Feb. 2, 1943. D. E. HOOKER ET AL 2,310,085

TARGET SHOOTING APPARATUS

Filed Aug. 10, 1940 4 Sheets-Sheet 1

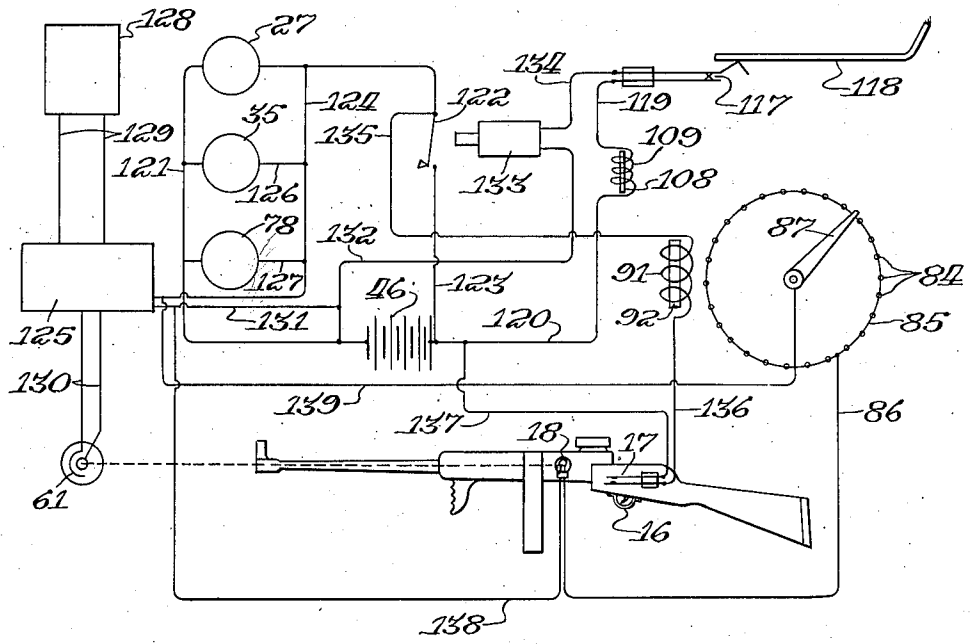


Fig. 1.

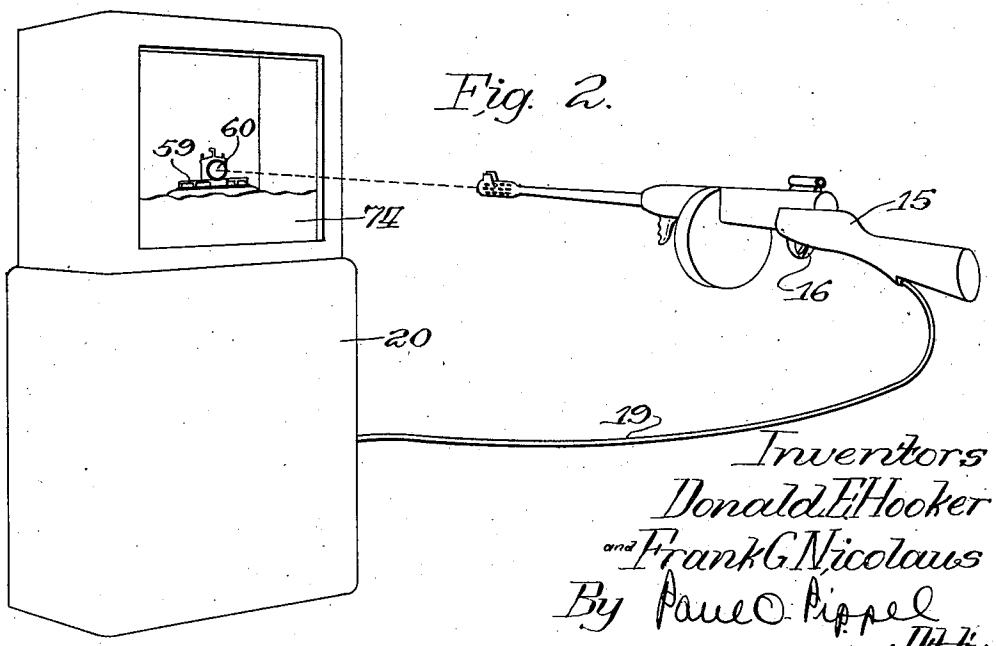


Fig. 2.

