 133, is arranged to respond to the operation of the target control timer 58 to reset the shot control timer 83 so as to condition it for controlling the operation of the gun 11 each time that a new target is presented.

An amplifier 136 (not shown in detail in Figure 9) is provided for amplifying the impulses from the photo tube 34, produced therein by the light from the gun 11, to operate a relay 138, which in turn controls a step switch 141, and a bell 145. The step switch 141 in turn controls the score lamps 38. The relay 138 includes a coil 139 and contacts 140, the coil 139 being shunted by a condenser 137. The step switch 141 includes a coil 142, a rotating contactor 143 and a series of stationary contacts 144. Each of the contacts 144 is connected to a separate one of the score lamps 38.

The step switch 141 is adapted to step its contactor 143 forward from one stationary contact 144 to the next, (one contact at a time) each time that its coil 142 is energized. It is further adapted to return its contactor 143 to a zero or starting position under the action of a spring, the same being released mechanically by the coin chute 13 when a coin is inserted therein. The specific operating mechanism of the step switch 141 and the mechanism by which it is reset from the coin chute 13 are not shown inasmuch as such apparatus is well known and the details of the same do not constitute any part of the present invention. The bell 145 preferably is of the single stroke type.

Two targets 22 and 23 are represented diagrammatically in Figure 9. As shown, target 22, for example, includes the photo tube 34 having one terminal connected to the amplifier 136 and the other to the contact 62—*a* of the target control timer 58. It also includes the two target lamps 37 shunted by a resistor 156 connected to the contact 62—*b* of the target control timer 58. The remaining targets include similar elements and are connected to the amplifier 136 and the

target and game control timer 58 in the same manner.

The details of the amplifier 136 are shown only in Figure 10. It includes a vacuum tube 146 which has a rectifier section 147, an amplifier section 148 and a heater 149 for heating the cathodes of both the amplifier and rectifier sections 147 and 148.

The amplifier section 148 is of the pentode type and includes a cathode 165, a control grid 166, a screen grid 167, a suppressor grid 168 and an anode 169.

A resistor 150 supplies the coupling impedance between the various photo tubes of the targets 21 to 25 and the amplifier section 148. A condenser 151 and voltage dividing resistors and potentiometers 152, 153 and 154 serve to filter the direct current output of the rectifier 147 and to supply the various voltages required by the photo tubes and the amplifier section 148 of the valve 146. A milliammeter 155 is included in series with the anode 169 of the amplifier section 148.

Referring to Figure 10, 125 volts alternating current is adapted to be supplied from the transformer secondary 115 to the motor 70 for operating the same and also to the rectifier 147 for providing a uni-directional voltage across the conductors 161 and 162, conductor 162 being positive. This furnishes direct current for the operation of the amplifier section 148 and the various phototubes of the targets. The cell coupling resistor 150 is connected between the negative conductor 161 and the control grid 166 of the amplifier 148. The cathodes of all the phototubes, such as the phototube 34, are connected to the grid 166 of the amplifier and their anodes are adapted to be connected through the contactors 71 and 72 of the target control and game timer 58 to the junction between the voltage dividing resistors 153 and 154, which junction has a potential positive with respect to the conductor 161. The cathode 165 of the amplifier 148 is connected to an adjustable tap 171 of the bleeder resistor or potentiometer 152 to provide an adjustment of the grid bias voltage applied to the amplifier. The coil 139 of the relay 138 shunted by the condenser 137, and also contacts 100 and 104 of the shot control timer 83 are connected in the circuit with the anode 169 of the amplifier section 148.

