May 23, 1939. W. P. FALKENBERG 2,159,141

ELECTRIC RIFLE RANGE

Filed Jan. 11, 1937 6 Sheets-Sheet 1

Fig. 1

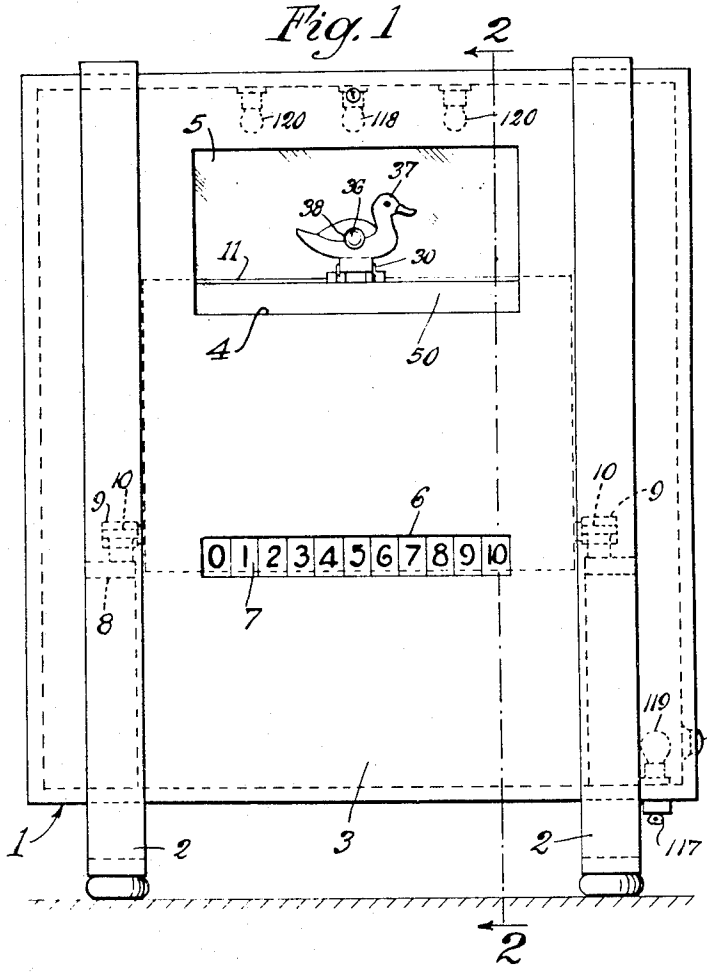


Fig. 8

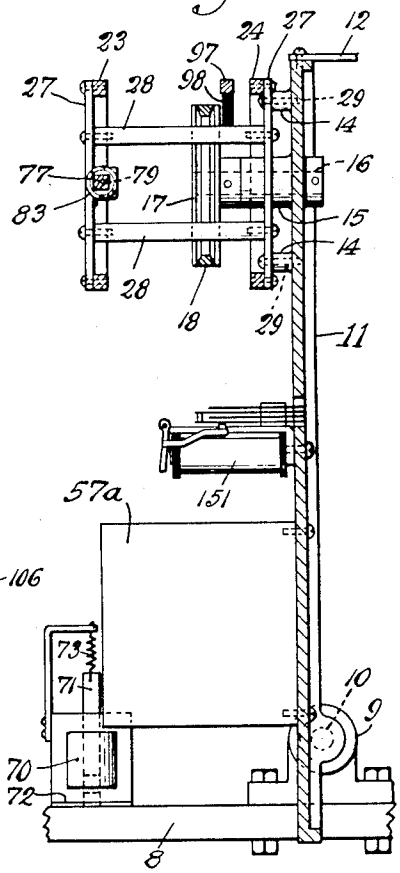
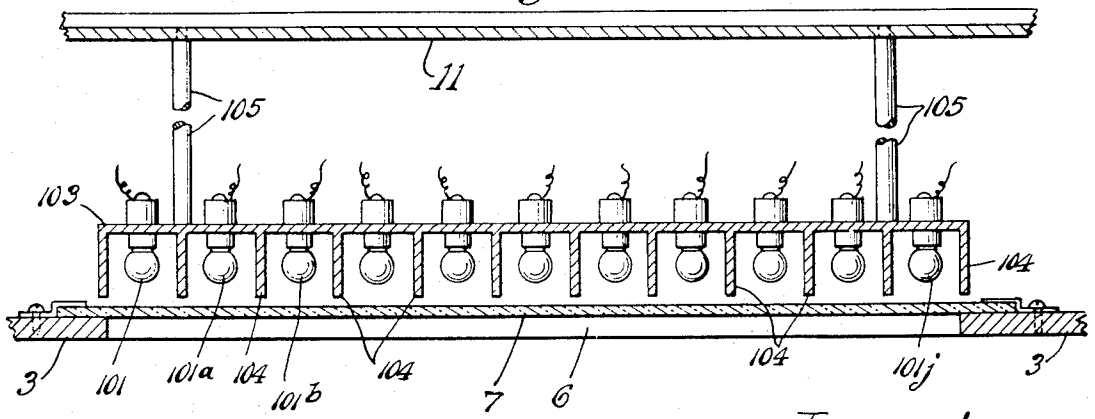


