Jan. 26, 1943. H. G. JENSEN 2,309,614

ELECTRIC TARGET DEVICE

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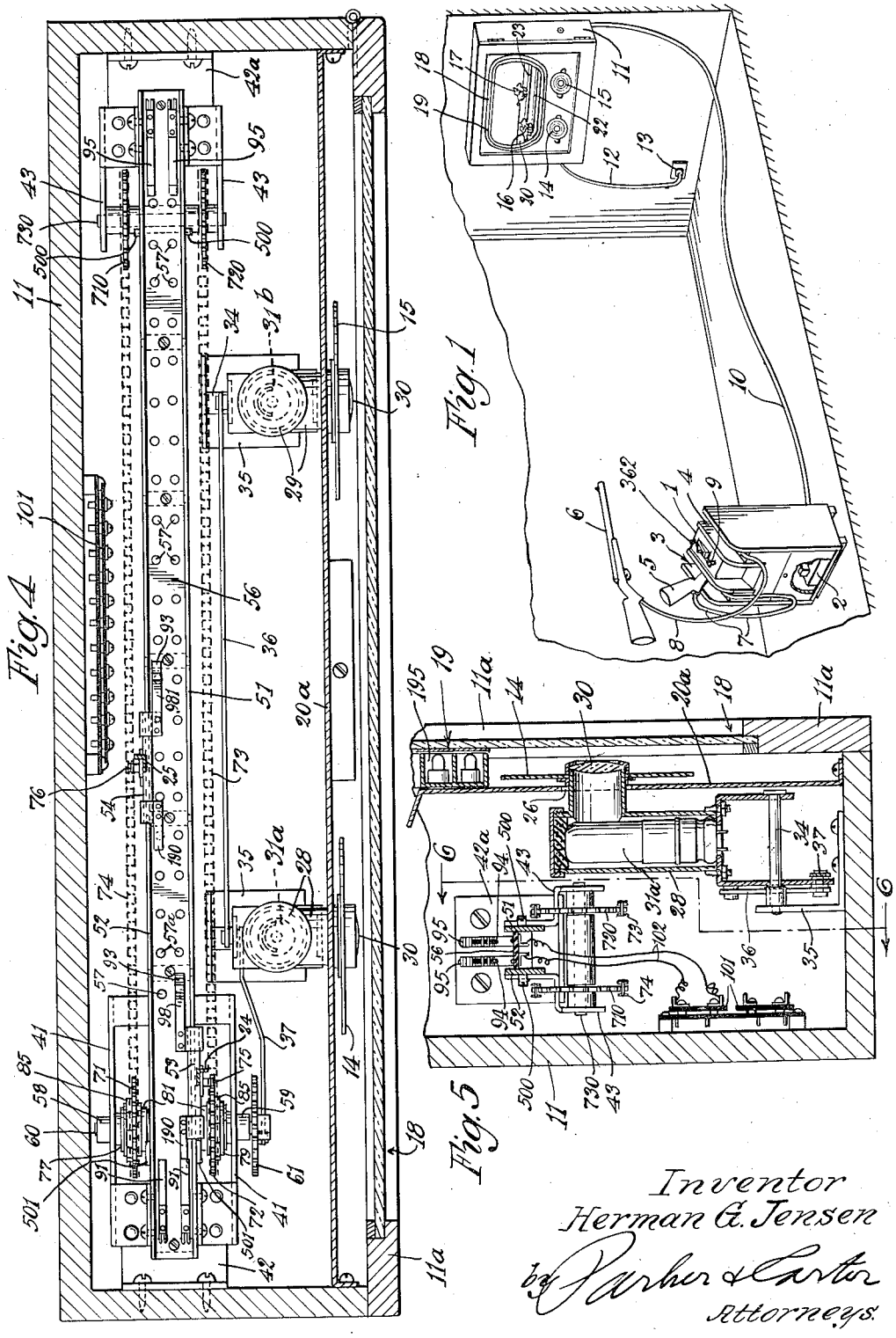


Fig. 4

Fig. 1

Fig. 5

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Fig. 2

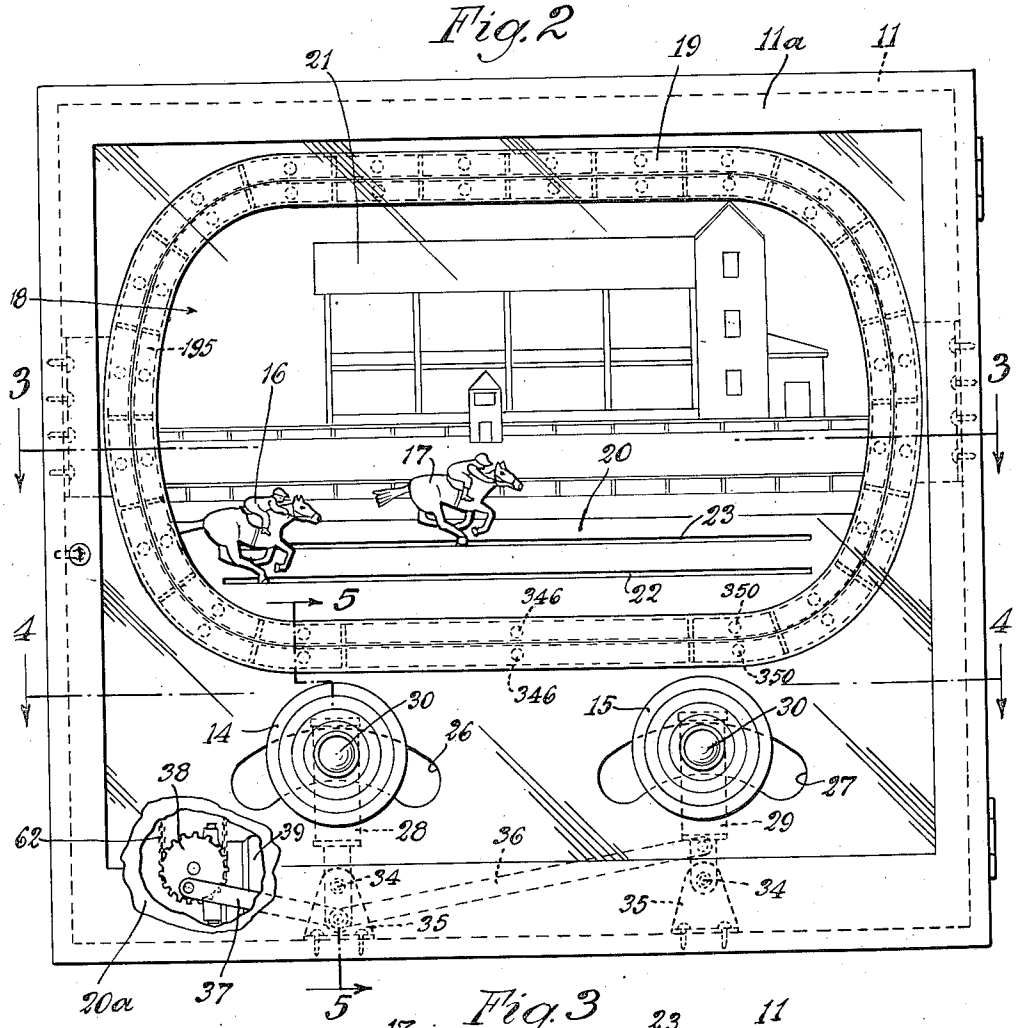
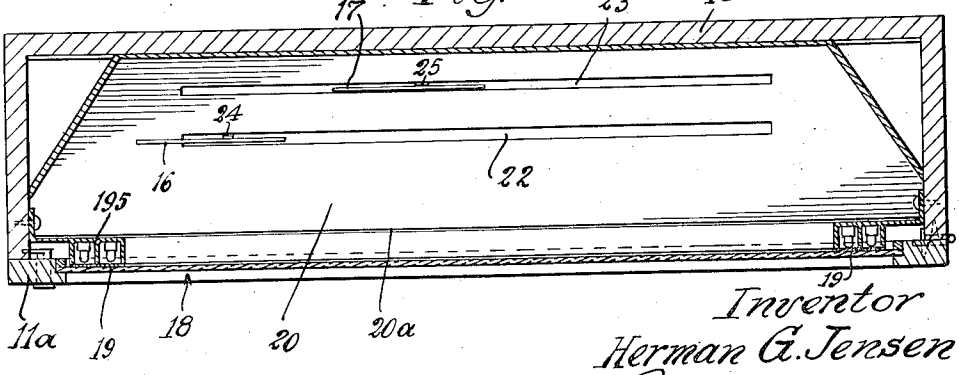


