

Jan. 19, 1954

H. C. FOSTER

2,666,424

VARIABLE THROWING ANGLE TARGET TRAP

Filed Sept. 16, 1950

6 Sheets-Sheet 1

Fig. 1

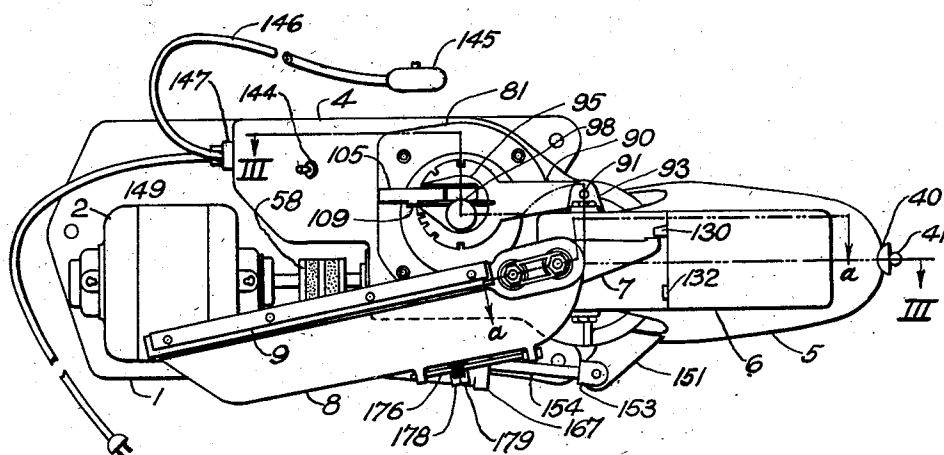
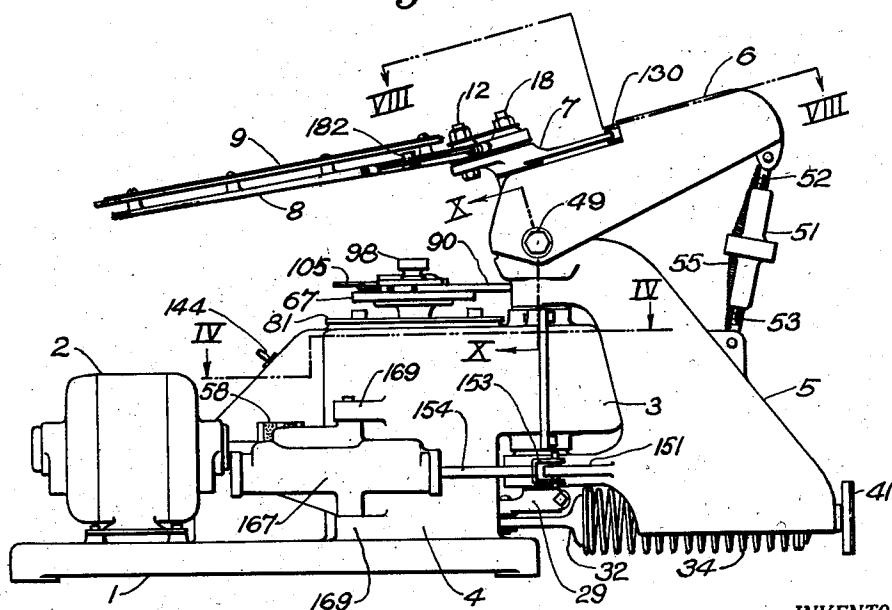