Fig. 9



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ELECTRIC RIFLE RANGE

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Fig. 2

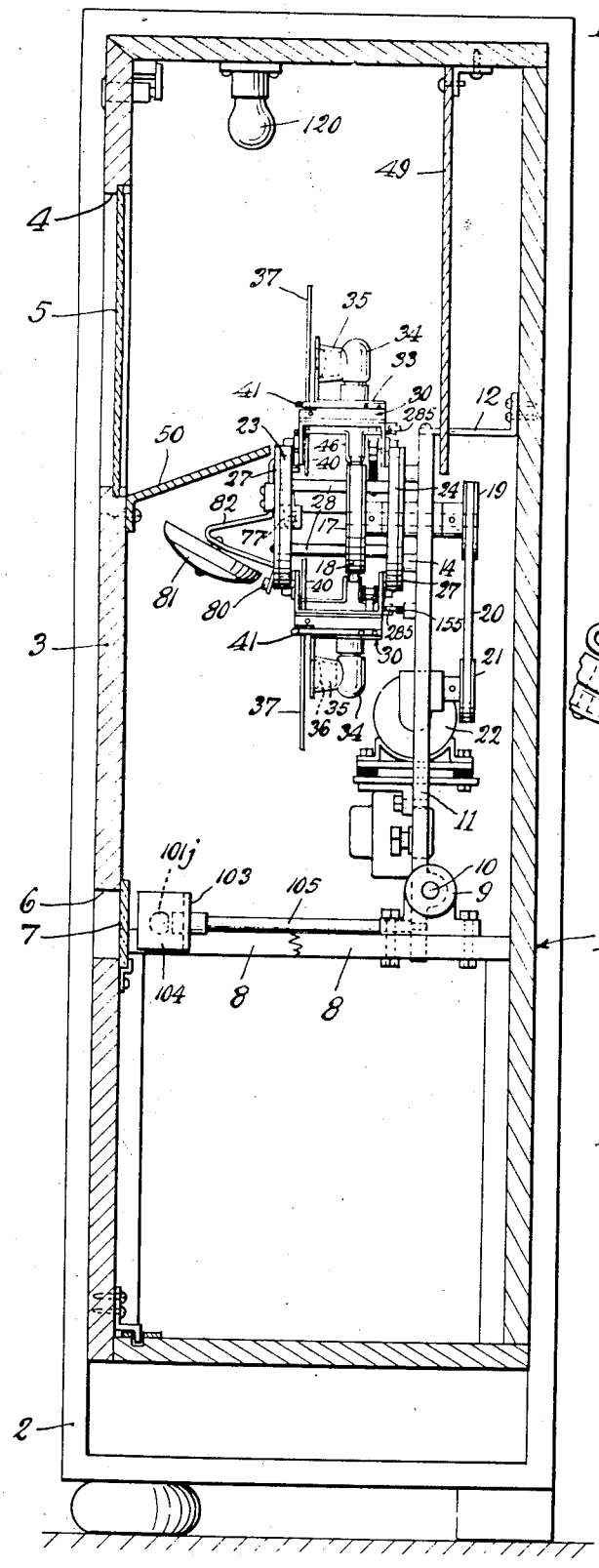


Fig. 6

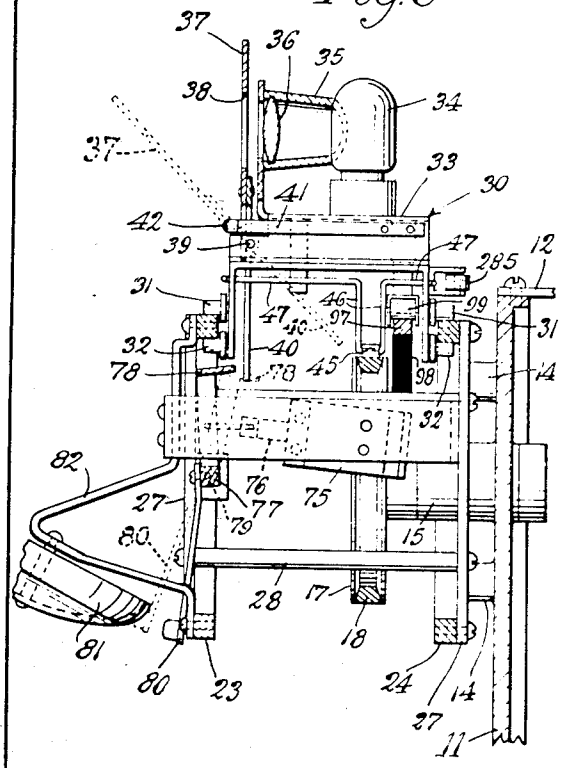
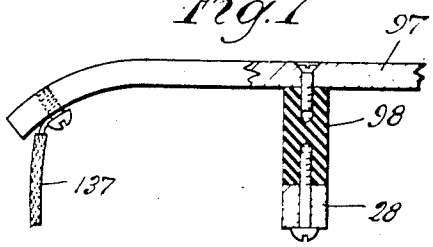


Fig. 7



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ELECTRIC RIFLE RANGE

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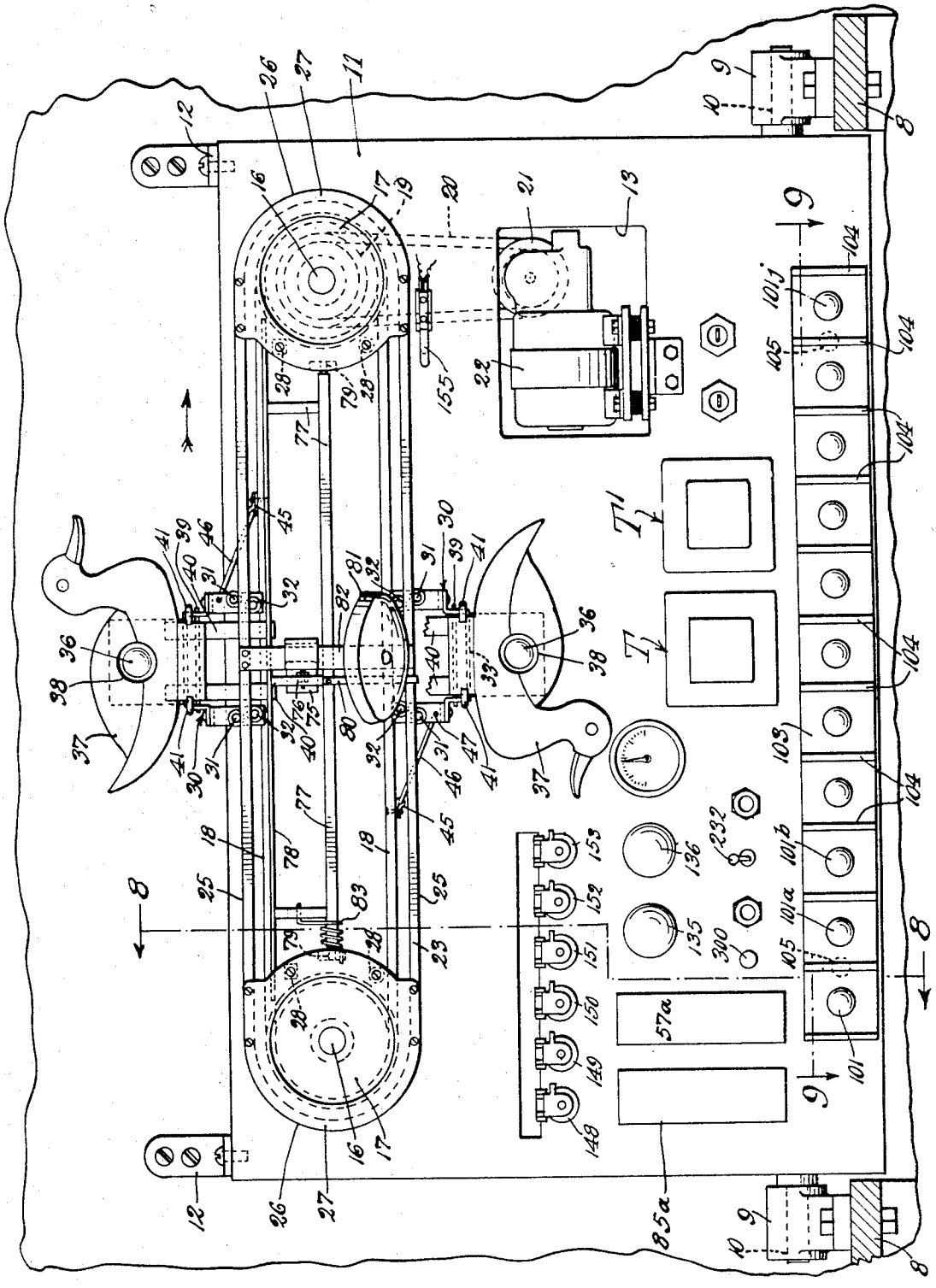