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TARGET SHOOTING APPARATUS

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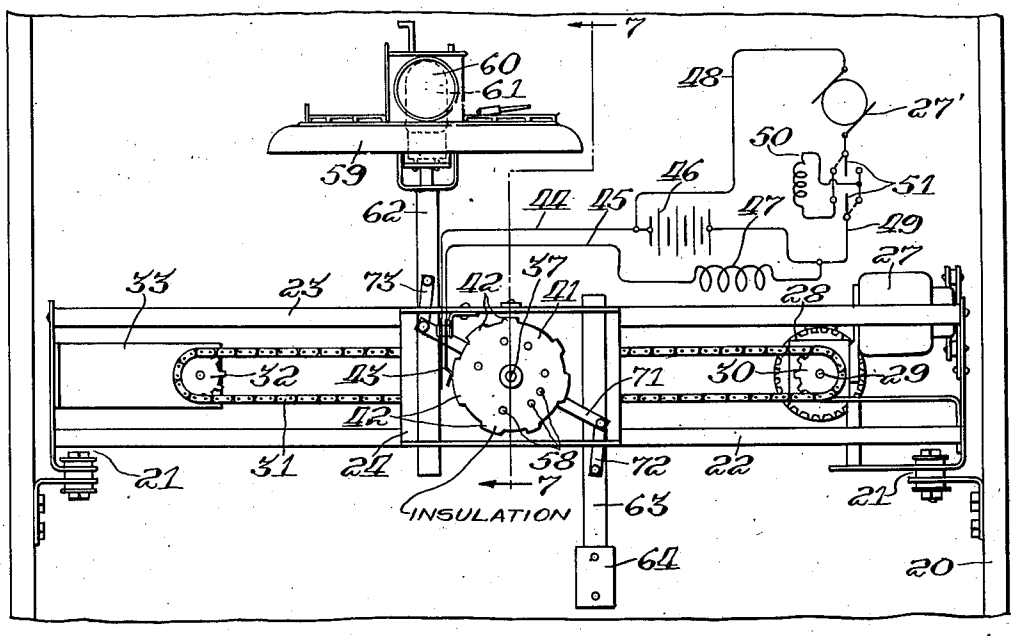


Fig. 3.

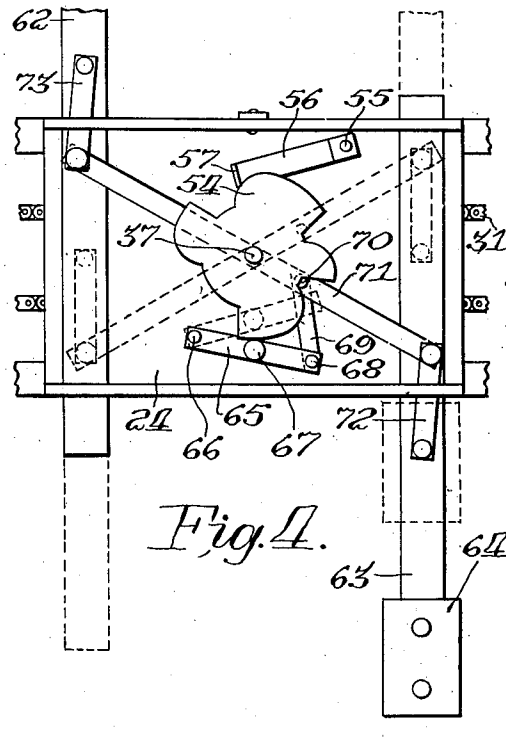


Fig. 4.

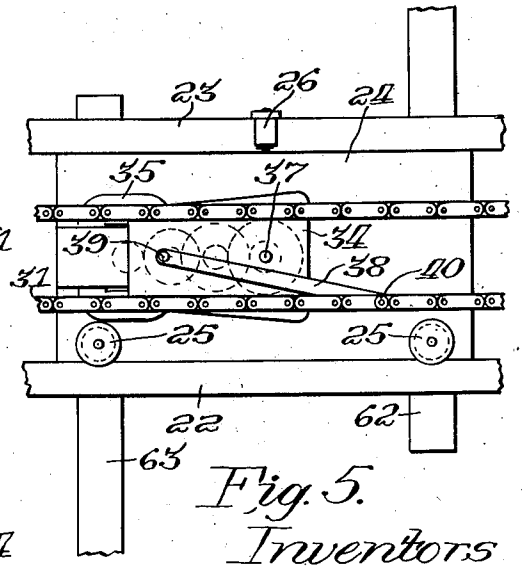


Fig. 5.

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TARGET SHOOTING APPARATUS

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Fig. 6.

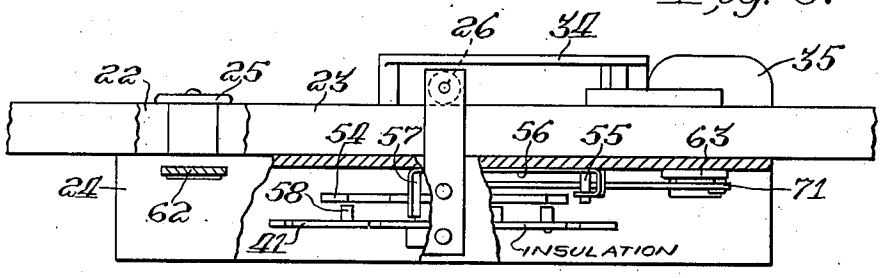


Fig. 7.