Fig. 3



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Fig. 6

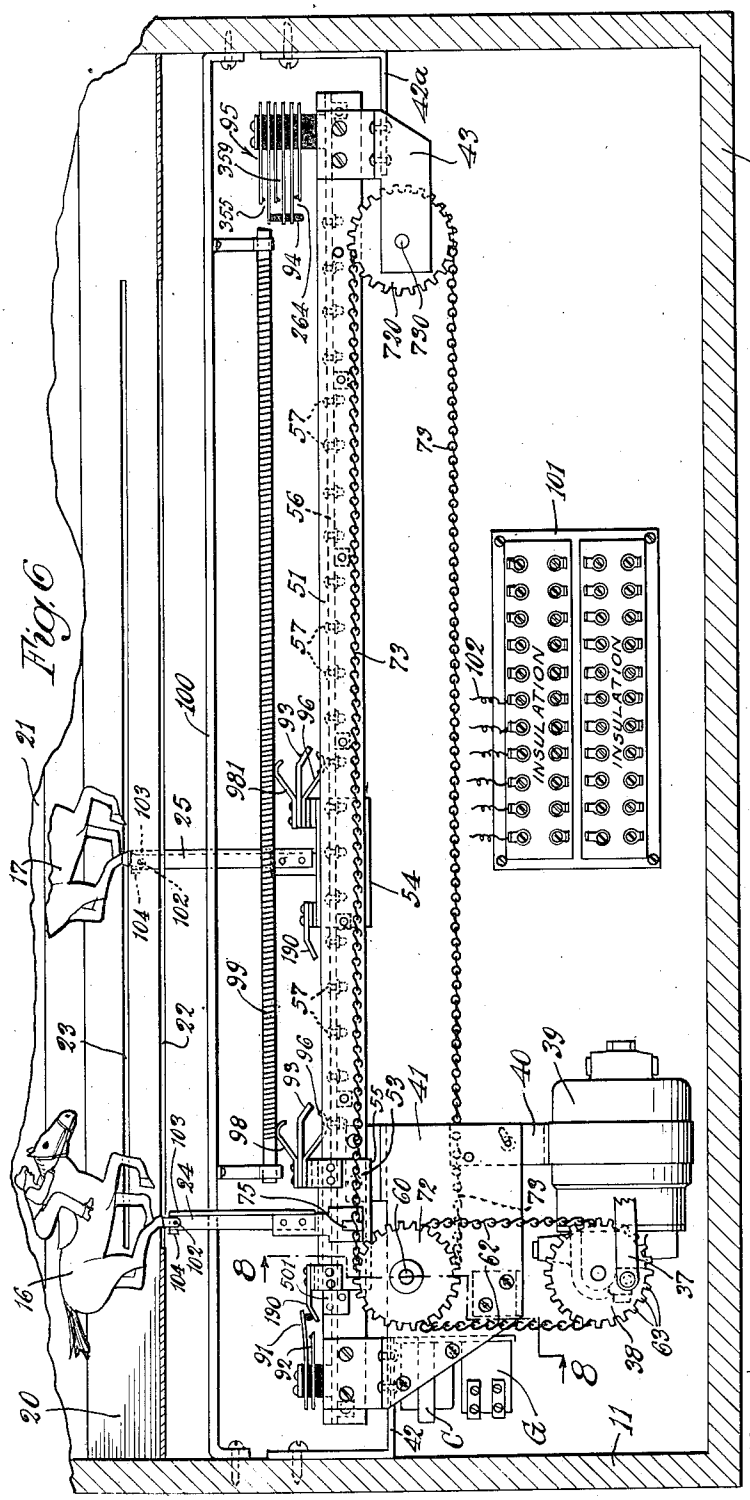
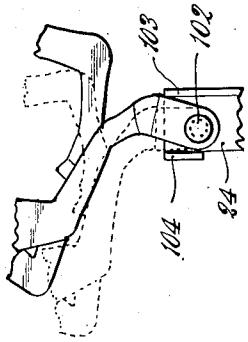


Fig. 7



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ELECTRIC TARGET DEVICE

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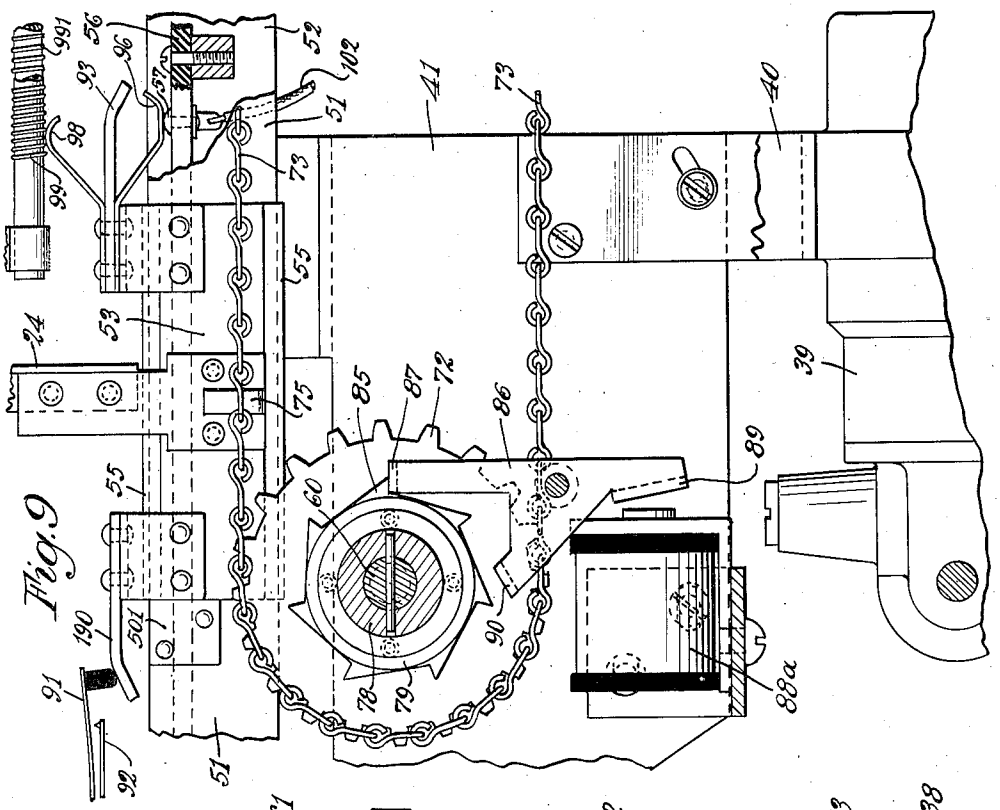