Fig. 2



INVENTOR.
Harry Clark Foster
BY
Lionel E. Goff
ATTORNEY

Jan. 19, 1954

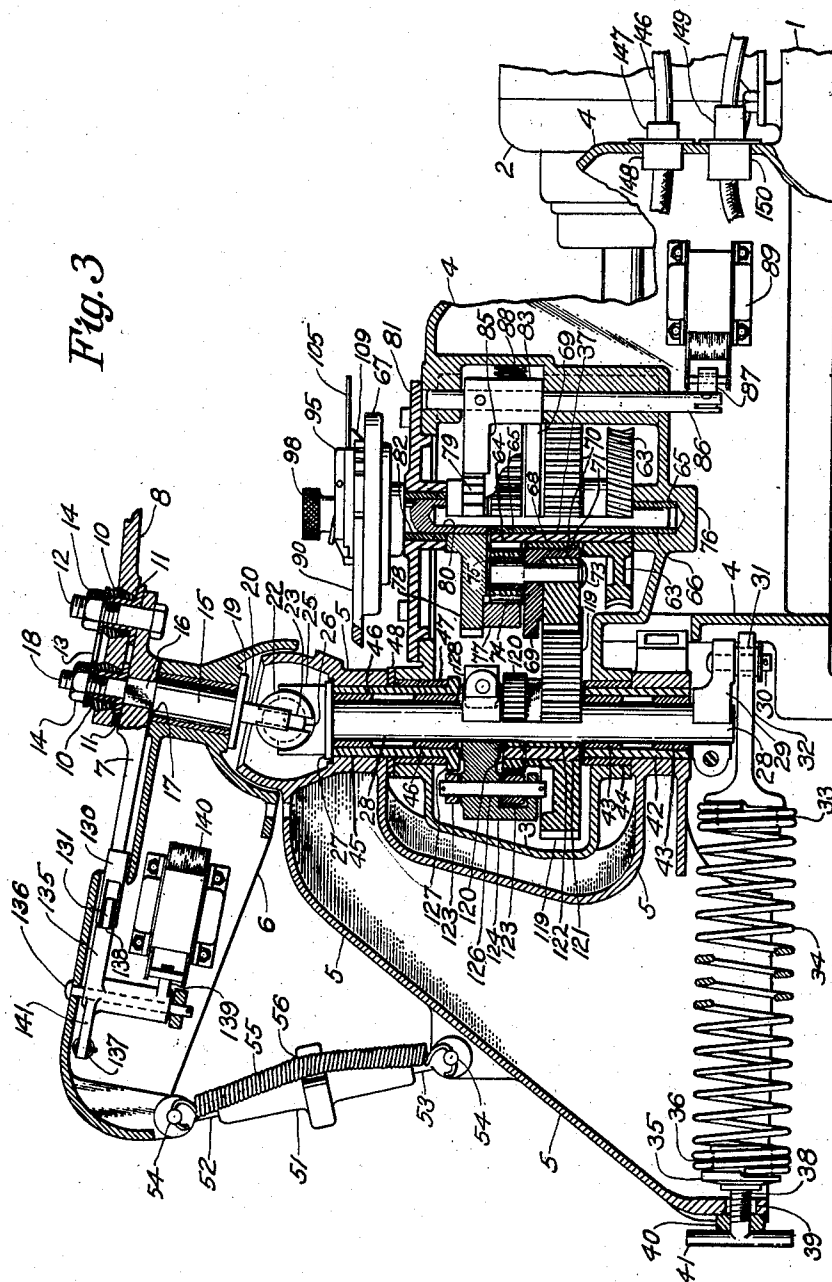
H. C. FOSTER

2,666,424

VARIABLE THROWING ANGLE TARGET TRAP

Filed Sept. 16, 1950

6 Sheets-Sheet 2



INVENTOR.
Harry Clark Foster
BY

Lionel B. Hoff
ATTORNEY

Jan. 19, 1954 .