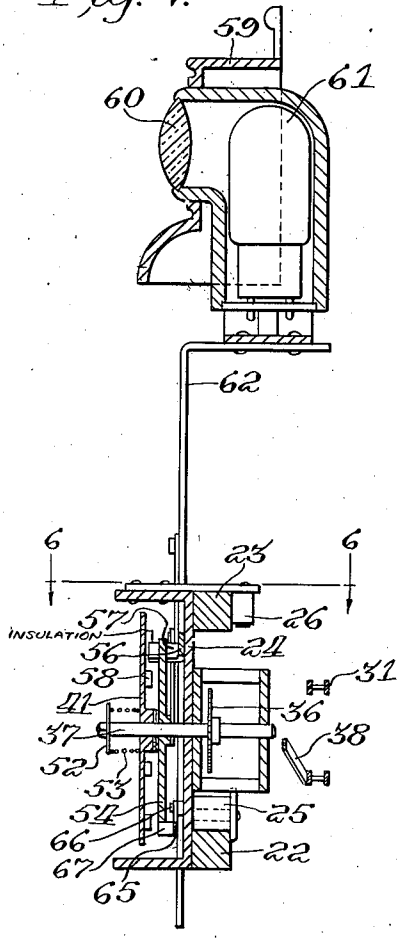
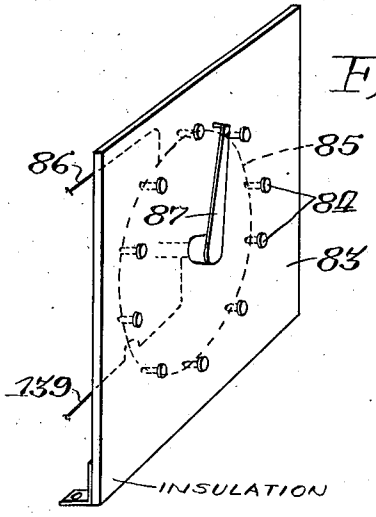


Fig. 8.



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TARGET SHOOTING APPARATUS

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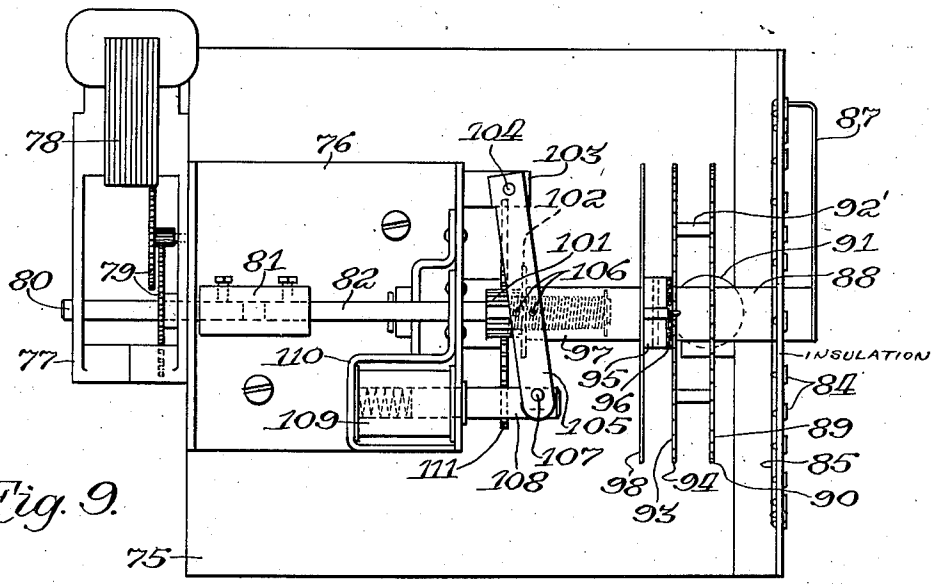


Fig. 9.

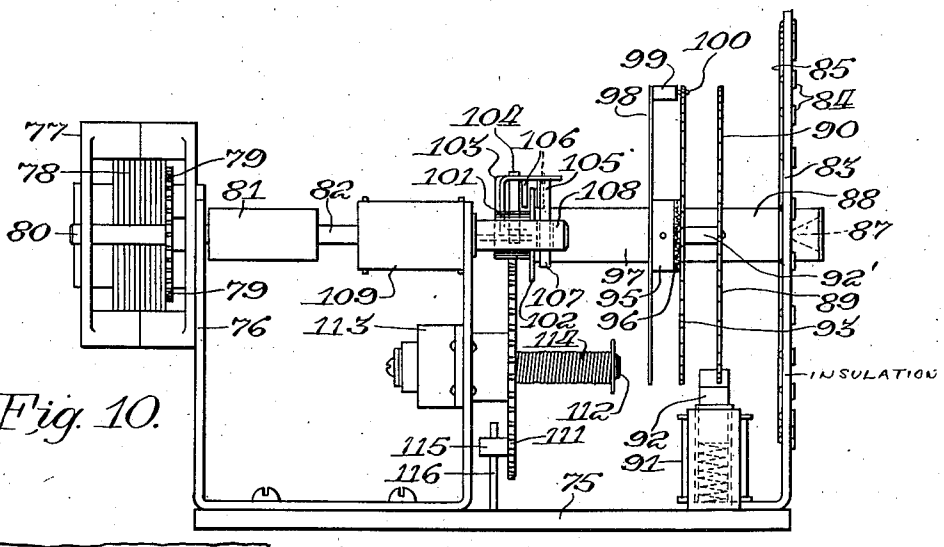


Fig. 10.