Fig. 9

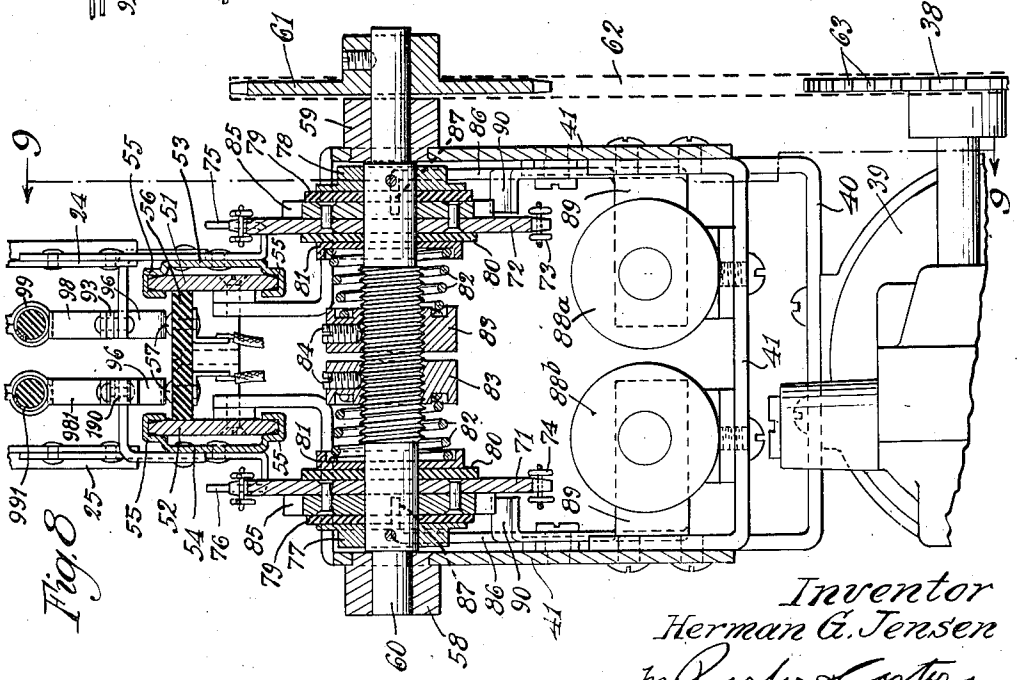


Fig. 8

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ELECTRIC TARGET DEVICE

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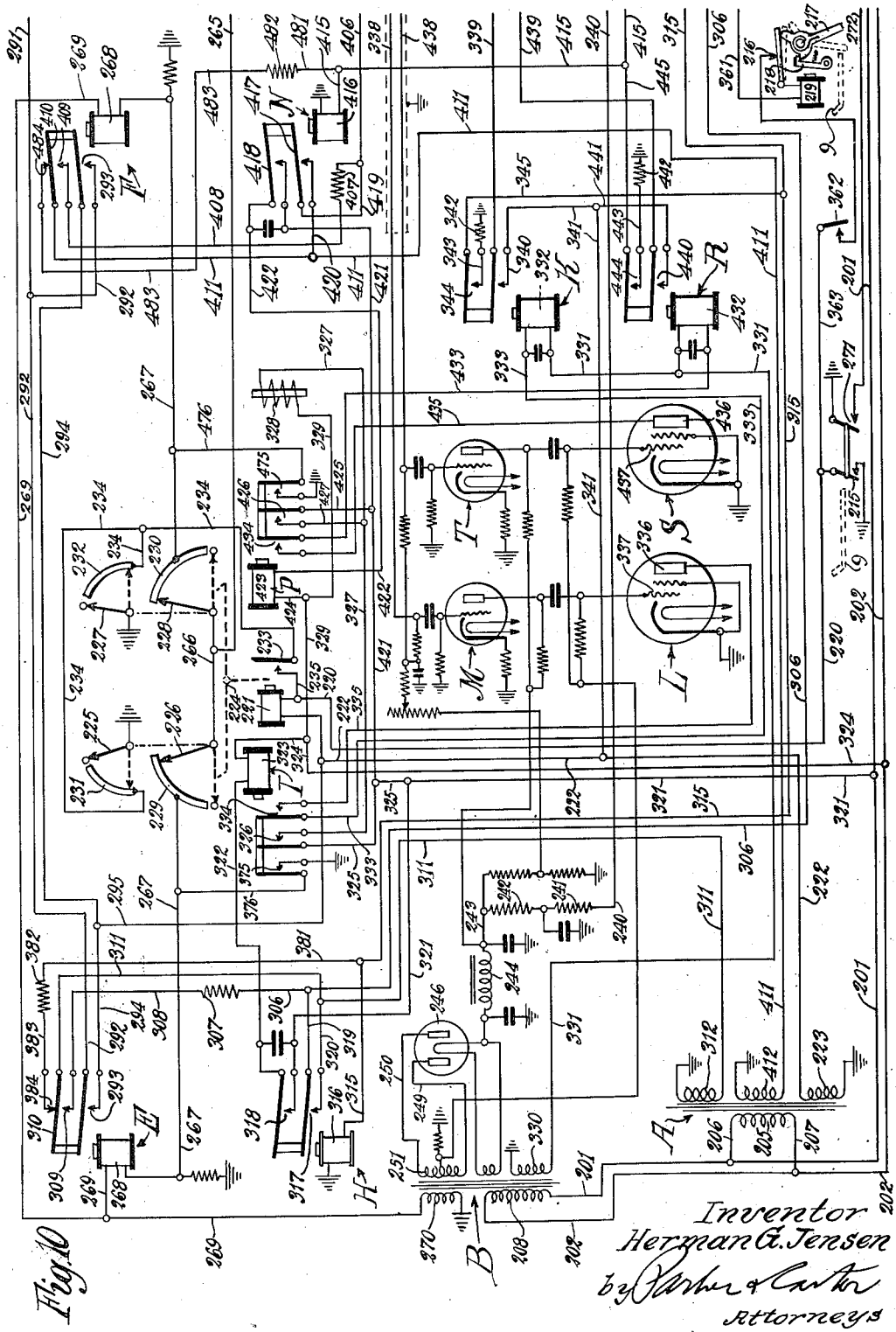