Fig. 3

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ELECTRIC RIFLE RANGE

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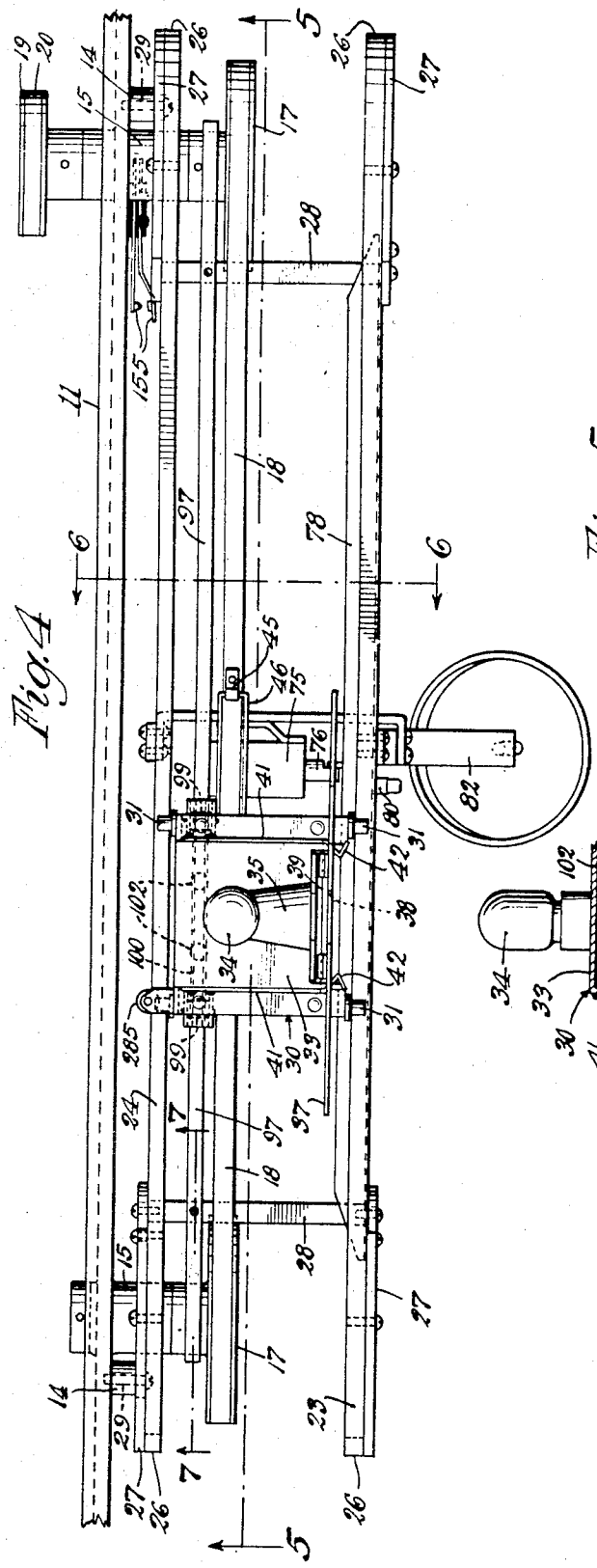