H. C. FOSTER

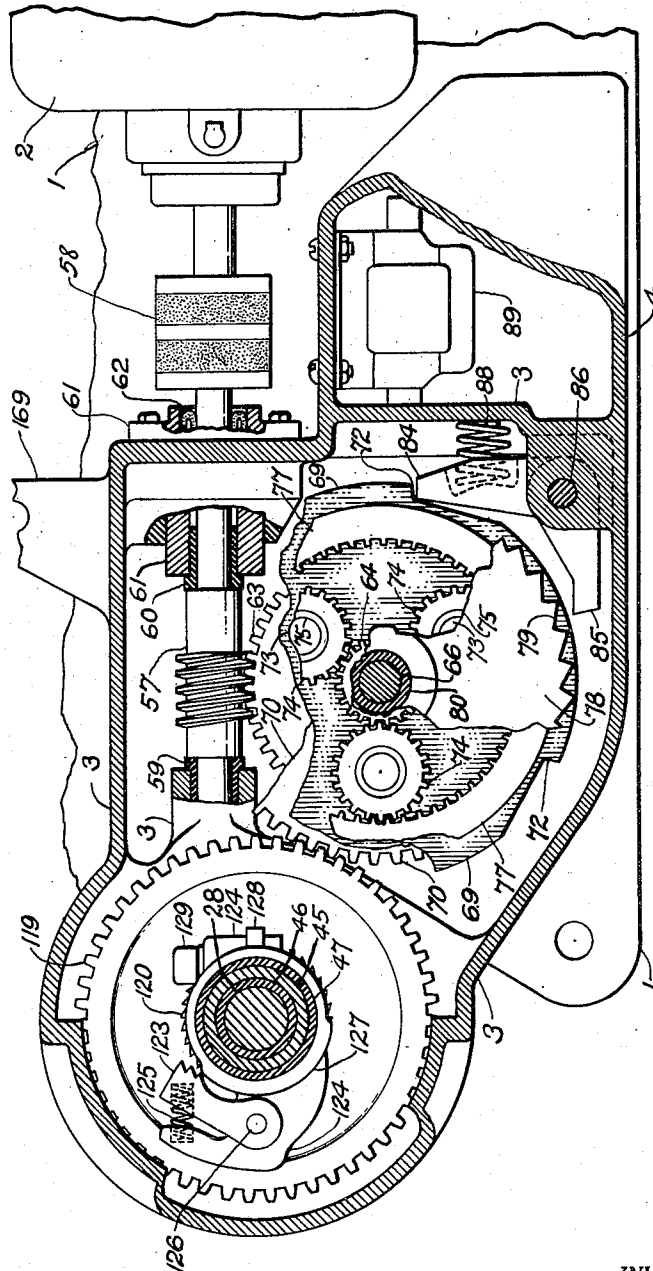
2,666,424

VARIABLE THROWING ANGLE TARGET TRAP

Filed Sept. 16, 1950

6 Sheets-Sheet 3

Fig. 4



INVENTOR.
Harry Clark Foster
BY
Lionel B. Goff
ATTORNEY

Jan. 19, 1954

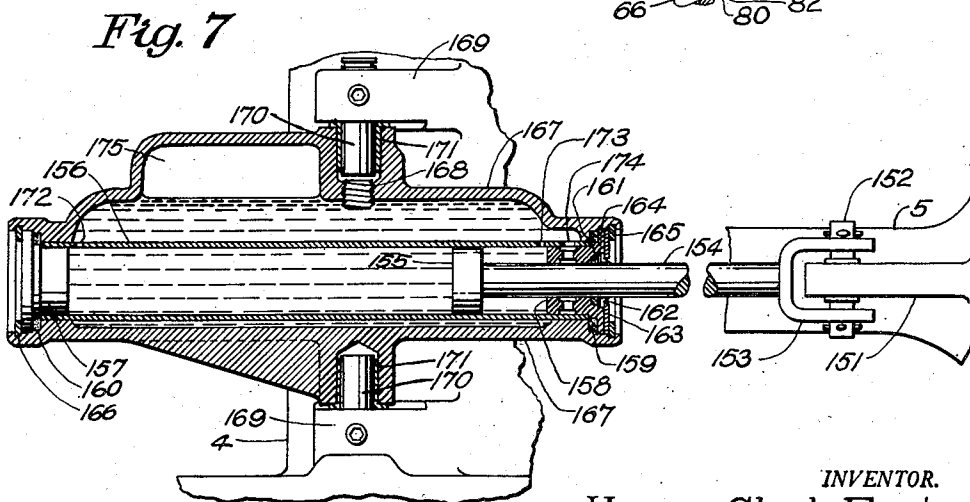
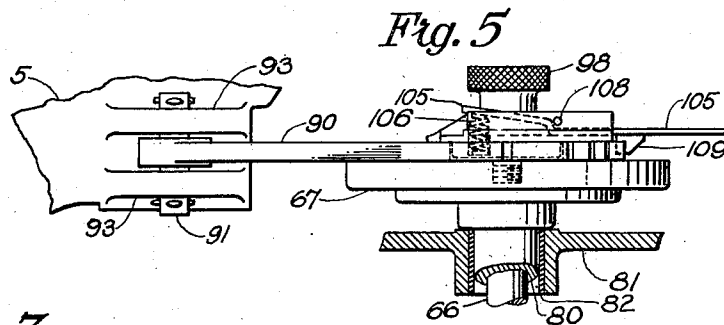
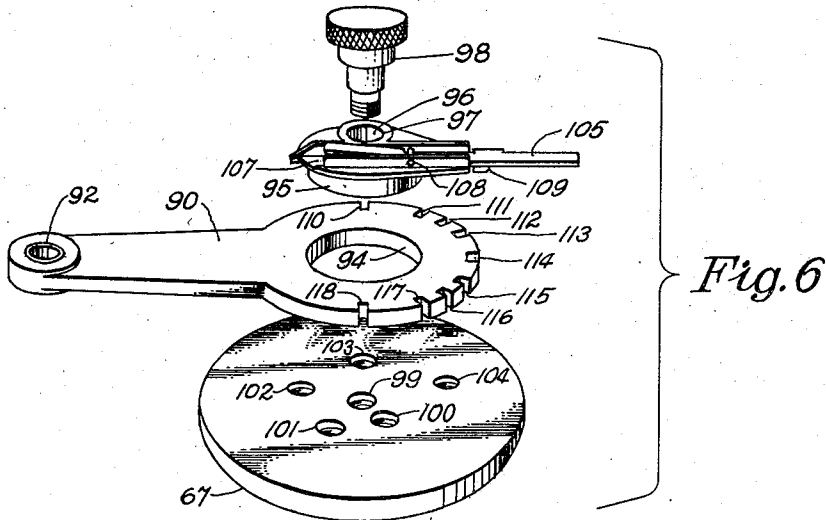