Fig. 10

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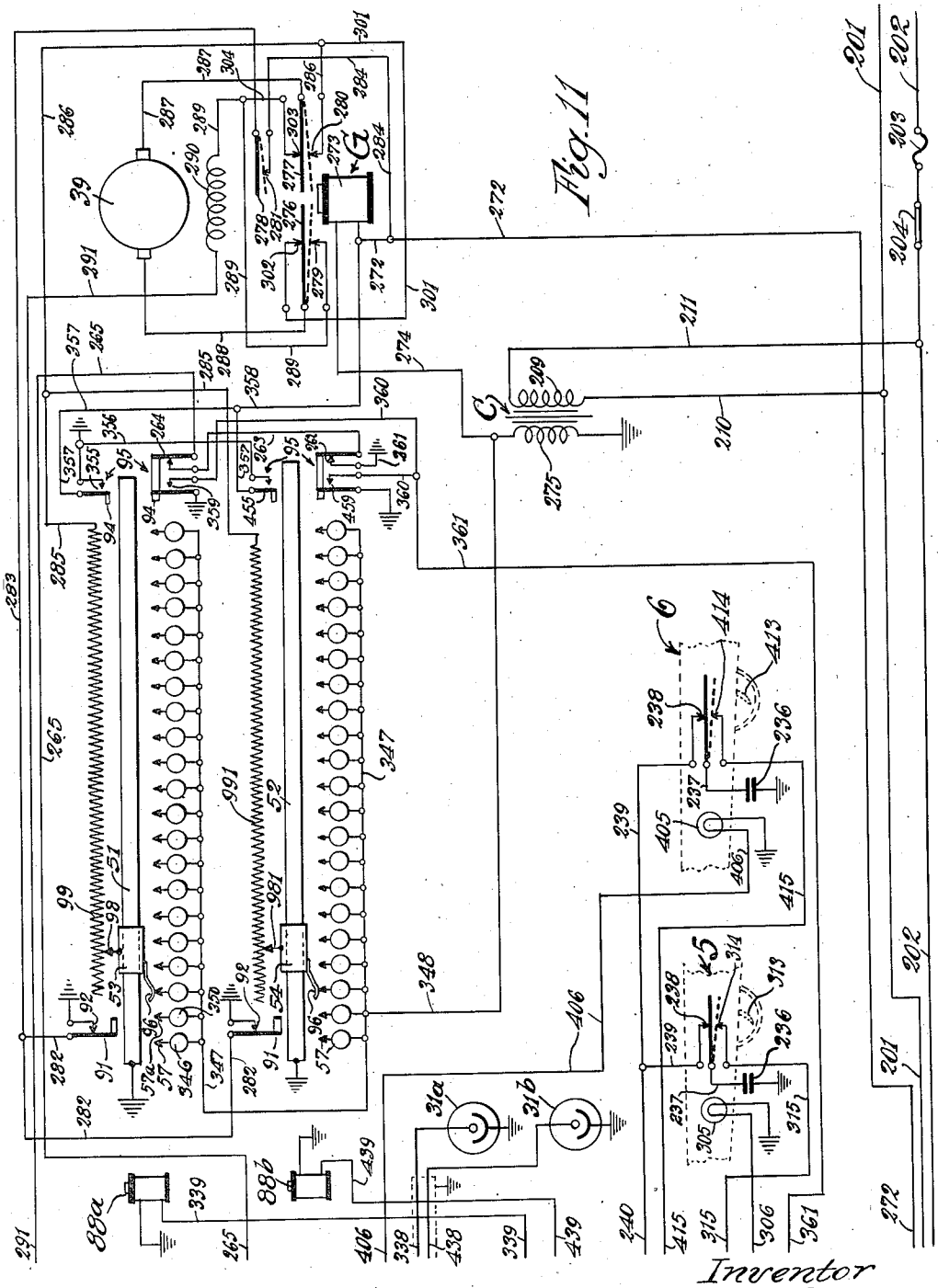


Fig. 11

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UNITED STATES PATENT OFFICE

2,309,614

ELECTRIC TARGET DEVICE

Herman G. Jensen, Chicago, Ill.

Application January 22, 1941, Serial No. 375,479

9 Claims. (Cl. 273—101.1)

My invention relates to improvements in electric target devices and has for one object to provide a new and improved apparatus whereby the skill of a marksman with an electric light gun may be recorded and indicated. Another object of the invention is to provide a new and improved control mechanism for electric light gun and target combinations. Another object of the invention is to provide suitable operating and control mechanisms whereby a plurality of shooters may compete and whereby the number of hits and the frequency of hits made by each of the shooters may be easily determined and disclosed. Another object of the invention is to provide a mechanism whereby, if any one of the players makes a perfect score, operation ceases so far as all the players are concerned but as a result all the players have the opportunity to fire another string.

Other objects will appear from time to time in the specification.

My invention is illustrated more or less diagrammatically in the accompanying drawings wherein Figure 1 is a perspective view of the device.

Figure 2 is a front elevation, on a larger scale, of the target and indicating device.

Figure 3 is a section along the line 3—3 of Figure 2.

Figure 4 is a section along the line 4—4 of Figure 2.

Figure 5 is a section along the line 5—5 of Figure 2.

Figure 6 is a section along the line 6—6 of Figure 5.

Figure 7 is a detail of the horse supporting mechanism.

Figure 8 is a section along the line 8—8 of Figure 6.

Figure 9 is a section along the line 9—9 of Figure 8.

Figures 10 and 11 together form a wiring diagram, the two figures being complementary in order that the scale may be large enough for easy reading.

Like parts are indicated by like characters in the various figures.

1 is a gun stand containing an electric amplifier 2 and pockets 3 and 4, for guns 5 and 6, the guns being joined to the gun stand respectively by electric cables 7 and 8. 9 is a coin control in the gun stand, 362 is a push button switch, 10 is a cable joining the target housing 11 with a suitable outlet 13, which may be connected to any suitable source of electric power, 14 and 15 are targets, 16 and 17 are race horse or other suitable movable racing devices, 18 is an aperture in the front panel or door 11*a*, preferably provided with a glass panel through which they are visible and 19 is a simulation of a race track in plan view, which may be made of translucent colored material and attached to the glass panel. Positioned in back of it is a housing 195, similar in shape as the race track which is divided into compartments, each of which houses a score indicating light later to be described.

Back of the aperture bounded by the race track 19 is an inclined floor 20, back of which again appears a picture of a race track grand stand 21, slots 22 and 23 are disposed in the inclined floor 20, through which the supports 24, 25 may project to support the horses 17 and 18, as will hereinafter appear.

Mounted adjacent the glass panel in the door 11*a* below the floor 20 is a partition 20*a* which conceals mechanism in the cabinet 11. It is provided with a pair of arcuate apertures 26, 27, through which extend offset portions of housings 28 and 29, upon which the targets 14 and 15 are mounted. Each housing 28 and 29 contains a photoelectric cell 31*a* and 31*b* respectively, which forms a bull's-eye for the targets 14 and 15. The offset portion of each housing has a lens 30 and through which the photocells are visible. The housings 28—29 are pivoted on pins 34 in brackets 35. A link 36 is attached to housing 29 above the pivot, and to housing 28 below the pivot and link 37 extends from housing 28 to a crank disc 38 so that when the crank disc 38 is rotated the two photoelectric cells will swing back and forth in opposite phases.