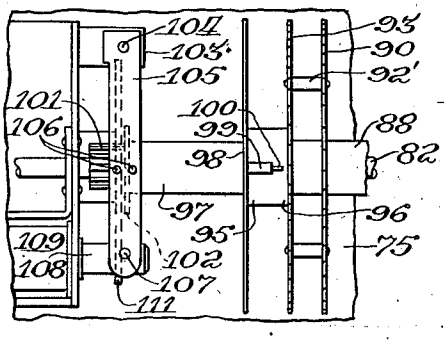


Fig. 11.

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Patented Feb. 2, 1943 2,310,085

UNITED STATES PATENT OFFICE

2,310,085

TARGET SHOOTING APPARATUS

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Application August 10, 1940, Serial No. 352,152

12 Claims. (Cl. 273—105.2)

This invention relates to a gun shooting apparatus usable for amusement purposes or practicing skill in marksmanship. More particularly the invention has to do with a novel target mechanism and means for moving the target in an improved manner to create interest and to test the marksman's skill to a maximum degree. Herein, the improved target is to be described in connection with a light ray gun shooting game, wherein a photo-electric cell or light responsive element is associated with the target, although it will be obvious as the disclosure is more fully made that the target and the means that moves same is usable in connection with guns shooting bullets other than a "bullet" of light.

It is desirable to cause the target to move back and forth and up and down in an indeterminate and unpredictable manner so that a real test of marksmanship will be presented.

Accordingly, the main object of the invention is to provide an improved target apparatus.

Another object is to provide improved means for moving the target in a novel manner.

Still another object is to provide motor driven means to cause the target to move in an indeterminate manner.

Other important objects of the invention will become apparent to those versed in this art as the disclosure is more fully made.

Briefly, in a preferred embodiment these objects are achievable by providing a track along which a carriage is driven back and forth by a reversible electric motor which is turned on when the game is released for play as by means of a coin chute controlled circuit. Mounted for up and down movement on the carriage as the latter moves to and fro is a support carrying a target including, if desired, a photo-electric cell. The carriage carries another electric motor also turned on when the game is started, the said second motor serving to rotate a cam wheel having high portions of varying lengths and varying length dwells. This cam wheel keeps turning as the carriage moves to and fro and regulates a switch that controls the field for the first motor and by reversing the field in an associated circuit the first motor is reversibly driven. This motor on the carriage also turns another cam wheel that actuates linkage for causing the target and its support to bob up and down. Up and down and to and fro motion of the target is thus provided, both movements being of variable stroke to create a surprising haphazard, unpredictable motion for the target behind a drop or panel, which is positioned in front of the target. A third electric motor is also provided and started simultaneously with the other two, this third motor serving to rotate a wiper switch arm over a circle of contacts. This wiper arm is normally locked, there being a friction drive coupling between the arm and motor. However, when the light gun has its trigger switch closed, the lock is unlocked and the wiper arm is freed to be driven by the said third motor over the contacts to make circuits causing the electric lamp in the gun to flash, all as will later be more fully described. By this means a single flash of light can be fired or a rapid series of them to simulate machine gun action.

In the accompanying sheets of drawings illustrating one preferred form of the invention;

Figure 1 is a typical electric wiring circuit for the gun and target apparatus;

Figure 2 is a general perspective view of the gun, connecting electric cable, and the cabinet housing the target apparatus;

Figure 3 is an enlarged, detail front elevational view of the target, track and carriage as viewed from the front of the cabinet when the front panel thereof is removed. A reversing motor circuit is also included in this figure;

Figure 4 is an enlarged detail, front elevational view of certain target carriage parts as viewed in Figure 3, but with the front cam wheel for the motor reversing circuit removed to expose the inner cam that mechanically regulates up and down motion of the target;

Figure 5 is a rear elevational view of the target carriage to show the motor on the carriage that rotates the cam wheels;

Figure 6 is an enlarged plan view, partly in section, taken along line 6—6 of Figure 7 to illustrate the target carriage;

Figure 7 is a vertical sectional view through the target and its carriage, taken along line 7—7 of Figure 3, looking in the direction of the arrows;

Figure 8 is a perspective detail view of the rotary wiper switch;

Figure 9 is a plan view of the rotary wiper switch unit used in the light control circuit for the light ray shooting gun. In this view the wiper switch arm is locked;

Figure 10 is an end elevational view of the unit as shown in Figure 9; and,

Figure 11 is a detail plan view of a portion of the showing in Figure 9 with the wiper arm shown released.

As shown in Figures 1 and 2 there is a light ray shooting gun 15 having a trigger 16 and a

trigger switch 17 which is normally open. The gun includes an electric lamp 18 as a light source. An electric cable 19 connects the gun with a cabinet 20 in which the target and control means therefor is housed.

In the housing 20 are opposite brackets 21 for carrying transverse, parallel, lower and upper track rails 22 and 23 on which a carriage 24 is carried for to and fro sliding movement by means of a pair of flanged rollers 25 on horizontal axes on the lower rail 22, and by means of a single roller 26 on a vertical axis on the upper rail 23, as shown best in Figures 5 and 7. The disposition of these rollers is such that the carriage is held from jumping off the track rails.