H. C. FOSTER

2,666,424

VARIABLE THROWING ANGLE TARGET TRAP

Filed Sept. 16, 1950

6 Sheets-Sheet 4



INVENTOR.
Harry Clark Foster
BY

Lionel E. Hoff
ATTORNEY

Jan. 19, 1954

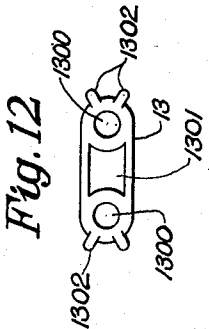
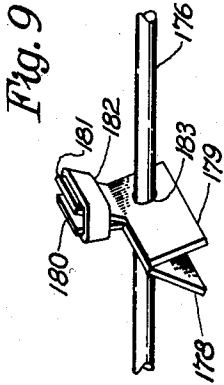
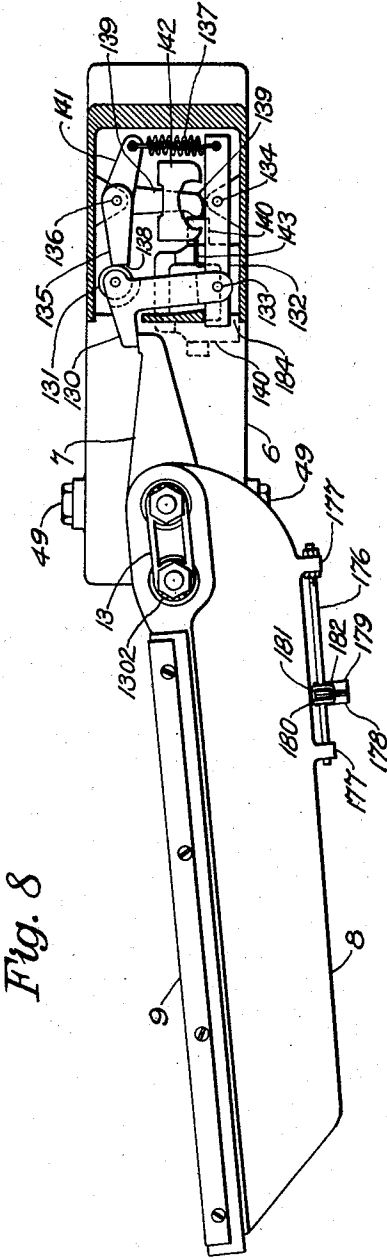
H. C. FOSTER