The crank disc 38 is driven by the motor 39 by means of any suitable drive mechanism, the motor being suspended on a bracket 40 downwardly depending from the frame 41.

The frame 41 is supported on a bracket 42 in the housing. Opposite to bracket 42 is a somewhat similar bracket 42—*a* on the other side of the housing, which supports a frame 43.

Supported by the frames 41 and 43 are rails 51, 52. Carriages 53 and 54 travel along these rails, being provided with grooved members 55, engaging the top and bottom edges of the two rails. Disposed between the rails adjacent their upper edges is an insulating plate 56 having spaced therealong a plurality of contact pins 57.

Mounted for rotation in the frame 41 in bearings 58 and 59 is a shaft 60, carrying a sprocket 61 driven by a chain 62 from the sprocket teeth 63 on the crank disc 38 so that the motor 39

drives both the link 37 to repirocate the targets and the shaft 60 to operate the remainder of the mechanism, as will hereinafter appear.

71 and 72 are sprockets mounted for free rotation on the shaft 60, they carry chains 73, 74 connected respectively to the carriages 53 and 54 by extending fingers 75, 76. The frame 43 supports two similar sprockets 710 and 720 which are mounted for free rotation on a shaft 730 so that the sprockets 710 and 720 are idle sprockets, about which the chains travel.

Sprockets 71 and 72 are driven by friction clutches including collars 77, 78 keyed or pinned to the shaft 60, having friction discs 79 engaging the outer sides of the sprockets 71, 72, and similar friction discs 80 which are pressed against the inner sides of the sprockets 71, 72 by spring cups 81 which enclose the outer ends of springs 82, the inner ends of which are engaged by collars 83 threaded on the shaft 60, locked in place by set screw 84. By adjusting the tension on the springs 82, the power of the clutches may be varied.

Riveted to each of the sprockets 71, 72 on the outer face thereof and so forming in effect a part of the sprocket is a toothed ratchet member 85. Associated with each member 85 is a pivoted Y shaped latch member 86 having an abutment arm 87 adapted to engage one of the ratchet teeth and so hold the tooth and the sprocket associated therewith against rotation. Since the pressures and velocities are low, no bad effect results from slipping the clutch and holding the sprockets against rotation while the shaft 60 continues to rotate. 88*a* and 88*b* are electromagnets in opposition to an armature 89 on the members 86. Each member 86 also has an arm 90. When either one of the magnets is energized the armature 89 is moved to the left in a clockwise direction, about its pivot, as shown in Figure 9, this disengages abutment 87 from the ratchet member 85 and allows the friction clutch to drive the sprocket. The angular displacement of latch member 86 disengaging abutment 87 from ratchet brings member 90 into the path of one of the teeth and so, as the sprocket rotates in a clockwise rotation, referring to Figure 9, the tooth which engages arm 90 will rotate it in a counterclockwise direction to force abutment 87 into engagement with the next ratchet tooth so that for each energization of the magnet 88*a* or 88*b* the chain sprocket is allowed to travel forwardly from one tooth to the next.

The horse supports 24, 25 are mounted on the carriages 53, 54 so that as the carriage travels the horse travels with it. Each carriage has an abutment 190 adapted when the carriage is at the rear end of its excursion to engage the limit switch arm 91 and break a circuit at the limit switch 92. Each carriage also has an abutment 93 adapted to engage the switch contact 94 to operate the multiple control switch 95, as will hereinafter appear. Each carriage also has a brush 96 adapted to engage successively each of the contact points 57 associated with that particular carriage and each carriage has a brush 98 and 981 respectively adapted to engage the rheostat coil 99 and 991 supported on the frame 100 in the cabinet 11; the purpose of this rheostat is to provide a variable resistance in the circuit, as will hereinafter appear, to change the rate at which the motors operate and the targets are reciproacted as the game progresses.

101 is a terminal block on the back wall of the housing 11, conductors 102, as indicated, lead from it to the various contact buttons 57, there being one series for each carriage.

The horses 16 and 17 are pivoted at 102 in the upper end of the supports 24 and 25 respectively, between stop members 103, 104, and are unbalanced so that as the carriage moves forward by a series of jerks or steps each horse will rock to simulate a gallop.

The following discussions of the wiring diagram shown in Figures 10 and 11 will disclose the method of operation of my device:

Current is supplied from any suitable source of power through the conductors 201, 202, there being a fuse 203 and a master switch 204 in the circuit. A primary coil 205 of transformer A is connected to conductors 201 and 202 by the conductors 206, 207. Primary coil 208 of the transformer B is directly connected to the conductors 201, 202. The primary coil 209 of transformer C is connected to the conductors 201, 202 by the conductors 210, 211.

In general the transformer A furnishes current to operate the switches, relays and associated portions of the apparatus, the transformer B furnishes current to operate the amplifying portion of the apparatus and some of the relays and switches, and the transformer C furnishes the current to operate certain of the indicating lights and reverisng relay for the motor 39.

When the device which forms the subject matter of my invention is to be operated the switch 204 will first be closed and this will energize the three transformers A, B, and C. Transformer B will provide power to heat or energize the various tubes in the amplifying system and the apparatus will then be in such condition that when the coin controlled switch is operated by manipulation of the coin slide the device will be conditioned for operation. For convenience I have shown in two places in Figure 10 the coin control slide 9 merely in order to show the fact that the coin control slide 9 simultaneously operates two switch mechanisms.

To condition the device for use, the operator drops a coin in the slot and pushes in the coin control slide. This closes the switch 215 and the switch 216 which is automatically held closed by the cam lever 217, which is locked then, as illustrated in full lines in Figure 10, against the tension of an associated spring by a latch 218 forming an armature for the magnet 219.

When the switch 215 is closed a circuit is closed from the ground through switch 215, conductor 220, reset magnet coil 221, conductor 222, secondary coil 223 of transformer A back to ground, this by means of reset mechanism 224, indicated diagrammatically by dotted lines, returns wipers 225, 226, 227, 228 from the position in which they were left upon previous operation of the machine to the starting position. Wipers 225, 226 being on one shaft and so operating in unison and the same being true of wipers 227, 228.

The starting position is the position shown in full lines in Figure 10 with the wipers 226, 228 engaging the segments 229, 230 and the wipers 225, 227 out of contact with the segments 231, 232.

When the reset magnet coil 221 is energized it also closes the switch 233. At that time the wipers 225 and 227 are respectively held in engagement with the segments 231, 232 and so a circuit is closed in parallel from the ground through 225, 231, conductors 234, and from ground through 227, 232 to conductor 234, thence through switch 233 to conductor 235, conductor

220, coil 221, conductor 222, secondary coil 223 of transformer A to ground. This insures that the magnet coil 221 will remain energized until the reset mechanism has fully completed its operation, and until the wipers 225 and 227 have passed beyond their associated segments 231, 232 even though the circuit may have been broken at switch 215 before the reset operation was completed.

The gun flash is timed by the discharge from a condenser so as to control the time of the flash. This condenser must be charged after every shot. This is accomplished by the following circuits:

From ground through condenser 236, conductor 237, switch 238, conductor 239, in each of guns 5 and 6, thence through conductor 240, resistance 241, resistance 242, conductor 243, to the source of direct current diagrammatically illustrated as including rectifying tube 245, choke coil 244, conductors 249, 250 and coil 251 of transformer B. This source of direct current furnishes the necessary current to charge each of the condensers 236 whenever the switch 204, is closed and the gun trigger switches are in the full line positions as shown in Figure 11.