The transformer winding 117 is adapted to supply current through the coil 131 of the relay 130 and thence to the target lamps of a single one of the targets, such as, for example, the lamps 37 of the target 22, the resistor 156 being shunted across the lamps 37. It is desirable to operate the lamps 37 at their full operating temperature, and inasmuch as they are subject to burn out under such conditions, it is desirable that the simultaneous burn-out of two lamps of a single target be avoided. Inasmuch as the coil 131 of the reset relay 130 is in series with the lamps, a burn-out of one lamp increases the voltage impressed across the remaining lamp. Therefore, the resistor 156 is designed to draw a large current compared to the individual lamps 37 so that the burn-out of a single lamp reduces the current drain by a small percentage compared to the percentage reduction which would be suffered by a burn-out of one of the lamps if the resistor 156 were not employed. Inasmuch as the relay coil 131 is connected in series with the lamps 37 and resistor 156, a burn-out of one of the lamps 37 raises the voltage applied to the remaining lamp, because of the reduced voltage drop in the coil 131. A certain number of volt-amperes are required at the coil 131 for operation of the relay 130. If the current is increased the relay coil may be designed for a lower voltage by giving it a lower impedance. Consequently the change of current resulting from a lamp burn-out produces a smaller change in the voltage drop in the coil 131 and therefore in the voltage impressed across the remaining lamp. The presence of the resistor 156 serves to reduce the amount by which the voltage rises on the remaining lamp when one of the lamps burns out.

The machine just described operates as follows: The heater 149 of the valve 146 is energized continuously by the secondary winding of the transformer 114 (Figure 10). Likewise the decorative lights 18 (Figure 11) are energized continuously from the transformer winding 116. Some one of the score lights 33 (Figure 13) is energized at all times from the transformer winding 112 through the contactor 143 and contacts 144 of the step switch 141. Whenever the contactors 73 and 74 (Figure 10) of the target control timer 58 engage one of the stationary contacts 61—*b*, etc., the corresponding target lights are energized from the transformer winding 117 through the coil 131 of the reset relay 130.

When a coin is inserted in the coin chute 13 (Figure 9) and the slide bar 120 thereof is pushed in, the rotating contact arm 143 of the score switch 141 is returned mechanically (mechanism not shown) to its zero or starting position. Also, the slide bar 120 (Figure 9) engages the contacts 122 to close them and (in Figure 11) energize the coil 125 of the motor maintaining relay 124 (the contacts 80 of the target control timer being closed at the time). When the motor maintaining relay 124 picks up, it closes its contacts 126 (Figure 11) which shunt the contacts 122 of the coin chute so as to maintain the coil 125 energized after the contacts 122 open. The operation of the relay 124 also closes the contacts 128 (Figure 10) which sets the motor 70 of the target and game control timer 58 into operation. Under this condition the contacts 121 (Figure 10) of the coin chute 13 are open so that the photoelectric amplifier remains deenergized except for the heater 149 which is energized continuously. The slide bar 120 of coin chute 13 (Figure 9) must be withdrawn promptly, and to this end it conveniently may be provided with a spring (not shown) for returning it to its withdrawn position when released by the player who inserts the coin.

The return of the coin chute to its withdrawn position opens the contacts 122 (Figure 11) and thereafter closes the contacts 121 (Figure 10) to energize the photoelectric amplifier. In this condition the machine is in operation.

Prior to the time that the slide bar 120 of the coin chute 13 is operated, the core 90 of the shot control timer 83 was in its released position or lowermost position. Under that condition, its contacts 103 (Figure 11) were open so that the shutter magnet 47 could not be energized. Also contacts 104 (Figure 10) were open to prevent operation of the relay 138. Consequently the gun 11 could not be shot and hits could not be indicated or recorded. The contacts 99 (Figure 11) were open. In addition, the target lamps (Figure 10) of one of the targets were illuminated and the coil 131 (Figure 10) of the reset relay 130 was energized. Consequently contacts 133 (Figure 11) were open and contacts 132 (Figure 11) were closed. So long as the trigger 52

(Figure 4) of the gun 11 is released, the contacts 55 (Figure 11) of the trigger switch are open and the contacts 56 (Figure 11) are closed.