Fig. 4

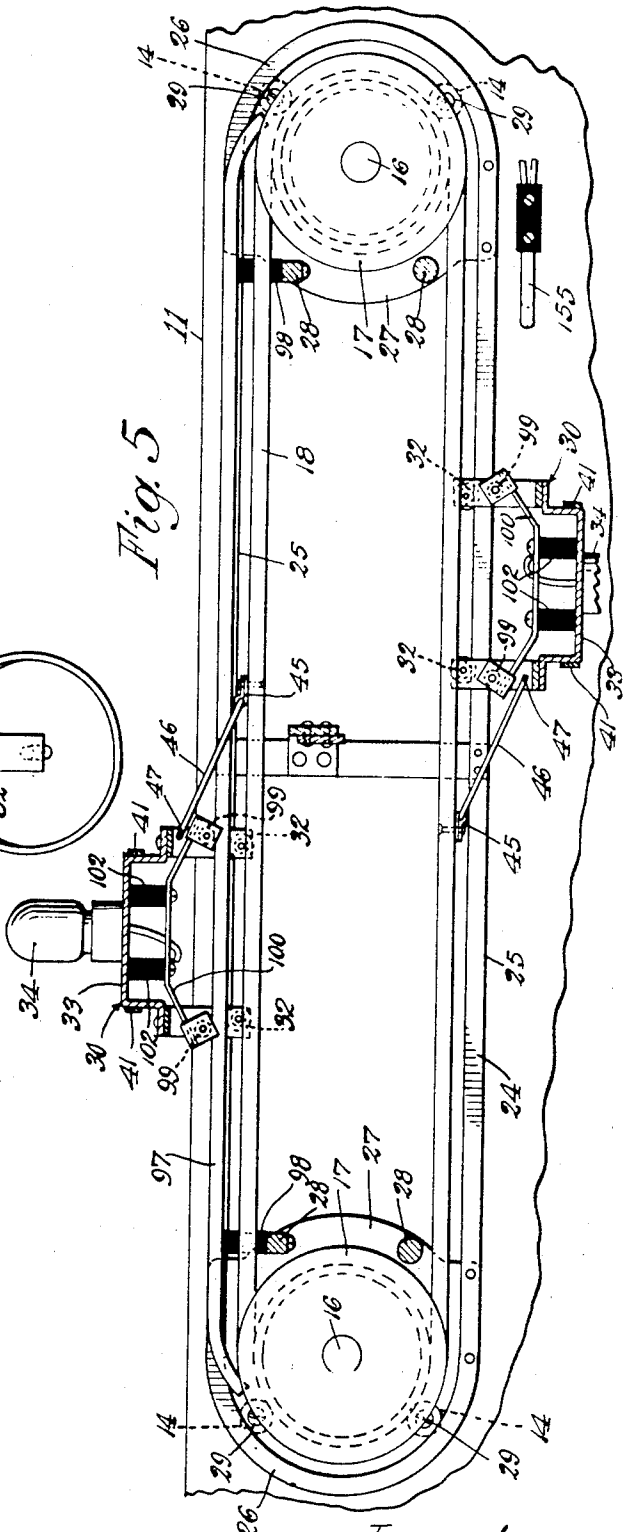

Fig. 5

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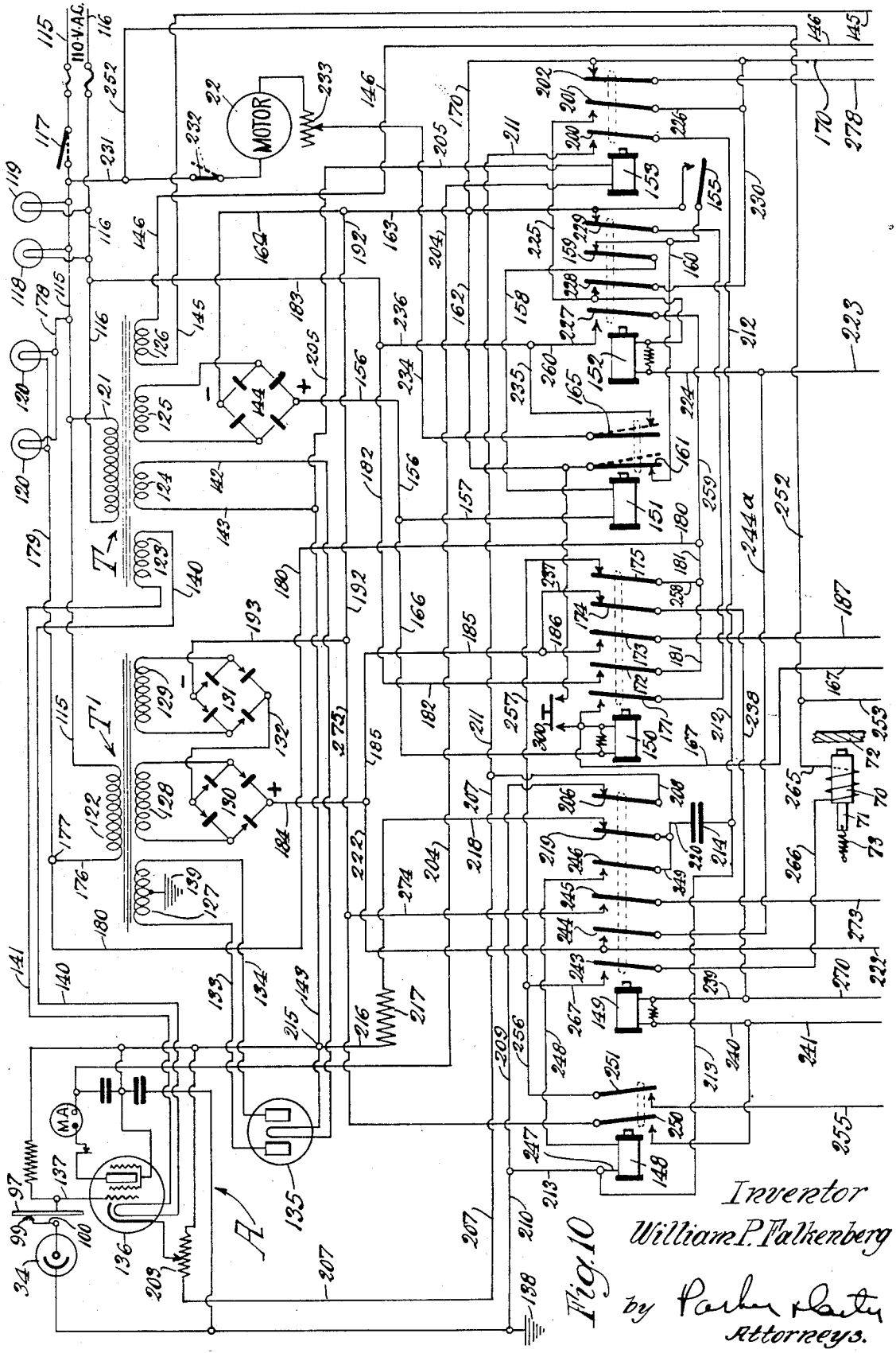

Fig. 10

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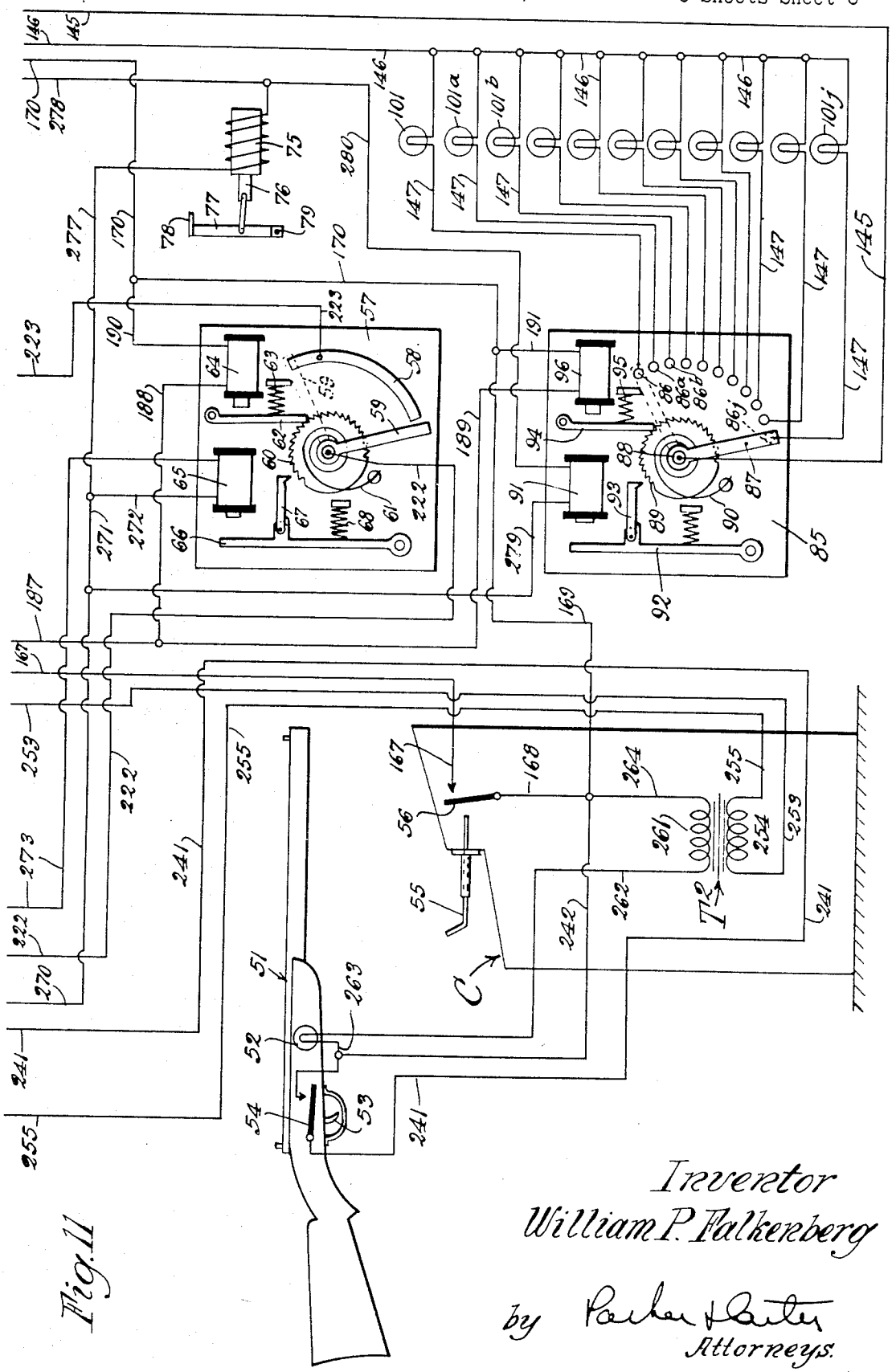

Fig. 11

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Patented May 23, 1939

2,159,141

UNITED STATES PATENT OFFICE

2,159,141

ELECTRIC RIFLE RANGE

William P. Falkenberg, Chicago, Ill., assignor to Rayolite Rifle Range Company, Chicago, Ill., a corporation of Oklahoma

Application January 11, 1937, Serial No. 120,046

1 Claim. (Cl. 273—101.1)

My invention relates to an improvement in electric target rifle ranges of the type in which an aimable member fires a flash of light at a target which may include a photoelectric or light sensitive element.