When the reset mechanism moves wipers 226 and 228 into engagement with the segments 229 and 230, identical circuits are closed through the two play control relays E and F. Since these circuits are identical a description of one will suffice for both. From ground conductor 261, switch 262 of one of the multiple switches 95, conductor 263, switch 264 of the other multiple switch 95, conductor 265, conductor 266, wiper 228, segment 230 or wiper 226, segment 229, conductor 267, play control relay coil 268 of play control relays E and F, as the case may be, conductor 269, coil 270 of transformer B to ground. This energizes both of the play control relays E and F and the circuit to do this will be closed unless one or the other of the carriages 53, 54 has been moved to the right hand end of its excursion, as shown in Figure 11, to break the circuits at switches 262 or 264, or both.

As will hereinafter appear, whenever all the competitors have fired their maximum number of shots or whenever any one of the competitors has had so many hits that the carriage associated with his gun has reached the end of its excursion the motor will stop and the apparatus will be left in that position until again reconditioned for operation. The reconditioning act responsive to the coin slide will, as above pointed out, hook up relays E and F and this by the circuit, about to be described, will start the motor, but it will always start the motor in the reverse direction because, since the device must be reconditioned, the motor must always first return the carriages to the starting position.

The circuits which do this are as follows:

The motor reversing circuit extends from ground through switch 271, actuated by the coin slide 9, conductor 272, coil 273 of reversing relay G, conductor 274, secondary coil 275, of transformer C to ground. This moves switch control arms 276, 277, 278 into dotted line positions closing circuits at 279, 280 and 281, when the following circuits will be completed.

First, the lock-up circuit to hold the relay G in the closed position, this extends from the ground through either one of the switches 92, conductor 282, to conductor 283, switch 281, conductor 284, conductor 272, relay coil 273, conductor 274, coil 275 to ground, thus, as soon as the magnet coil 273 has been energized by closing the circuit at switch 271, this second lock-up circuit is closed and remains closed independent of opening and closing the circuit at 271. The lock-up circuit is broken only when each of the carriages has moved back to the starting position to engage the switch arms 91 and break the circuit at switch points 92. If either one of the carriages should be at the starting position, that would not interfere with the closure of the circuit through the other switch; only when both carriages are at the starting position is the lock-up circuit broken.

With these circuits closed, the motor is started by the following circuit:

From ground through either track 51 or 52, or both, carriages 53, or 54, wipers 98 or 981, resistance coil 99 or 991, conductor 285, conductor 286, switch point 289, switch arm 277, conductor 287, motor 39, conductor 288, switch arm 276, switch point 279, conductor 289, field coil 290 of the motor 39, conductor 291, conductors 292, switches 293, associated with either or both of the relays E or F, conductor 294, conductor 295, conductor 222, coil 223 of transformer A to ground. This starts the motor and because of the position of the switches 276, 277 causes it to return the carriages 53, 54 back to the starting position.

As soon as all of the carriages have reached the starting position the circuits are broken at 92, the magnet 273 is de-energized, the switch arms 276, 277, 278 return to the full line position and this causes the motor to rotate in a direction such as to drive the carriages forward. The circuit which accomplishes this is from ground through tracks 51, 52, wipers 98, 981, resistance coils 99, 991, conductor 285, conductor 286, conductor 301, switch point 302, switch arm 276, conductor 288, motor 39, conductor 287, switch arm 277, switch point 303, conductor 304, conductor 289, field coil 290, conductor 291, conductor 292, switch points 293 of relays E and F, conductor 294, conductor 295, conductor 222, coil 223 of transformer A to ground. The motor is now rotating in the forward direction, the carriages are held against movement, the friction clutches slipping, by means of the Y latches disclosed in Figures 8 and 9.

During this time the gun light is supplied with a current sufficient to heat it but not sufficient to generate light enough to cause actuation of the photoelectric cell. There is a separate gun for each target and the circuits for each gun are independent and must be separately traced, both for heating the gun light and for gun operation.

In order to protect the gun light against too rapid deterioration, to speed up the flash of light and to avoid the danger of current surges in the system which might cause improper operation of the amplifying device, it is desirable to keep the filament hot during operation of the devices so that when a flash of light is to be projected on the target the gun light does not have to be heated from dead cold.

The heating circuit for gun 5 is from ground through gun lamp 305, conductor 306, resistance 307, conductor 308, switch point 309, switch arm 310, conductor 311, coil 312 of transformer A to ground. The circuit for gun 6 is from ground through gun lamp 405, conductor 406, resistance 407, conductor 408, switch point 409, switch arm 410, conductor 411, coil 412, of transformer A to ground. These two circuits remain closed and the guns are heated as long as play control relays

E and F are kept in the closed position, by the shot counting mechanism previously disclosed.

The two gun light circuits being independent, each operator, when he pulls the trigger, produces an effect altogether independent of what happens with respect to the other gun. When he pulls the trigger 313 on gun 5 or 413 on gun 6, by a mechanism not here shown because it forms no part of the present invention, the switch arm 238 in each case is moved to the down position, shown in dotted line in Figure 11, and the appropriate condenser 236 is allowed to discharge.

Taking first gun 5, the condenser discharge circuit is from ground through condenser 236, conductor 237, switch point 314, conductor 315, coil 316 of shot timer relay H to ground. The charge in the condenser takes a measurable time to discharge and as it discharges through the coil 316, the time it takes controls the length of time during which the shot time relay remains energized. The energization of relay H closes switches 317 and 318, shunts out the resistance 307 and actuates the shot counting relay I.

The circuit for shunting out the resistance 307 is from ground through light 305, conductor 306, conductor 319, switch 317, conductor 320, conductor 311, coil 312 to ground.

The closing of switch 318 closes a circuit from the main power line 201 through conductor 321, switch 318, conductor 322, coil 323 of hit counting relay I, conductor 324, to source of power at conductor 202, thus every time the trigger 313 is pulled and the coil 316 is energized, coil 323 is energized to move the wiper 226 one step along the shot counting segment 229, and to move wiper 225 upon and along the segment 231.

The energization of the shot counting coil 322 also closes up the three switches associated with the shot counting relay I. One of these switches closes the thud sounding circuit to simulate the sound of a shot, another closes the safety circuit which makes it impossible for the photoelectric cell to be energized by anything except a flash of light from its own gun, and the third is a delay action circuit which keeps the circuit hooked up after the last shot to make sure that all elements of the system will have time to assume their proper final position.

The thud sounding circuit is from the power line 201, conductor 321, conductor 325, switch 326, conductor 327, thud sounding coil 328, conductor 329, conductor 324, back to line 202.

The safety circuit is from ground through coil 330 of transformer B, conductor 331, coil 332, of relay K, conductor 333, switch 334, conductor 335, to plate 336 of tube L. This puts voltage on the plate but current of course will not flow until the photo cell has energized the grid 337, thus voltage is put on the plate when the trigger is pulled so that only a flash of light projected by the gun, and properly aimed to energize one of the photoelectric cells can be effective.