As the game and target control timer 58 begins its operation, as above described, its rotating contactors 73 and 74 disengage the stationary contacts which they engaged while the machine was idle and thereby de-energized the coil 131 (Figure 10) of the relay 130. This opens the contacts 132 (Figure 11) and also closes the contacts 133 (Figure 11) of the relay 130 so that the coil 87 of the shot control timer 83 is energized through the contacts 133 and through the contacts 127 of the relay 124. The full voltage of the transformer winding 116 is impressed across the coil 87 to draw up the core 90 (see Figures 7 and 8) to its sealed position. When the core 90 of the shot control timer 83 reaches its uppermost position, it closes its contacts 99 (Figures 7 and 11) to prepare a holding circuit for the coil 87, (Figure 11) which circuit includes the normally closed contacts 56 of the trigger switch, the contacts 99 and the resistor 173. The contacts 103 (Figure 11) of the shot control timer also are closed when the core 90 is drawn up. Contacts 104 (Figure 10) have closed but contacts 100 have opened so that the plate circuit relay still may not be operated.

Now as the contactors 73 and 74 (Figure 10) of the target control timer 58 continue to move and come into engagement with another set of stationary contacts to energize the lights 37 of another one of the targets and also to connect the photoelectric cells thereof to the amplifier, the coil 131 of the relay 130 is traversed by the current drawn by the target lamps of the particular target, so that the relay 130 picks up. This opens the contacts 133 (Figure 11) so that the coil 87 of the shot control timer must draw its current through the normally closed contacts 56 of the trigger switch, the contacts 99 of the shot control timer itself and the resistor 173. Also, the contact 132 is closed. In this position of the apparatus, the gun 11 is in condition to be shot. A pull on the trigger piece 52 (Figure 4) operates the snap switch 51 to open the contacts 56 and close the contacts 55 (Figure 11) thereof. This de-energizes the coil 87 so as to permit the core 90 thereof to drop. It is to be noted that a resistor 174 shunts the normally closed contacts 56 of the trigger switch. This resistance is comparatively high and permits insufficient current to pass for holding up the core 90. However, it does supply sufficient current to the coil 87 to supply the necessary coercive force for demagnetizing the iron structure of the magnet so as to release the core 90 in the event that it should tend to remain held by residual magnetization.

The closing of the contacts 55 (Figure 11) of the trigger snap switch 51 energizes the gun lamp 43 and also the coil 47 of the solenoid of the shutter 46 in the gun 11, the latter being energized through the contacts 132 of the relay 130 and the contacts 103 of the shot control timer 83.

The normally closed contacts 56 (Figure 11) of the trigger snap switch 51, having opened as described above, the core 90 (Figures 7, 8 and 9) of the shot control relay 83 begins to descend. Its initial motion opens the contacts 99 (Figure 11) so that the trigger switch 51 may not be manipulated to re-energize the coil 87. The initial motion of the core 90 also closes contacts 100 (Figure 10) to complete the circuit to the coil 139 of the relay 138.

Thus, in this condition while the core 90 of the shot control timer is descending, the lamp 43 is energized and the shutter 46 (Figures 4 and 9) is withdrawn from the path of the light beam so that the gun 11 projects a beam of light. Also, the plate circuit of the amplifier is completed through the plate circuit relay 138 so that if the gun is properly aimed at the bull's-eye of the proper target (the one which is "on" at the time as indicated by its lighted target lamps) the light from the gun 11 will energize the proper photoelectric cell to actuate the relay 138 which, in turn, actuates the score switch 141 and the bell 145. This will serve to advance the contactor 143 (Figures 9 and 13) to the next stationary contact 144 of the score switch so as to energize the lamp, such as lamp 38, which is located behind the first score number in the score register 31.