Looking from the front, it will be seen in Figure 3 that the right hand bracket 21 includes supports for carrying an electric motor 27 having armatures 27' as shown in the wiring diagram included in Figure 3. This motor has a shaft driving reversible worm gearing 28 for turning a horizontal shaft 29 and a drive sprocket wheel 30. An endless chain 31 is trained around said wheel 30 and also around an idler sprocket wheel 32 carried in a bracket 33 supported on the opposite structure 21, all as clearly shown in Figure 3.

To the back side of the carriage 24 (see Figures 5 and 7) is suitably secured the frame 34 of another electric motor 35 connected by reduction gearing 36 to drive a fore and aft extending horizontal shaft 37 journaled in the carriage 24 and bracket 34. A push pull link 38 is pivotally connected at one end as at 39 to the bracket 34 and at its other end as at 40 is pivotally connected to one run of the chain 31, said link 38 being disposed under the shaft 37 thereby limiting upward movement thereof. When the chain 31 is being driven in one direction or another by the motor 27 it can now be appreciated that the link 38 acts to push or pull the carriage 24 and cause it slidably to roll along the track rails 22 and 23.

The shaft 37 on the front face of the carriage 24 (see Figures 3, 4 and 7) has loose on the shaft, the hub of a timer disk 41 which by means of a friction disk 41' is turnable with the shaft 37 when the motor 35 is running. As best seen in Figure 3 this disk 41 is made of insulation and has high cam portions 42 on its periphery of varying lengths, between which cam portions are dwell portions. This disk is positioned in a manner to cause these cams and dwells to engage one blade of a double blade, spring contact switch 43 suitably carried on the carriage 24 and having opposite wire connections 44 and 45. These wires 44 and 45 as shown in the diagram in Figure 3 are in circuit with a suitable source of energy 46 and a reversing relay coil 47. As shown, the armatures 27' for motor 27 by means of wires 48 and 49 are also in circuit with the source of energy 46. In the wire 49 is arranged a field coil 50 for the armatures 27', said coil being controllable by a reversing switch structure 51 controlled by energization and deenergization of the reversing relay coil 47. Said coil 47 as can be seen is controlled by the opening and closing of the blade switch 43 in response to action of the cam wheel 41. Consequently, the carriage driving motor 27 is reversibly operated to drive the carriage first one way and then the other. The period of operation of the motor in one direction or the other is obviously determined by the length of the cams 42 and the length of time the switch 43 is held closed. Thus, the stroke or path of movement of the carriage along the track is variable in either direction of movement. The cam wheel 41 is driven at such speed and is so proportioned thtat the carriage 24 can travel within only certain prescribed limits and can never reach the ends of the tracks 22 and 23 and run off or cause damage to any parts.

Looking to Figure 7 it will be seen that by means of a cap 52 and coil spring 53 the disk wheel 41 through a disk 41' is frictionally clutched to the front face of another cam wheel 54, having a hub keyed to the shaft 37 always to turn therewith. The front face of the carriage as shown also in Figure 4, above the wheel 54 has a pivot 55, pivotally carrying a gravity lever 56 having a dog end 57 loosely riding the periphery of said cam wheel 54. This wheel 54 is formed with varying length cam and dwell portions as shown on its periphery. Looking now at the disk 41 it will be seen that the same carries variably spaced pins 58 disposed normal to the plane of the disk and extending inwardly in a position to be engaged by the end 57 of the dog 56. When a high cam portion on wheel 54 holds the dog 56 high enough to permit the end 57 to be positioned in the path of the pins 58 on the disk 41, then said disk 41 will have its rotation interrupted, the friction disk 41' coming into play to take up the lost motion. Thus, the reversing movements of the motor 27 in driving the carriage 24 are so scrambled or varied as to make such to and fro movement of the carriage completely haphazard and unpredictable. Of course, when the end 57 drops into a dwell on the disk 54 then it cannot engage a pin 58 and the disk 41 will through the friction coupling 41' turn with the shaft 37 and disk 54. The cam wheel 54 performs another important function which will presently be described in connection with a target on the carriage.

This target herein assumes the form of a submarine 59 and as seen in Figures 3 and 7 includes a lens 60 for directing a ray of light to an interior disposed photo-electric cell 61 carried on the angular extension of a target support 62 positioned for up and down sliding movement in one end of the carriage 24. The other end of the carriage 24 carries for sliding up and down movement, a complementary bar 63 the lower end of which has secured thereto a counterweight 64 for a purpose presently to appear. Looking now to Figure 4 it will be seen that below the cam wheel 54 the front face of the carriage 24 carries a lever 65 pivoted at 66 and between its ends carrying a roller 67 to ride the periphery of the disk 54. The opposite end of the lever 65 is pivotally connected at 68 to an upstanding link 69 in turn pivotally connected at 70 to an intermediate portion of a lever 71, which has one end articulately connected by a link 72 to the bar 63 and its other end similarly connected by a link 73 to the target supporting bar 62. Thus, the bars 62 and 63 are interconnected by the lever 71 for opposite up and down movements and the weight 64 counterbalances the weight of the target structure 59, 61. Looking from the front it will be understood that the wheels 41 and 54 always turn counterclockwise. The motor 35 is not reversible and always runs in the same direction. It will now be clear that as the cam disk 54 turns the cam portions thereof will push down on the roller 67 to swing the lever 65 and cause the relative up and down movements of the bars 62 and 63 as shown in full and dotted lines in Figure 4. Thus, the target 59 bobs up and down behind a curtain drop or front panel 74 in-