The circuit is from ground through the photoelectric cell 31*a*, conductor 338, tube M and thence through the amplifying system, energizing grid 337 so tube L may function so that current flows through the coil 332, to close the relay K.

When the relay K is energized a circuit is closed from ground through magnet coil 88*a*, conductor 339, switch 340, conductor 341, conductor 222, coil 223 of transformer A to ground. This attracts the armature 89 and results in one actuation of the Y shaped latch member 86 allowing the friction clutch to drive the chain one step forward to move the carriage 53 one step forward, thus indicating by the position of the carriage that a hit has been made.

At the same time the energization of coil 332 and so the hooking up of relay K closes a circuit from ground through resistance 342, conductor 343, switch 344, conductor 345, conductor 315, switch 314 closed by the pull on the trigger, conductor 237, condenser 236 to ground. The resistance 342 associated with relay K is of less value than the resistance of coil 316 in relay H so that as soon as a hit is scored relay H is de-energized, thus making it impossible, even during the short time that discharge from the condenser continues, for another hit impulse to be received.

The purpose of this is to protect the apparatus against the danger of anyone again pulling the trigger so rapidly that two impulses may be recorded and to protect it against the danger of simultaneously, or nearly simultaneously, with the pull of the trigger, energizing the photoelectric cell with light from some other source, thus makes it impossible for two hits to be recorded when only one shot is counted on the shot counter.

The condenser discharge circuit for gun 6 is from ground through condenser 236, conductor 237, switch point 414, conductor 415, coil 416, of shot timer relay N to ground, the energization of relay N closes switches 417 and 418 to shunt out the resistance 407 and actuate the shot counting relay P.

The circuit for shunting out the resistance 407 is from ground through light 405, of gun 6, conductor 406, conductor 419, switch 417, conductor 420, conductor 411, coil 412 to ground.

The closing of switch 418 closes the circuit from the main power line 201 through conductor 321, conductor 325, conductor 421, switch 418, conductor 422, coil 423 of hit counting relay P, conductor 424, conductor 329, conductor 324 to source of power at conductor 202, thus every time the trigger 413 is pulled and the coil 416 is energized coil 423 is energized to move the wiper 228 one step along the shot counting segment 230 and to move wiper 227 upon and along the segment 232.

Coil 423 also closes up the three switches associated with the shot counting relay P, the effect of which is substantially the same as the closing up of the switches associated with the shot counting relay I. Either gun will operate the thud sounder. Each gun has its own safety circuit and each gun has its own delay action circuit.

The thud sounding circuit for gun 6 is from power line 201, conductor 321, conductor 325, conductor 421, conductor 425, switch 426, conductor 427, conductor 327, thud sounding coil 328, conductor 329, conductor 324, to power line 202.

The safety circuit is from ground through coil 330 of transformer B, conductor 331, coil 432 of relay R, conductor 433, switch 434, conductor 435 to plate 436 of tube S. This circuit has the same effect on tube S that the circuit previously described with respect to gun 5 has on tube L and makes it possible for energization of photoelectric cell 31*b* to cause operation of the device, under which circumstances current would flow from the plate 436 of tube S or 336 of tube L to the cathode and thence to ground.

This circuit is from ground through cell 31*b*, conductor 438, tube T, thence through the ampli-

fying system energizing grid 437, permitting tube S to function so that current flows through the coil 432 to energize the relay R.

When the relay R is energized, a circuit is closed from ground through magnet coil 88b, conductor 439, switch 440, conductor 441, conductor 341, conductor 222, coil 223 of transformer A to ground.

This energizes the coil 88b to actuate the Y shaped latch member 86 which controls the carriage 54 associated with the gun 6 which is being fired. Each gun separately controls one of the latch members.

At the same time the energization of coil 432 and the hooking up relay R closes a circuit from ground through resistance 442, conductor 443, switch 444, conductor 445, conductor 415, switch 414, closed by the pull on the trigger 413, of gun 6, conductor 237, condenser 236 to ground. The resistance 442 associated with the relay R is of less value than the resistance of coil 416 in relay N so that as soon as a hit is scored relay N is de-energized, thus making it impossible even during the short time that discharge from the condenser continues for another hit impulse to be received.

This protects the system just as does the safety circuit associated with gun 5.

When the carriage 53 is in the initial position wiper 96 engages the first light button 57 and this illuminates the light 346 associated therewith, the circuit being from ground through track 51, carriage 53, wiper 96, button 57, light 346, conductor 347, conductor 348 to coil 275 of transformer C, thence to ground. This lights up light 346 in the start-finish panel. As soon as the carriage 53 has been moved forward one step as a result of a hit, wiper 96 engages the second button 57a and lights 350, the circuit in this case being from ground through track 51, carriage 53, wiper 96, button 57—a, light 350, conductor 347, conductor 348, coil 275 of transformer C to ground, thus lighting up the first light in the course around the track.

Each successive hit moves the carriage one step forward and lights up the next light in the sequence up to twenty, at which time the carriage 53 will reach the end of its course and will engage by means of the switch lug 93 member 94 of the switch assembly 95, thus opening one of the switches and closing two others. The opening of switch 262 or 264 resulting from either one of the carriages reaching the end of its excursion breaks the circuit which hooks up the play control relays E and F and the shot counter wipers 226, 228 so as to permit conditioning of the apparatus for a second game independent of manipulation of the coin control. The apparatus is so conditioned in connection with closing of the other two switches associated with the switch element 95.

The two switches 355 and 455 are in parallel. When they are closed a circuit is closed from ground through conductor 356, of the switch 355 or 455, conductor 357, conductor 358, coil 273, of relay G, conductor 274, coil 275 of transformer C to ground. This results independently of the coin control switch, in reversing the power circuit for the motor 39.

The closing of the two switches 359, 459 closes a circuit from ground through 359 or 459, conductor 360, conductor 361, coil 219, switch 216 already closed and held closed by cam lever 217, pushing button control switch 362, conductor 363, conductor 220, reset coil 221, line 222 to the coil 223 of transformer A back to ground. This circuit is only partially closed and the apparatus does not become reconditioned for re-operation until push button switch 362 has been manipulated by the player, but when the circuit above described is hooked up and ready, all the player needs to do is push the button 362 to automatically re-condition the whole apparatus for a second run, because the closing of the circuit by button 362 energizes coil 221 just as it would have been energized by manipulation of the coin slide to return the shot counter wipers to the starting position, to start the motor in the reverse direction, to energize the play control relays and return the carriage to the starting position, after which of course the motor automatically reverses, as previously disclosed.

When either one of the players makes a perfect score and his carriage operates its associated switch assembly 95 this makes it impossible for the other player to fire any more shots because the opening of switches 262 or 264 and the closing of switches 355, 359 or 455, 459 opens the circuit which hooks up the play control relays E and F so that no further play is possible, but even though the second player cannot finish his string as a result of the success of the first player he has an opportunity to play the entire game over again.

The purpose of the resistance coils 99 and 991 is to vary the speed of the motor and therefore the rate of oscillation of the targets. The resistance is high at the beginning of the travel of the carriage and the motor speed is low. The resistance decreases as the wiper 98 or 981 moves to the right in Figure 11 and as the resistance decreases the motor speed increases and the targets oscillate more rapidly to make it harder and harder to make a hit. The speed is controlled by the competitor who makes the most hits since the resistances 99 and 991 are in parallel, whichever carriage gets ahead will reduce the resistance so that the more nearly either competitor comes to the end of the game the more rapidly will the targets move.