One purpose is the provision of an improved target rifle range of the type described in which the target includes a movable base target portion and an apertured target drop portion.

Another purpose is the provision of an improved target drop and an improved means for maintaining it normally upright, and for releasing or moving it to depressed position in response to a hit.

Another purpose is the provision of improved wiring means and control means for such a device.

Another purpose is the provision of an improved score indicating means for such a device.

Other purposes will appear from time to time in the course of the specification and claim.

I illustrate my invention more or less diagrammatically in the accompanying drawings wherein:

Figure 1 is a front elevation;

Figure 2 is a section on an enlarged scale along the line 2—2 of Figure 1;

Figure 3 is a front elevation of the target structure proper;

Figure 4 is a top plan view of the structure shown in Figure 3;

Figure 5 is a section on the line 5—5 of Figure 4;

Figure 6 is a section on the line 6—6 of Figure 4;

Figure 7 is a section on the line 7—7 of Figure 4;

Figure 8 is a section on the line 8—8 of Figure 3;

Figure 9 is a section on the line 9—9 of Figure 3; and

Figures 10 and 11, taken together, constitute a wiring diagram.

Like parts are indicated by like symbols throughout the specification and drawings.

Referring to the drawings, 1 indicates any suitable cabinet having downwardly extending supports 2 and a removable front panel 3. The said front panel has an upper aperture 4 which may be closed by a pane of glass or equivalent member 5. A lower aperture 6 is closed by a pane of glass 7 which is herein shown as having indicating numbers or signals thereon from zero to ten, as shown in Figure 1, the purpose of which will later appear.

I illustrate any suitable cross pieces or supports 8 within the cabinet 1 which may be provided with bearing sleeves 9 which in turn receive bearing pins 10 mounted on any suitable panel 11. 12 being means for holding the upper end of said panel whereby the panel is normally in upright position. The panel is provided with an aperture 13, the purpose of which will later appear. The panel 11 may be of metal and is herein shown as provided with forwardly projecting bosses 14 to which the later described structure is mounted, and also forwardly projecting bearing sleeves 15.

Mounted in said bearing sleeves 15 are any suitable shafts 16 which receive pulleys 17 about which passes the belt 18 which may be of the V-belt type. 19 is a drive pulley on one of the said shafts which may be driven by means of a belt 20 from the motor drive pulley 21 associated with the motor 22 herein shown as positioned in the aperture 13. Any suitable gear reduction structure may be interposed between the pulley 21 and the motor. It will be understood that when the motor 22 is energized the pulleys 17 rotate and cause the belt 18 to move in the direction indicated by the arrow in Figure 3.

23, 24 indicate tracks which include horizontal parallel portions 25 and end portions 26 generally concentric with the axes of rotation of the pulleys 17. These tracks may be mounted in any suitable fashion as by plates 27 which may be connected together by the cross pieces 28, the inner plates being secured to the bosses 14 as by any suitable screws 29. Mounted for movement along the said tracks are carriages generally indicated as 30, each such carriage having pairs of wheels or rollers 31 engaging the outer track surfaces and pairs of wheels or rollers 32 engaging the inner track surfaces, the distance separating the axes of the outer rollers being slightly greater than that separating the inner, to permit the carriage to move readily around the arcuate portions of the track. The carriages 30 may include an upper platform 33, upon which is mounted a photoelectric cell 34 herein shown as provided with a forward chamber 35 which may be closed by the lens 36 the purpose of which is to concentrate light upon the cell 34. The rest of the cell 34 may be painted black or otherwise obscured or, if desired, may be surrounded by a housing, in order that the cell may be protected from any light except that which passes through the lens 36.

Pivoted to the carriage 30 is any suitable target drop member 37 herein indicated as in the form

of a duck and provided with an aperture **38** which, when the target drop portion is in upright position, is positioned forwardly of and alined with the lens **36**. The target drop portion **37** may be pivoted as at **39** and is herein shown as having a downwardly extending lever or levers **40**. It is normally held in upright position as by the springs **41** which have inwardly extending drop gripping portions **42**, as shown for example in Figure 4.

The carriage structure as a whole is moved along the tracks **23**, **24** in response to the movement of the belt **18** by a flexible connection which includes an eye **45**. A link structure **46** is pivoted in the eye and includes laterally extending terminal portions **47**, **47**, which engage side portions of the carriage **30**, in a pivotal relationship. Thus the carriage is toed by the belt through the above described flexible connection.

49 indicates a removable scenery back drop and **50** a removable foreground apron, the purpose being to simulate an outdoor scene through which the birds or target drop portions may move with a relatively natural appearance. It will be clear from Figure 2 that the actuating structure for the targets is entirely concealed and only the target drop portions themselves are visible to the user looking through the glass pane **5**.

It will be understood that the purpose of the invention is to provide a target range which includes a moving target which can be shot at with a gun which shoots what may be described as bullets of light. Referring to Figure 11, I illustrate the gun generally indicated as **51** which is provided with a lamp bulb or light source **52**, the circuit for which will later be described. It is also provided with a manually operable trigger **53** which controls a trigger switch **54**. The device is initially put in play by inserting a coin in the coin receiving element **55** which permits it to be closed and to close the coin switch **56**. The result is to put the entire structure in condition for operation. The device may be divided into the following general elements:

(*a*) The gun proper which, when the device is in operation, projects a very short flash of light at each trigger pull. The flash preferably is so timed that the operator cannot correct his aim after the trigger is pulled.

(*b*) The target structure which includes the carriages **30**, carrying the photoelectric cells **34** and the target drop portions **37**, which move continuously during the period after the closure of the coin switch **56**, and continue to move until the operator has taken his allowed shots. In the present structure, the operator is permitted ten shots or ten trigger pulls and at the tenth trigger pull the device is put out of operation and the targets cease to move.

(*c*) In order to limit the number of shots, I provide a shot limit switch mechanism which is returned to initial position when the coin switch **56** is closed and which is moved one step at each trigger pull, the tenth trigger pull serving to move the shot limit switch to inoperative position with the result that the operation of the device ceases.

(*d*) In order to indicate the score, I provide a generally similar switch which is moved to zero position when the coin switch **56** is closed. At the zero position, the zero light of the window **7** is illuminated. At every hit recorded against one of the photo cells **34**, the next ensuing numeral is illuminated. If the user gets a perfect score, the number 10 is illuminated at the last shot and may remain illuminated to indicate the score until the device is prepared for an ensuing user by the insertion of a coin and the closure of the coin switch **56**.