cluded in the cabinet 20, which drop 74 may be painted to represent the sea. Since the cam portions on the disk 54 are of different lengths, a different or variable up and down succession of strokes is imparted to the target. This up and down variable target movement combined with the intermediate to and fro movement of the target carriage along the track creates an unusually interesting target motion, causing the target to appear and disappear from behind the drop 74 in up and down and sidewise movements. A real test for the marksman thus occurs.

The control for the gun lamp 18 will now be described. In a suitable place in the cabinet 20, or in a stand for the gun 15 not shown, is positioned the unit shown in Figures 9, 10 and 11, which unit comprises a base 75 carrying a U-bracket 76 on which is a sub-bracket 77 carrying an electric motor 78 for driving reduction gearing 79 for turning a shaft 80 connected by a coupling 81 to an extension shaft 82. Said shaft 82 is supported with shaft 80 in the U-bracket 76, the shaft 82 as seen, projecting through and beyond the bracket with its far end turnably carried in an end plate 83 made of insulation and carrying (see also Figure 8) a circle of spaced, electrical contacts 84 wired together on the back side of the plate 83 by a wire 85 from which a lead 86 goes to one side of the lamp 18 in the gun 15 as shown in Figure 1.

A conductor wiper arm 87 is secured to a sleeve 88 turnable in the support 83 and loose on the shaft 82 to turn thereon. Formed as a functionally integral part of the sleeve 88 is a disk 89 having peripheral spaces thereon formed by teeth 90. A solenoid 91 having a spring pressed core 92, is positioned on the support 75 in a manner to enable said core normally to engage radially in a peripheral space on the disk 90 and lock it against turning, when the core 91 is not energized. By means of bolts and spacers 92' another disk wheel 93 is secured in spaced relation to the first disk 89. This disk 93 also has peripheral spacers formed by teeth 94.

Secured to the shaft 82 to turn therewith at all times, and positioned adjacent the disk 93 is a drive collar 95 faced on the side proximate the disk 93 with a friction driver facing or washer 96. The collar 95 will have slight axial movement on the shaft 82. On the shaft between the disk 93 and U-bracket 76 is a loose turning sleeve unit 97 which at one end includes a disk 98 having an axial spacer 99, including a detent pin 100 positionable to engage in the spaces between the teeth 94 on the disk 93 to lock disk 98 to the disk 93 to turn therewith and rotate the wiper arm 87 when the disk 89 is freed by the solenoid core 92 as will appear.

The other end of the sleeve 97 is provided with an integral, wide spur gear 101 and an integral washer 102. The bracket 76 carries a support 103 for pivotally carrying, by means of a pin 104 a lever 105, which between its ends carries two spaced, depending pins 106 disposed on opposite sides of the washer 102. The free end of the lever 105 carries a depending pin 107 engaged in the notched end of the spring pressed core 108 of a solenoid 109 carried in a support 110 mounted on the bracket 76. When the core 108 is inoperative the spring thereof holds the core and lever 105 out as shown in Figure 9, thus sliding the sleeve 97 over to the right to move the disk 98 with its detent 100 into locking engagement with the wheel 93, at the same time pressing the collar 95 and its friction face 96 into driving engagement with the disk 93, thereby causing the parts 97, 88 to turn as a unit with the wiper arm 87 moving over the contacts 84.

The wide gear 101 is in constant mesh with a large spur gear 111 journaled on a shaft 112 mounted in the bracket 76 and a journal support 113 thereon. As the gear 111 turns it winds a clock spring 114 disposed around the shaft 112 and having its opposite ends connected respectively to the gear and shaft. The gear 111 carries an axially extending pin 115 from near its periphery to cooperate with an upstanding stop pin 116 on the base 75 as seen in Figure 10. The gear 111 has a starting position determined by the pins 115 and 116 and as the gear 111 turns to move the pin 115 away from the pin 116, the spring 114 is wound up to store energy for returning the gear 111 to its home or starting position when these parts are reset. When the gear wheel 111 has turned one revolution the pins 115, 116 prevent further rotation of the wiper arm 87 and consequently the latter is held fixed between contacts 84 until reset.