On the last shot the wiper 226 or 228 leaves the segment 229, or 230 and it is necessary to insure that this leaving of the segment will not break the necessary control circuits soon enough to prevent the various moving elements of the system completing their excursion.

When the coil 323 of relay I is energized, it also results in closing switch 375 which closes a circuit from ground through switch 375, conductor 376, conductor 267, magnet coil 68 in play control relay E, conductor 269, coil 270 of transformer B to ground. This keeps play control relay E hooked up until coil 323 has become de-energized, after which time it is safe for play control relay E to let go because all of the parts will then have assumed their terminal position.

When the coil 423 of relay P is energized it also results in closing switch 475 which closes a circuit from ground through switch 475, conductor 476, conductor 267, magnet coil 268, in play control relay F, conductor 269, coil 270 of transformer B to ground. This keeps the play control relay F hooked up until coil 423 has become de-energized, after which time it is safe for play control relay F to let go because all of the parts will then have assumed their terminal position.

During the time that the apparatus is not functioning but during the time that the master switch is closed the shot timing condenser

is always charged and means are therefore provided to insure that a pull on the trigger, when the coin control switch has not been manipulated, will not result in operation of the shot timer relay. The circuit that protects the apparatus against improper operation of the shot timer relay includes means for shunting in a lesser resistance than the shot timing relay so that, whenever the condenser is discharged, when the apparatus is not conditioned for operation, the discharge will be through that resistance but not through the shot timer relay. The resistance is provided to prevent the condenser discharging against a dead short.

The circuit that accomplishes this is from ground through condenser **236**, conductor **237**, switch **314**, of gun **5**, conductor **315**, conductor **381**, resistance **382**, conductor **383**, switch **384**, switch arm **310**, conductor **311**, coil **312** to ground, thus when the trigger **313** is pulled the condenser discharge is through the coil **382** rather than through coil **316** and the intensity will not be great enough to actuate the shot timer relay.

A similar circuit for the gun **6** to prevent actuation of its shot timer relay N is from ground through condenser **236**, conductor **237**, switch **414** of gun **6**, conductor **415**, conductor **481**, resistance **482**, conductor **484**, switch **484**, switch arm **410**, conductor **411**, coil **412** to ground.

In a number of places on the wiring diagram I have shown condensers and resistors. They have not been specifically described because their function is the usual one in electronics, namely to prevent surging, act as filters and to prevent sparking and they illustrate diagrammatically the fact that the circuits and mechanisms above outlined must be and will be protected by the use of such filters, resistors and condensers in accordance with usual electronic practice.

In Figures 10 and 11 the dotted lines and grounds associated with the conductors **338** and **438** indicate shielding for the photoelectric cell cables to protect them and the system against impulses from outside sources which might otherwise interfere with the operation of the apparatus and which might even go so far as to cause hits or shots to be registered when not fired.

In order to insure against mechanical failure which might result in the carriage not stopping at the end of its excursion and so causing damage to the switches and other parts of the mechanism. Stops **500** are placed at the end of the tracks so as to positively arrest the carriages in their forward excursion.

Similar stops **501** are provided at the opposite end of the tracks to positively arrest the carriages in their rearward excursion during resetting operation.

The electrical circuits for the heating elements for tubes L, M, S, T of the amplifier have been omitted since they are well understood in the art.

I claim:

1. In an electric target device, a plurality of light guns, a plurality of targets and a plurality of visible, movable racing devices, electric connections between a gun, a target and a racing device, a motor adapted to impart movement to the targets and means controlled by each racing device for increasing the speed of the motor as the racing device advances.

2. In an electric target device, a plurality of light guns, a plurality of targets and a plurality of visible, movable racing devices, electric connections between a gun, a target and a racing device, a motor adapted to impart movement to the targets and automatic means for increasing the speed of the motor as the racing device advances.

3. In an electric target device a plurality of light guns, a plurality of targets and a plurality of visible, movable racing devices, electric connections between a gun, a target and a racing device, a motor adapted to impart movement to the targets, means responsive to a hit on the target for causing the motor to impart movement to the racing device corresponding to the target which is hit and means controlled by each racing device for increasing the speed of the motor as the racing device advances.

4. In an electric target device, a plurality of light guns, a plurality of targets and a plurality of visible, movable racing devices, electric connections between a gun, a target and a racing device, a motor adapted to impart movement to the targets, means responsive to a hit on the target for causing the motor to impart movement to the racing device corresponding to the target which is hit, and means for increasing the speed of the motor as the racing device advances.

5. In a target device, a light gun, a movable target, a movable racing object, electric connections between the three of them adapted to cause the racing device to take one step forward in response to each hit on the target and means controlled by the racing device for increasing the rapidity of movement of the target as the racing device advances.

6. In a target device, a light gun, a movable target, a movable racing object, electric connections between the three of them adapted to cause the racing device to take one step forward in response to each hit on the target and automatic means for increasing the rapidity of movement of the target as the racing device advances.

7. A target device including a plurality of parallel tracks, a plurality of carriages mounted for movement, one along each track, a motor, a friction drive connection between the motor and each carriage, releasable means for holding each carriage against movement, a target associated with each carriage and means responsive to a hit on a target for releasing the associated carriage, holding means to permit forward movement of the carriage and automatic means for causing reengagement of the carriage holding means after the carriage has moved forward a predetermined excursion, a series of contact members spaced along each track, a contact finger on the carriage adapted to engage one of the contact members after each forward step of the carriage has been made, a plurality of electric lights, one associated with each contact member and circuits including said lights, said contact members, and the finger on the carriage, adapted to be successively closed as the contact finger moves from one contact member to the next.

8. A target device including a plurality of parallel tracks, a plurality of carriages mounted for movement one along each track, a motor, a friction drive connection between the motor and each carriage, releasable means for holding each carriage against movement, a target associated with each carriage and means responsive to a hit on a target for releasing the associated carriage holding means to permit forward movement of the carriage and automatic means for causing reengagement of the carriage holding means after

the carriage has moved forward a predetermined excursion, a rheostat coil parallel with each track and a contact finger on the carriage adapted to travel along the rheostat coil as the carriage moves forwardly, a power circuit for the motor including the rheostat coil whereby the resistance in the circuit decreases as the carriage moves forwardly.

9. A target device including a plurality of parallel tracks, a plurality of carriages mounted for movement one along each track, a motor, a friction drive connection between the motor and each carriage, releasable means for holding each carriage against movement, a target associated with each carriage and means responsive to a hit on a target for releasing the associated carriage holding means to permit forward movement of the carriage and automatic means for causing reengagement of the carriage holding means after the carriage has moved forward a predetermined excursion, a rheostat coil parallel with each track and a contact finger on the carriage adapted to travel along the rheostat coil as the carriage moves forwardly, a power circuit for the motor including the rheostat coil whereby the resistance in the circuit decreases as the carriage moves forwardly, there being a similar finger associated with each carriage whereby the resistance in the circuit is decreased by forward movement of each and everyone of the carriages.

HERMAN G. JENSEN.