(*e*) In order to indicate a hit, I also provide other indicating means. In the first place, at each hit the target drop portion **37** falls forward and, in the second place, a chime sounds.

(*f*) In order to make the device realistic, I also provide a thud sounder which may simulate a shot or hit, and which sounds at each trigger pull.

Considering first the shot limit switch mechanism, I illustrate any suitable base or plate **57** upon which is positioned any fixed arcuate contact **58** which is insulated and which is adapted to be opposed by the rotating arm **59**. When the device is in initial position, the arm **59** is in the dotted line position in which it is shown in Figure 11. Its movement is controlled by the ratchet **60** which is normally urged in counterclockwise direction of rotation by the spring **61** but which is held against such rotation by the detent **62** urged into locking position by the spring **63**. The reset magnet **64**, when energized in response to the closure of the coin switch **56**, withdraws the detent **62** and permits the ratchet wheel **60** and the arm **59** to be returned to the initial dotted line position. Assuming that it is in the initial position, each trigger pull, or each closure of the trigger switch **54** results in the energization of the magnet **65** which in turn moves the armature **66** to the right, referring to the position of the parts in Figure 11. The dog **67** then moves the ratchet wheel **60** one step. The spring **68** returns the armature **66** to the full line position as soon as the energization of the magnet **65** terminates. It will be understood that it is energized for only an instant. Thus the result of ten trigger pulls is ten step by step movements of the arm **59**, the parts being so proportioned that the last movement moves the arm **59** beyond the end of the segmental contact **58** and thus breaks the circuit and puts the machine out of use.

At the time that the device is being shot, and at each closure of the trigger switch **54**, the electromagnetic coil **70**, referring to Figure 8, is energized and results in a movement of the solenoid armature **71** against any suitable plate or frame portion **72**, causing a thud to sound. A spring **73** serves to withdraw the armature **71** when the energization of the coil terminates. Thus, at every trigger pull, a thud sounds, which adds to the natural effect of the device.

Assuming that the operator so aims his gun **51** as to direct a flash of light through the window **5**, the aperture **38** and the lens **36**, and energizes or strikes the photo cell **34**, the electromagnet or solenoid **75** is energized. This causes the armature **76** to move to the right, referring to the position of the parts in which they are shown in Figure 6. This in turn rotates the trigger member generally indicated as **77**. The upper member or bar **78** then strikes the downward extensions **40** of the target drop, frees the target drop from the springs **41**, and causes it to fall forward into the dotted line position in which it is shown in Figure 6. Since the member **77** is pivoted as at **79**, its lower arm or portion **80** moves in the opposite direction and strikes a bell or chime **81**, herein shown as mounted on any suitable bracket **82** on the track structure. A spring **83**, as shown in Figure 3, normally holds the structure **77** in the full line position in which it is shown in Figure 6.

A hit, in addition to causing the duck to fall

and the chime to sound, operates the scoring device. I illustrate, for example, on any suitable base 85 a series of individual fixed contacts 86, 86a, etc., which are insulated from each other. Opposed to them is a moving switch arm 87 pivoted as at 88 and operated by the ratchet wheel 89 which is normally urged in counterclockwise rotation by the spring 90, the structure being generally similar to the limit switch structure above described. 91 indicates an electromagnet which is energized at each hit. When energized, it moves the armature 92 in such fashion as to cause the dog 93 to move the ratchet wheel 89 one step. Retrograde movement of the ratchet wheel is prevented by the detent 94 which is held in operative position by the spring 95 unless and until it is withdrawn by the energization of the reset magnet 96. Both the shot limit mechanism and scoring device above referred to may be enclosed in housings 57a and 85a, respectively, and may be mounted upon the panel 11.

The operation of the device may be summarized as follows. When the operator inserts a coin and closes the switch 56, the reset magnets 64 and 96 are energized and both the shot limit switch and the scoring switch are returned to the initial or dotted line positions in which they are shown in Figure 11. At the same time, the motor 22 is energized and the targets begin to move.

When the operator aims and pulls the trigger, and closes the switch 54, the result is an energization of the light 52 and the projection of a briefly timed flash of light from the gun 51. The thud sounder 71 also sounds, simulating a shot or the impact of a bullet against the target.

The operator tries to hit the photo cell by holding his aim on the lens 36 which he sees through the aperture 38 of the target drop. If he is successful in hitting the photo cell, he energizes both of the electromagnets 65 and 91. The energization of 65, which results each time the trigger switch 54 is closed, merely uses up one shot by moving the arm 59 one step. The energization of the electromagnet 91 extinguishes the light zero and illuminates the light 1 to the rear of the window aperture 6. In this connection, and associated with each of the contacts 86, 86a, I may employ an incandescent lamp 101, 101a, etc. A further result of a hit is the forward fall of the target drop member 37 which indicates that the bird has been struck and the sounding of the chime 81.

After the operator has taken ten shots, the arm 59 breaks its contact with the contact 58 and breaks the circuit for the motor 22, thus causing the targets to cease their motion. By a limit switch structure which will later be described, the targets continue to move until the upper target drop is centered midway between the ends of the track, and all further movement then ceases. The scoring light remains illuminated to indicate the total number of hits and the device is out of operation until the next ensuing operator inserts a coin and closes the switch 56.

It will be understood that I may employ a considerable variety of circuits in obtaining the above result and I do not wish to be limited to any specific circuit. I illustrate, however, a practical and operative circuit which has actually been employed.

In order to provide a connection between the cell 34 which is on a moving structure and the necessary amplifier and fixed parts, I illustrate a contact track member 97 which may be mounted on any suitable insulating blocks 98 associated with the cross pieces 28. Opposed to the tracks 97 are contact rollers 99 which may be mounted on springs 100 associated with the carriages or bases 30. They may be mounted on insulating blocks or members 102. The track 97 provides one connection for the cell and the other connection may be obtained as by grounding on the carriage structure.

The indicating lamps 101, 101a, etc., may be mounted on a frame 103 which is divided into compartments by walls 104. The frame 103 may be mounted upon the panel, for example, by arms 105.

Referring to the wiring diagram of Figures 10 and 11, a source of outside 110 volt current is indicated at 115, 116, although it will be understood that any suitable voltage may be employed and the device may be operated on direct current. However, for convenience, I illustrate it in connection with 110 volt alternating current. A manually controlled switch 117 may be interposed in one of the power lines whereby the entire circuit may be broken. Shunted across the main power lines are the lamps 118, 119, which are controlled by the switch 117. The lamp 119 is illustrated in Figure 1, as mounted at the bottom of the cabinet 1, and is visible through a lens 106. The lamp 118 is preferably mounted above the target structure to illuminate the scenery panels 49, 50 and the target drops 37. A pair of colored lamps 120, 120 may be mounted at either side of the lamp 118, its purpose being to indicate, when energized, that the device is in operation.