As already has been explained, the core 90 of the solenoid timer 83 descends slowly because of the retarding effect imposed on the core 90 by the dash-pot action of the core 90 in the tube 88. The time required for the descent of the core 90 of the shot timer 83 is the time allowed for the "shot." It need be only long enough for the lamp 43 to come up to full brilliance and for the photo tube, the amplifier 136, etc., and the score switch 141 to respond thereto. It is desirable that the time of descent of the core 90 of the shot timer 83, and therefore the time of the "shot," be less than the time required by a person to observe the position of the projected spot of light on the target field and correct his aim therefrom. For example, I have found that a time of .010 to .015 second produces satisfactory operation of the apparatus, and that that time is much too short to give a person opportunity to correct his aim after observing the position on the target field of the spot of light projected from the gun. When the core 90 reaches its lowermost position, it operates its contacts 103 and 104 (Figures 7 and 8). The contacts 103 (Figure 11) open the circuit through the coil 47 so as to cause the shutter 46 again to obstruct the path of the light beam in the gun 11; and the contacts 104 (Figure 10) disconnect the coil 139 of the relay 138 from the amplifier so as to leave the scoring apparatus unresponsive to any further illumination of the photo tubes of the targets.

When one of the targets is "on" and the gun is properly aimed at it, the bell 145 and the score switch 141 and lights 38 are responsive to the pull of the trigger 52. The pull of the trigger causes the gun 11 to project a beam of light which illuminates the photo tube of the target, which in turn actuates the relay 138 to operate the bell 145 and score switch 141. The shot can be effective only if this chain of control is complete Consequently the duration of the "shot" may be effectively terminated either by interrupting the light beam from the gun or by interrupting the chain of control between the photo tube of the target and the score switch 141 and bell 145.

The light beam may be interrupted by means of the shutter 46 as described herein. It might be also interrupted by extinguishing the lamp 43 or by employing a shutter at the target to cover the photo tube.

The chain of control between the photo tube and the score switch 141 and bell 145 may be interrupted in the circuit of the photo tube itself, as is shown in connection with turning the targets on and off; in the output circuit of the amplifier, as is shown herein; or in the circuit to the

operating bell 145 and the coil 142 of the score switch 141.

Thus, either the opening of the contacts 103 (Figures 9 and 11) or the contacts 104 (Figures 9 and 10) will terminate the responsiveness of the scoring switch 141 to the actuation of the trigger switch 51. Thus, for example, if the contact 103 only were employed, the light beam would be interrupted by the shutter 46, although the score switch remained responsive to an illumination of the photoelectric cells 34. Also, if only the contacts 104 only were employed the light beam would remain unobstructed but the score switch 141 would be made unresponsive to the illumination of the photo tubes of the targets. If desired, the gun lamp 43 may be de-energized automatically by contacts such as the contacts 103 of the shot control timer 83.

It is desirable that the light beam projected from the gun 11 be interrupted in order to simulate more faithfully, from the player's point of view, the action of a firearm. That is, if the projection of the light beam is initiated and then quickly obstructed, the result will be an apparent flash simulating the apparent instantaneous firing of a firearm. Also, it is desirable that the contacts 104 be employed for rendering the score switch 141 unresponsive to an illumination of a photoelectric cell 34 at times when the gun is not being "fired" in order to lessen the possibility of the player or another person from actuating the score switch 141 by directing onto the photoelectric cells 34 a light originating elsewhere than the gun 11.

I claim:

1. In a target for electric target ranges, a base structure, a target background member mounted on said structure, a plurality of individual target elements associated with said background, each such element including a translucent pictorial representation, and means for illuminating it from the rear, and a photosensitive member, and means for shielding said member from said illuminating means while leaving said member exposed to a flash of light directed at the target.

2. In a target for electric target ranges, a base structure, a target background member mounted on said structure, a plurality of individual target elements associated with said background, each such element including a translucent pictorial representation, and means for illuminating it from the rear, and a photosensitive member, and means for shielding said member from said illuminating means while leaving said member exposed to a flash of light directed at the target, including a passage member extending from said photosensitive member toward said pictorial representation and terminating closely adjacent the rear thereof.