Looking now to the diagram of Figure 1, it will be seen, that a main starting switch 117 is provided in the circuit, the same being initially closed by a conventional coin chute 118 operable by the player in releasing the apparatus for use. A wire 119 goes from one side of said main switch 117 to the solenoid 109 and from the other side of said solenoid, a wire 120 leads to one side of the source of energy 46. From the source 46 a wire 121 leads to one side of a switch 122 and from the other side of said switch is lead a wire 123 connecting with wire 120 and the source of energy. A wire 124 leads from wire 121 and goes into one side of an amplifier 125. The motor 27 is in wire 121 and by cross wires 126 and 127 the motors 35 and 78 are respectively placed in circuit with the source of energy, as shown. An electromagnetically operable hit counter 128 of any standard type is in circuit with the amplifier through wires 129. By means of wires 130 the amplifier is in circuit with the photo-electric cell 61. A wire 131 leads from the amplifier 125 to a wire 132 in circuit with the source of energy 46 through wire 121. The wire 132 connects with one side of a relay operated time clock unit 133 positioned to hold closed the switch 122 for the desired time interval. A wire 134 leads from the other side of the relay 133 to the other side of starting switch 117. A wire 135 goes from wire 121 around the switch 122 and connects with one side of the solenoid 91, while an out wire 136 from said solenoid goes to one side of the gun trigger switch 17. A wire 137 leads from the other side of the trigger switch to the wire 120 and source of energy 46. A wire 138 goes from the other side of the lamp 18 to the wire 131 and source of energy. A wire 139 connects between the wiper arm 87 and wire 124. This completes the detailed description of the parts and the manner of use and mode of operation of the apparatus will next be described.

In starting, it is to be understood all parts are at rest in what may be termed reset positions. When the coin chute 118 is operated it closes switch 117 for an instant to make a circuit 134, 133, 132, 46, 120, 109 and 119 to energize the solenoid core 108 and cause it to pull in the lever 105 from the position shown in Figure 9 to that shown in Figure 11. Thus, with the unit 97, 98 pulled over and freed from the wheel 93, the spring 114, which was energized, acts instantly to turn the gear wheel 111 back to its initial start-

ing position determined by pins 115 and 116. The unit 97 with disk 98 and gear 101 merely turns loosely about the shaft 82 during this reset operation.

Closing of the switch 117 by the coin chute also in the same circuit just described, energized the relay timer unit 133 to set a time clock and also close the master switch 122, which now remains closed by the time clock unit 133 for a predetermined time interval, even though the coin chute 118 is drawn to retracted position causing opening of the blade switch 117. The circuits shown in Figure 1 are now established, causing all motors 27, 35 and 78 to run, the amplifier 125 likewise being placed in circuit with the source of energy. With the solenoid 91 deenergized normally, the wheel 90 is held locked and the wiper arm 87 cannot turn over the contacts 84, said arm 87 when at rest having a normal position between adjacent contacts 84 so that no current is passed, as shown in Figure 1. The friction disk 96 makes it possible so to hold the unit 93, 89, 88, 87 stationary. When the coin chute was retracted and switch 117 opened, the solenoid 109 was deenergized so that the spring therein pushed the lever 105 out as seen in Figure 9 to lock the disk 98, through detent 100 to the disk 93. Thus all these sleeve parts 97, 88 are tied together, but normally held against turning about the shaft 82 by the lock 92, since the coil 91 is normally deenergized and the spring therein holds the core 92 to locking engagement with the teeth 94 of wheel 89.

Of course, the motor 27 turns since it is now in a closed circuit and through the gearing described drives the endless chain 31 to move, through link 38, the carriage 24 on which is carried the target 59 and variator motor 35, which also runs now all during the game cycle. As this motor 35 turns, the cam wheels 54 and 41 likewise turn. The cam portions on wheel 41 control opening and closing of the blade switch 43 for varying time intervals, said switch 43 controlling the circuit 44, 45, shown in Figure 3 that reverses the field for the brushes 27' of the motor 27, thereby causing the latter to run reversibly. It follows that the carriage 24 is consequently driven to and fro on the tracks 22 and 23 by the endless chain 31 with varying lengths of travel, but never off the ends of the rails 22 and 23 because the cams 42 on the cam wheel 41 are designed to prevent this from happening.

At the same time the motor 35 drives the cam wheel 41, it also drives from the same shaft 37, the second cam wheel 54 having varying length cam portions to act on the roller or pin 67 and operate the counterbalanced parallel ruler linkage 63, 62 to move the target 59 up and down in strokes of varying length. This cam wheel 54 also raises and lowers the stop dog 56 into and out of the path of the pins 58 on the wheel 41 so that the latter wheel is actually momentarily held or locked against turning for varying intervals determined by the length of the cams on the wheel 54. Thus, reversing action of the motor 27 and to and fro strokes of the carriage 24 are additionally scrambled. Such holding action of the wheel 41 is made possible because of the friction disk driver 41', between wheels 54 and 41. It follows that the target 59 moves back and forth and up and down in an unpredictable, haphazard manner, darting up and down and to and fro relative to the drop panel 74 in front of it.