Electrically connected with the main power lines 115, 116 is the primary winding 121 of a power transformer T. A second transformer T' has one side of its primary winding 122 connected to the main power line 115. The primary winding of the transformer T serves to energize the secondary windings 123, 124, 125 and 126. The transformer T' is provided with secondary windings 127, 128 and 129 of which the windings 128 and 129 are electrically connected with the rectifying units 130, 131 which in turn are connected in series by a line 132. The secondary coil 127 is connected by lines 133, 134 to the plates of a rectifying tube 135 associated with any suitable photoelectric amplifier, indicated by A. The electrical circuit of the amplifier A is merely illustrated as an example, since several well known photoelectric circuits are suitable for the operation of my invention.

For exemplification, I have illustrated an amplifying tube 136, the grid element of which is connected by a line 137 to the rail 97 which in turn is engaged by the rollers 99 on the spring 100 associated with the target carriage 30. The spring is electrically connected to the anode of the photoelectric cell 34.

In the drawings I have illustrated two target carriages 30, each of which carries a photoelectric cell 34. Since only one target drop is visible at a time, an electrical rail 97 extending parallel with the upper edge of the rails 23, 24 may be employed as illustrated in Figure 5 or, if desired, it may be a continuous rail conforming to the contour of the rails.

Referring back to the diagrams of Figures 10 and 11, the cathode of the photoelectric cell 34 is diagrammatically connected by a line with a ground connection 138. Likewise, the center tap of the secondary winding 127 of the transformer T' is grounded as at 139.

The secondary coil 123 of the transformer T supplies current to the filament of the amplify-

ing tube 136 through the lines 140, 141. The secondary coil 124 is connected by the lines 142, 143 to the filament of the rectifying tube 135. The secondary winding 125 of the transformer T connects to a rectifier 144, the purpose of which will later appear. The end taps of secondary winding 126 are provided with lines 145, 146 of which the line 145 extends to the switch arm 87 of the score indicator. The line 146 is connected to one side of the indicating lights 101, 101a etc., the other terminals of which are connected by lines 147 leading to their respective contacts 86, 86a, etc.

Incorporated in the electrical circuits below described are several electromagnets 148, 149, 150, 151, 152 and a photo relay 153, each of which, when energized, serves to actuate associated multiple switches.

In the normal operation of the device, the control switch 117 is closed, which results in closing circuits through the lamps 118 and 119, through the primary of the transformer T, the secondary winding 126 of which establishes a circuit through one of the score indicating lamps 101, etc., depending which one of the contacts 86, etc., is opposed to the switch arm 87. Further, the rectifying tube 135 and amplifying tube 136 are energized by the secondary windings 123 and 124.

An additional circuit is provided through the electromagnet 151 which previously had been established by the limit switch 155, later to be described in detail, which may be traced from the positive terminal of the rectifier 144 through line 156, 157, electromagnet 151, line 158, closed switch 159 associated with electromagnet 152, line 160 leading to the closed switch 161 of electromagnet 151, thence through lines 162, 163 and 164 to the negative terminal of the rectifier 144.

Obviously, in the normal operation of the device, when at rest, the electromagnet 151 is energized and its associated switch members 161 and 165 are in the position indicated in full lines of Figure 10.

Assuming the user inserts a coin or token into the coin slide 55 and manipulates it in the usual manner, he temporarily closes the coin controlled switch 56, preferably located in a suitable gun cabinet C and closes the following electrical circuit through the electromagnet 150 traceable from the positive terminal of the rectifier 144 through the lines 156, 166, electromagnet 150 and line 167 leading to the coin controlled switch 56, thence through the lines 168, 169, 170, 163, 164 to the negative terminal of the rectifier 144. Energization of the electromagnet 150 results in closure of the associated switch members 171, 172 and 173 and opening of the switch members 174 and 175, completing thereby the following circuits

First, a circuit through the primary winding 122 of the transformer T' and simultaneously through the colored lamps 120, 120, from the main power line 115 through the primary winding 122 and line 176 to the junction point 177, and the additional shunt connection 178, lamps 120, 121 and line 179 leading to said junction point 177, thence through lines 180, closed switch 172 and lines 182, 183 to the other power line 116. This results in energization of the secondary windings 127, 128 and 129 of the transformer T' and consequently of the associated circuits previously described.

An electrical circuit through the reset magnets 64 and 96 of the shot limiting means 57 and score indicating device 85, respectively, may now be traced from the positive terminal of the rectifier 130, which is connected in series with the rectifier 130, along the lines 184, 185, 186 to the closed switch 173, thence along the line 187, line 188 and shunt line 189 leading to the reset magnets 64 and 96 respectively, thence continues through the lines 190 and shunt line 191, the common lines 170, 163, and lines 192, 193 to the negative terminal of the rectifier 131.

In practice, the negative terminals of both the rectifiers 131 and 144 as well as the ground connections 138, 139, are grounded to the metal frame or panel 11 to eliminate wiring.

The shot limit switch mechanism and the score indicating mechanism are thus returned to initial position with the switch members 59 and 87 assuming the dotted line position as illustrated in Figure 11. The score indicating light 101 is now illuminated as well as the colored lamps 120, 120 indicating that the device is ready for its cycle of operation.

As soon as the operator releases the manually controlled coin slide 55, it automatically returns to inoperative position in a well known manner and opens the switch 56, thus breaking the circuit through the electromagnet 150 above described, and its associated switch members return to the position illustrated in Figure 10. That is to say, the switch members 171, 172 and 173 are opened and the switch members 174 and 175 are closed.

Energization of the secondary coil 127 of the transformer T' further results in energizing the amplifier circuits by means of the rectifying tube 135. The potentiometer 203 of the amplifier A in conjunction with the cathode of the power output tube 136 is adjusted to energize the photoelectric relay 153 when the amplifier circuits are completed and energized by the transformer T', except for momentary interruptions, when the photoelectric cell 34 is energized or actuated when struck by a flash of light from the gun 51.

The photoelectric amplifier A is connected by line 204 and lines 205 and 143 respectively, with the photoelectric relay 153, which, when energized, closes the switch members 200, 201 and opens the switch 202.

The circuit of the cathode of the power output tube 136 and potentiometer 203 had previously been closed by a switch 206 associated with the electromagnet 149 and may partially be traced from the potentiometer 203 through lines 207, 208, switch 206, lines 209, 210 to the ground 138 and thence to the grounded center tap 139 of the secondary coil 127.

Closure of the switch member 200 closes a shunt connection of the potentiometer 203 which is traceable from the line 206, through the line 211, switch 200, lines 212, 213 and 210 to the ground 138.

The amplifier further provides an electrical circuit through a condenser 214 which functions to energize the electromagnet 148, later to be described in detail, the circuit of the condenser 214 may be traced from the intersecting point 215 in the line 143 leading to the filament of the rectifying tube 135 through the line 216, a resistor 217, line 218, a switch 219, associated with the electromagnet 149, and a line 220 to the condenser 214, thence through lines 213, 210 and ground 138 to grounded center tap 139 of the secondary coil 127 of the transformer T' which in turn is connected by lines 133, 134 to the plates of the rectifying tube 135.