3. In combination in a shooting gallery, a stationary target continuously in view including a photoelectric cell, a gun including a trigger and also including means adapted to project a beam of light, said gun being adapted to be aimed manually at said target, signal means adapted to be actuated by said photoelectric cell for indicating a hit, target control means for turning said target "on" and "off" repeatedly and for maintaining said target "on" each time sufficiently long to permit a person to take aim with said gun and pull the trigger, game limiting means for defining a cycle of operation of said target control means and for stopping said target control means at the end of said cycle, said cycle including a predetermined number of "on" conditions of said target, starting means adapted to be actuated to start said target control means, target indicating means controlled by said target control means for indicating the "on" and "off" conditions of said target and then simultaneously turning "off" said target and said indicating means, shot control means operable when said gun is aimed properly while said target is "on" to respond to a pull of said trigger to actuate said signal means by initiating the projection of said beam of light from said gun to illuminate said photoelectric cell and by permitting said signal means to respond to the illumination of said photoelectric cell whereby to indicate a hit, said shot control means being operative automatically to render said signal means unresponsive to the pulled condition of said trigger within a period of time after the initiation of the projection of the light beam which is of less duration than the time required by a person aiming the gun to observe the position of the projected beam and correct his aim therefrom, said signal means being unresponsive to a pull of said trigger when said target is "off" regardless of whether or not the gun is aimed properly.

4. In combination in a shooting gallery, a stationary target continuously in view including a photoelectric cell, a gun including a trigger and also including means adapted to project a beam of light, said gun being adapted to be aimed manually at said target, signal means adapted to be actuated by said photoelectric cell for indicating a hit, target control means for turning said target "on" and "off" repeatedly and for maintaining said target "on" each time sufficiently long to permit a person to take aim with said gun and pull the trigger, game limiting means for defining a cycle of operation of said target control means and for stopping said target control means at the end of said cycle, said cycle including a predetermined number of "on" conditions of said target, starting means adapted to be actuated to start said target control means, target indicating means controlled by said target control means for indicating the "on" and "off" conditions of said target, shot control means operable when said gun is aimed properly at said target while said target is "on" to respond to a pull of said trigger to actuate said signal means by initiating the projection of said beam of light from said gun to illuminate said photoelectric cell and by permitting said signal means to respond to the illumination of said photoelectric cell whereby to indicate a hit, said shot control means being operative automatically to render said signal means unresponsive to the pulled condition of said trigger within a period of time after the initiation of the projection of the light beam which is of less duration than the time required by a person aiming the gun to observe the position of the projected beam and correct his aim therefrom, whereby to simulate a shot from a firearm.

5. In combination in a shooting gallery, a plurality of targets all of which are continuously in view each of which includes a photoelectric cell, a gun including a trigger and also including means adapted to project a beam of light, said gun being adapted to be aimed manually at said targets, signal means adapted to be actuated by said photoelectric cells for indicating hits, target control means for turning "on" said targets

one at a time and for keeping each target "on" for a length of time sufficient to permit a person to take aim with said gun and pull said trigger, indicating means controlled by said target control means for indicating the "on" and "off" conditions of said targets, shot control means operable when said gun is aimed properly at a target which is "on" to respond to a pull of said trigger to actuate said signal means by initiating the projection of said beam of light from said gun to illuminate the photoelectric cell of said target and by permitting said signal means to respond to the illumination of said photoelectric cell whereby to indicate a hit, said shot control means being operative automatically to render said signal means unresponsive to the pulled condition of said trigger within a period of time after the initiation of the projection of the light beam which time is of less duration than the time required by a person aiming the gun to observe the position of the projected beam and correct his aim therefrom, whereby to simulate a shot from a firearm.

6. In combination in a shooting gallery, a plurality of targets all of which are continuously in view each of which includes a photoelectric cell, a gun including a trigger and also including means adapted to project a beam of light, said gun being adapted to be aimed manually at said targets, signal means adapted to be actuated by said photoelectric cells for indicating hits, target control means for turning "on" said targets one at a time and for keeping each target "on" for a length of time sufficient to permit a person to take aim with said gun and pull said trigger whereby to present said targets one at a time to be shot at with said gun, indicating means controlled by said target control means for indicating the "on" and "off" conditions of said targets, game limiting means for stopping said target control means when a predetermined number of presentations of individual targets has been effected, starting means adapted to be actuated to start said target control means, shot control means operable when said gun is aimed properly at a target which is "on" to respond to a pull of said trigger to actuate said signal means by initiating the projection of said beam of light from said gun to illuminate the photoelectric cell of said target and by permitting said signal means to respond to the illumination of said photoelectric cell whereby to indicate a hit, said shot control means being operative automatically to render said signal means unresponsive to the pulled condition of said trigger within a period of time after the initiation of the projection of the light beam which time is of less duration than the time required by a person aiming the gun to observe the position of the projected beam and correct his aim therefrom, whereby to simulate a shot from a firearm.