With the target moving under influence of the motors 27 and 35 and the motor 78 also running but not turning the wiper arm 87 because of the lock 92, the marksman can now shoulder the gun 15 and aim it at the target lens 60. When the gun trigger 16 is pulled the trigger switch 17 is closed to make a circuit 136, 135, 121, 46, 137 to energize the solenoid 91. This moves the core 92 out of engagement with the lock wheel 89 to free the latter, whereupon through driver disk 95 and face 96 and coupling 100 the motor 78 through shaft 82 drives sleeve 88 and the wiper arm 87 over the contacts 84. If the trigger 16 is only closed for an instant then the wiper arm 87 contacts only one contact 84, thus making a circuit 85, 86, 138 with source of energy 46, returning by wires 139, 124, 123, with switch 122 held closed, back to source 46 to light the lamp 18. If the flash of light from the gun hits the photo-cell lens 60, then the amplifier 125 causes the hit counter 128 to function. Of course, since the coupling detent 100 is locked to the wheel 93 that turned one step with the wiper arm 87, it follows that the gear 101 turned the gear 111 in a direction away from the stop 116, the spring 114 being wound in the process.

Should the trigger switch 17 be held closed, then the circuits established keep the wiper 87 turning rapidly over the contacts 84 and the flashes of light from the gun are in rapid succession, like a machine gun, as the wiper 87 runs on and off successive contacts 84. All the while this happens the gear 111 keeps turning away from its home position until it has completed one turn, whereupon the pin 115 abuts the stop 116 and the turning parts 97, 88 are locked even though the motor 78 should still be running. The friction 96 takes up the lost motion in such instance. When the game cycle is cut off by the timer unit 133, then switch 122 opens and all three motors stop. When the next game is played the coin chute 118 acts to close switch 117 and reset the one revolution control wheel 111 by means of the spring 114 as has been described. This completes the description.

It can now be seen that an improved target apparatus has been provided which achieves the objects heretofore recited.

The intention is to cover all changes and modifications not departing from the spirit and scope of the invention as indicated by the appended claims.

What is claimed is:

1. In a target apparatus, a track, a carriage movable therealong, a motor located in a fixed position adjacent the track and including means connected to drive the carriage, a target on the carriage including means to raise and lower the target relative to the carriage, a motor traveling with the carriage, means driven by said latter motor to raise and lower the target, and control means operatively associated with said latter means for automatically varying the stroke of the target.

2. In a target apparatus, a track, a carriage movable therealong, a motor located in fixed position adjacent the track and including means connected to drive the carriage, a target on the carriage including means to raise and lower the target translationally relative to the carriage, a motor traveling with the carriage, means driven by said latter motor to raise and lower the target, and control means operable by the latter motor to regulate the up and down travel of the target and cause the said movement of the target to be variable.

3. In a target apparatus, a track, a carriage movable therealong, a motor located in a fixed position adjacent the track and including means connected to drive the carriage, a target slidably mounted on the carriage including means to raise and lower the target relative to the carriage, a motor traveling with the carriage, said means to raise and lower the target including a cam wheel driven by said latter motor.

4. In a target apparatus, a track, a carriage movable therealong, a motor located in a fixed position adjacent the track and including means connected to drive the carriage, a target slidably carried on the carriage including means to raise and lower the target relative to the carriage, a motor traveling with the carriage, and means to raise and lower the target including a cam wheel driven by said latter motor, said cam wheel having varying shaped cam portions to vary the up and down stroke of the target.

5. In a target apparatus, a track, a carriage driven therealong, a motor movable with the carriage, parallel links mounted on the carriage, one link supporting a target, and the links arranged for opposite and alternate up and down movement, means interconnecting said links, and means operable on the last means to actuate the links from said motor.

6. In a target apparatus, a track, a carriage driven therealong, a motor movable with the carriage, substantially parallel links mounted on the carriage for up and down sliding movement, one link carrying a target and the other a counterbalance means, linkage articulately interconnecting said links to slide oppositely, and means operable from the motor so to move the links.

7. In a target apparatus, a track, a target carrying carriage movable to and fro along the track, a reversible electric motor located in a fixed position adjacent the track and including means connected to drive the carriage, and a motor traveling with said carriage including means for reversing the first motor and travel of the carriage.

8. In a target apparatus, a track, a target carrying carriage movable to and fro along the track, a reversible electric motor including means to drive the carriage, a motor traveling with said carriage, a rotary member driven by said latter motor, and a switch in an electric circuit for the first motor operable by the member to regulate reversal of the first motor.

9. In a target apparatus, a track, a target carrying carriage movable to and fro along the track, a reversible electric motor including means to drive the carriage, a motor traveling with said carriage, means operable by said latter motor to effect reversal of the first motor and travel of the carriage, said latter means serving also to time the periods of drive of the first motor in either direction.

10. In a target apparatus, a track, a carriage movable to and fro along the track, a reversible electric motor located in a fixed position adjacent the track and including connections to drive the carriage, a target, up and down movable support means on the carriage to carry the target, and means traveling with the carriage for varying during operation the amount of up and down travel of the target support means as well as the to and fro movement of the carriage.

11. In a target apparatus, a track having ends, a target carriage mounted for to and fro movement therealong, a reversible motor positioned independently of the carriage and including connections to drive the carriage, and a second motor traveling with said carriage including means to regulate reversals of the first motor.

12. In a target apparatus, a track, a carriage movable therealong, parallel vertical bars slidably carried in the carriage, one bar supporting a target, a lever articulately connecting said bars, and rotary means operatively associated with the carriage to operate the lever and cause the bars to move in opposite directions.

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