Closure of the switch 201 of the photoelectric relay 153 closes a circuit through the electromagnet 152, which is traceable from the positive terminal of the rectifier 130 through the lines 184, 222, switch arm 59 of the shot limiting means, segment contact member 58, lines 223, 224 to the electromagnet 152, thence through line 225, closed switch 201 and lines 226, 170, 163, 192, 193 to the negative terminal of the rectifier 131 which in turn is connected with the rectifier 130.

The electromagnet 152, thus energized, closes the switch members 227, 228 and opens the switch members 159 and 229. The switch member 228 closes a shunt connection in circuit with the electromagnet 152 by means of a line 230, which, in effect shunts out the switch member 201 associated with the photoelectric relay 153.

Opening of the switch member 159 interrupts the circuit through the electromagnet 151 above described and the switch members 161 and 165 move to the dotted line position of Figure 10. The switch member 165, now closed, completes a circuit through the motor 22 from the main power line 115, through the line 231, a normally closed switch 232, the motor 22, an adjustable resistor 233, and line 234, to the switch 165, thence through the lines 235, 236, and 183 to the other power line 116.

The motor 22, thence commences to rotate the pulleys 17, which in turn moves the belt 18 and the target carriages 30.

The user may now commence to shoot at the moving targets. As soon as he pulls the trigger 53 of the gun 51 he closes the switch 54 momentarily, which results in a flash of light to project from the gun barrel, simulating in effect a bullet of light.

The gun switch 54 closes a circuit through the electromagnet 149, which may be traced as follows: From the positive terminal of the rectifier 130 through the lines 184, 185, 237, the closed switch 174, lines 238, 239, to the electromagnet 149, thence through the lines 240, 241, through the gun switch 54 and lines 242, 169, 170, 163, 192, and 193 to the negative terminal of the rectifier 131.

The electromagnet 149, thus energized, closes the multiple switch members 243, 244, 245, and 246, and opens the switch members 219 and 206. The following electrical circuits are thus completed; closure of the switch member 246 closes a circuit through the electromagnets 148, which may be traced from the condenser 214, the energizing circuit of which has been previously described, through the lines 213, and 247, leading to the electromagnet 148, thence through the line 248, the switch member 246, and lines 249 and 220 to the condenser 214. In other words, the energy stored up in the condenser 214 actuates the electromagnet 148 when the switch member 246 is closed and the switch member 219 is opened.

The electromagnet 148 in turn closes the switch members 250 and 251, and closes a circuit through the transformer T—2 in the gun cabinet C which may be traced from the main power line 115 through the lines 231, 252, 253, to the primary coil 254 of the transformer T—2, thence through the line 255, switch member 251, lines 256, 257 to the closed switch member 175, associated with the electromagnet 150, and continues through the lines 258, 181, 259, the closed switch member 227, and lines 260, 236 and 183, to the other power line 116. The primary coil 254, of the transformer T—2 in turn energizes the secondary coil 261, and closes a circuit through the gun lamp 52, by means of the line 262 leading from the secondary coil to the gun lamp 52 and continues through the lines 263, 242, and 264 to the other side of the secondary coil 261.

Note that the electromagnet 148 is energized only momentarily by the above described circuits, resulting in illuminating the gun lamp 52 to produce in effect a flash of light, which may be called a light bullet.

Closure of the switch member 251 associated with the electromagnet 148 closes an electrical circuit through the thud sounder coil 70, which may be traced from the power line 115 through the lines 231, 252, 265 to the thud sounder coil 70, thence through the lines 266, the closed switch member 243, lines 267, 257, through the closed switch 175, lines 258, 181, 259, the closed switch member 227, and lines 260, 236, 183, to the other power line 116.

In addition the switch member 245, associated with the electromagnet 149 closes a circuit through the electromagnet 65 of the shot limiting means, which may be traced from the positive terminal of the rectifier 130 through the lines 184, 185, 237, the closed switch 174, the lines 238, 270, 271, 272, to the electromagnet 65, thence through the line 273, the closed switch member 245, and lines 274, 275, and 193, to the negative terminal of the rectifier 131, which is connected in series with the rectifier 130.

Energization of the electromagnet 65 results in advancing the switch arm 59 in relation to the contact segment 58 one step.

As will be realized, each time the operator pulls the trigger 53 of the gun 51, the gun lamp 52 projects a flash of light, the thud sounder 71 is actuated, to produce in effect the report of a gun, and the shot limiting means is advanced one step. If the operator has been successful in obtaining a hit, that is to say, the flash of light has struck the photoelectric cell 34 upon the moving target 30, the additional circuits are completed.

First, energization of the photoelectric cell 34 deenergizes the photoelectric relay 153 momentarily. This in turn opens the associated switch members 200, and 201, and closes the switch member 202. Closure of the switch member 202 closes the circuit through the target drop solenoid 75, which may be traced from the positive terminal of the rectifier 130, through the lines 184, 185, 237, the switch 174, of the electromagnet 150, the line 238, 270, 271, 277, to the magnetic coil 75 of the solenoid, thence through the line 278, the switch member 202, and lines 170, 163, 192 and 193, to the negative terminal of the rectifier 131. Actuation of the solenoid coil 75 results in the target drop 37 to fall, and further to sound the chime 81. In addition, the electromagnet 91 is energized by means of the shunt connection including the lines 279 and 280 which connect to the lines 270 and 278, respectively. Energization of the electromagnet 91 advances the arm 87 of the score indicating unit 85 to the succeeding contact 86*a*, assuming the arm 87 has been in register with the contact 86 associated with the zero indicating lamp 101. The score lamp 101*a* is thus illuminated, indicating one hit.

At the tenth trigger pull, the arm 59 of the shot limiting means leaves the contact 58. However, the electromagnet 152 remains energized to complete its cycle of operation by the shunt connection 244*a* connected to the closed switch member 244 of the electromagnet 149, as long as the gun switch 54 remains closed. As soon as the circuit

through the electromagnet 152 is broken, the switch members 227 and 228 open and the switch members 159 and 229 close. Closure of the switch member 159 partially closes a circuit through the electromagnet 151, which is completed when a roller 285, carried by each target carriage, closes the limit switch 155.

The electromagnet 151, thus actuated, opens the switch 165 which breaks the motor circuit and closes the switch 161, which completes the holding circuit for the electromagnet 151 previously described. Opening of the switch member 227 of the electromagnet 152 breaks the circuit of the colored lamp 120, and of the transformer T' and the cycle of operation of my device is thus completed, and ready for the succeeding player. 300 represents a service switch whereby the reset electromagnets 64 and 96 may be energized, independent of the coin operated switch 56 in the gun cabinet C.

I claim:

A shooting gallery comprising a traveling target, a driving motor for said target, means for establishing a circuit for said motor, including a shot limit switch having electrical actuating means which must be successively operated to finally open said shot limit switch, a trigger for said gun, a circuit for said electrical actuating means controlled by said trigger, and means effective, after the last allowed shot, to move said target into a predetermined position within the view of the user prior to the stoppage of the motor.

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