7. In combination in a shooting gallery, a plurality of targets each of which includes a photoelectric cell, a gun including a trigger and also including means adapted to project a beam of light, said gun being adapted to be aimed manually at said targets, signal means adapted to be actuated by said photoelectric cells for indicating hits, target control means for turning "on" said targets one at a time and for keeping each target "on" for a length of time sufficient to permit a person to take aim with said gun and pull said trigger whereby to present said targets one at a time to be shot at with said gun, indicating means controlled by said target control means for indicating the "on" and "off" conditions of said targets, game limiting means for stopping said target control means when a predetermined number of presentations of individual targets has been effected, starting means adapted to be actuated to start said target control means, shot control means operable when said gun is aimed properly at a target which is "on" to respond to a pull of said trigger to actuate said signal means by initiating the projection of said beam of light from said gun to illuminate the photoelectric cell of said target and by permitting said signal means to respond to the illumination of said photoelectric cell whereby to indicate a hit, said shot control means being operative automatically to render said signal means unresponsive to the pulled condition of said trigger within a period of time after the initiation of the projection of the light beam which time is of less duration than the time required by a person aiming the gun to observe the position of the projected beam and correct his aim therefrom, whereby to simulate a shot from a firearm, said shot control means including shot limiting means for preventing said signal means from responding to additional pulls of the trigger during the interval that a single target is "on", whereby to prevent a hit to be indicated by any except the first "shot" taken during said interval that a single target is "on".

8. In combination in a shooting gallery, a plurality of targets all of which are continuously in view each of which includes a photoelectric cell, a gun including a trigger and also including means adapted to project a beam of light, said gun being adapted to be aimed manually at said targets, signal means adapted to be actuated by said photoelectric cells for indicating hits, target control means for repeatedly turning "on" said targets one at a time in irregular order of occurrence and for keeping each target "on" for a period of time sufficient to permit a person to take aim with said gun and pull said trigger, whereby to present said targets one at a time in irregular order to be shot at, indicating means controlled by said target control means for indicating the "on" and "off" conditions of said targets, game limiting means for stopping said target control means when a predetermined number of presentations of individual targets has been effected, starting means adapted to be actuated to start said target control means, shot control means operable when said gun is aimed properly at a target which is "on" to respond to a pull of said trigger to actuate said signal means by initiating the projection of said beam of light from said gun to illuminate the photoelectric cell of said target and by permitting said signal means to respond to the illumination of said photoelectric cell whereby to indicate a hit, said shot control means being operative automatically to render said signal means unresponsive to the pulled condition of said trigger within a period of time after the initiation of the projection of the light beam which time is of less duration than the time required by a person aiming the gun to observe the position of the projected beam and correct his aim therefrom, whereby to simulate a shot from a firearm.

9. In combination in a shooting gallery, a plurality of stationary targets all of which are continuously in view disposed in a target field, each target including a photoelectric cell, a gun including a trigger and also including means adapted

to project a beam of light, said gun being adapted to be aimed manually at said targets, signal means adapted to be actuated by said photoelectric cells for indicating hits, target control means for turning "on" the targets in said field one at a time in an irregular order as respects the respective locations of said targets in said field and for keeping each target "on" for a period of time sufficient to permit a person to take aim with said gun and pull said trigger, whereby to present said targets to be shot at one at a time in a manner simulating a random presentation thereof, indicating means controlled by said target control means for indicating the "on" and "off" conditions of said targets, game limiting means for stopping said target control means when a predetermined number of presentations of individual targets has been effected, starting means adapted to be actuated to start said target control means, shot control means operable when said gun is aimed properly at a target which is "on" to respond to a pull of said trigger to actuate said signal means by initiating the projection of said beam of light from said gun to illuminate said photoelectric cell and by permitting said signal means to respond to the illumination of said photoelectric cell whereby to indicate a hit, said shot control means being operative automatically to render said signal means unresponsive to the pulled condition of said trigger within a period of time after the initiation of the projection of the light beam which time is of less duration than the time required by a person aiming the gun to observe the position of the projected beam and correct his aim therefrom, whereby to simulate a shot from a firearm.

10. In combination in a shooting gallery, a plurality of stationary targets disposed in a target field, each target including a photoelectric cell, a gun including a trigger and also including means adapted to project a beam of light, said gun being adapted to be aimed manually at said targets, signal means adapted to be actuated by said photoelectric cells for indicating hits, target control means for turning "on" the targets in said field one at a time in an irregular order as respects the respective locations of said targets in said field and for keeping each target "on" for a period of time sufficient to permit a person to take aim with said gun and pull said trigger, whereby to present said targets to be shot at one at a time in a manner simulating a random presentation thereof, indicating means controlled by said target control means for indicating the "on" and "off" conditions of said targets, game limiting means for stopping said target control means when a predetermined number of presentations of individual targets has been effected, starting means adapted to be actuated to start said target control means, shot control means operable when said gun is aimed properly at a target which is "on" to respond to a pull of said trigger to actuate said signal means by initiating the projection of said beam of light from said gun to illuminate said photoelectric cell and by permitting said signal means to respond to the illumination of said photoelectric cell whereby to indicate a hit, said shot control means being operative automatically to render said signal means unresponsive to the pulled condition of said trigger within a period of time after the initiation of the projection of the light beam which time is of less duration than the time required by a person aiming the gun to observe the position of the projected beam and correct his aim therefrom, whereby to simulate a shot from a firearm, said shot control means including shot limiting means for preventing said signal means from responding to additional pulls of the trigger during the time that a single target is "on," whereby to permit a hit to be indicated only by the first "shot" taken during the interval that a single target is "on."

11. In a gun game, in combination, a plurality of targets having stationary positions, an indicating means associated with each target, a photoelectric cell associated with each target, an amplifier, switching means for energizing any one of said indicating means and connecting the associated cell to the amplifier, and an electric motor for continuously operating said switching means to energize the indicating means and connect the associated cell of individual targets in sequence.

12. In a target range a plurality of fixed targets, a photosensitive member associated with each, a light gun having a trigger, a light source associated with the gun, means for causing the light source upon the actuation of the trigger to project a flash of aimed light upon any selected target, automatic means for successively conditioning one target after another for operation, a coin controlled mechanism and means controlled thereby for operating the target conditioning means and for stopping such operation after a predetermined number of targets have been conditioned and means forming a part of the target conditioning means for limiting the length of time during which each successive target remains conditioned for operation, and indicating means controlled by the photosensitive member for indicating hits on the targets.

13. In a target range a plurality of fixed targets, a photosensitive member associated with each, a light gun having a trigger, a light source associated with the gun, means for causing the light source to project a flash of aimed light upon any one of said targets selected by the operator upon the actuation of the trigger, means for conditioning a plurality of successive targets for operation, a coin controlled mechanism, and means controlled thereby for operating the target conditioning means and for stopping such operation after a predetermined number of target conditioning operations have been completed.

14. In a target range a plurality of continuously visible fixed targets, a photosensitive member associated with each, a light gun having a trigger, a light source associated with the gun, means for causing the light source upon the actuation of the trigger to project a flash of aimed light upon any selected target, automatic means for successively conditioning one target after another for operation, a coin controlled mechanism and means controlled thereby for operating the target conditioning means and for stopping such operation after a predetermined number of targets have been conditioned and means forming a part of the target conditioning means for limiting the length of time during which each successive target remains conditioned for operation, and indicating means controlled by the photosensitive member for indicating hits on the targets.

ARCHIE J. McMASTER.