2,666,424

VARIABLE THROWING ANGLE TARGET TRAP

Filed Sept. 16, 1950

6 Sheets-Sheet 5



INVENTOR.
Harry Clark Foster
BY
Lionel E. Hoff
ATTORNEY

Jan. 19, 1954

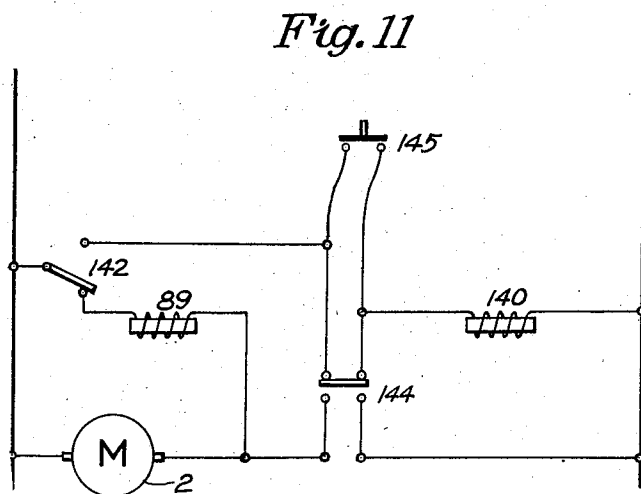
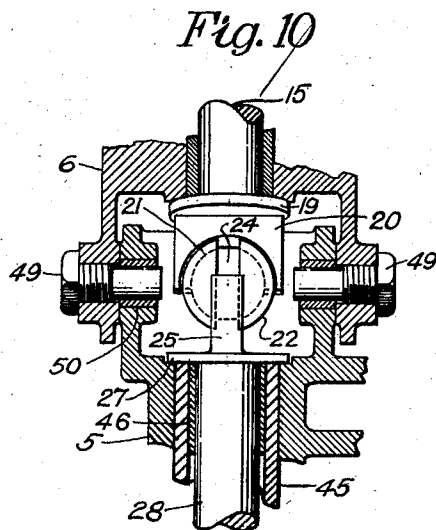
H. C. FOSTER

2,666,424

VARIABLE THROWING ANGLE TARGET TRAP

Filed Sept. 16, 1950

6 Sheets-Sheet 6



INVENTOR.
Harry Clark Foster
BY
Lionel E. Hoff
ATTORNEY

UNITED STATES PATENT OFFICE

2,666,424

VARIABLE THROWING ANGLE TARGET TRAP

Harry Clark Foster, Alton, Ill., assignor to Olin Industries, Inc., East Alton, Ill., a corporation of Delaware

Application September 16, 1950; Serial No. 185,296

18 Claims. (Cl. 124-9)

1

This invention pertains to target traps, such as are used for throwing targets known as clay pigeons, and more particularly to power driven target traps adapted to vary automatically the angle at which the targets are thrown.

In the art of shooting targets of the clay pigeon type, it is desirable that the shooter be unable to anticipate direction of flight of successive targets. Heretofore, some traps designed to prevent such anticipation by the shooter by throwing targets at random angles have employed chance wheels for the purpose while others have depended upon the random motion of certain of the trap elements. The utilization of power operation instead of manual operation with such traps complicates the mechanism necessary. For example, in such traps the throwing arm is usually operated by a strong spring which must be cocked or energized prior to the firing time and the power requirement for this purpose is thus intermittent. Prior devices have therefore either operated the electric motor intermittently, which is unsatisfactory among other things from the standpoint that the motor must on each cocking stroke start under dead load with the attending heavy wear, or utilized complicated clutches and the like to connect a continuously running motor to the cocking and angle changing mechanisms. The motor ordinarily runs at a speed greater than the elements of the trap and it has been necessary to employ speed reducing gears and the like which unless massively and ponderously built have been subject to rapid wear.

It is therefore an object of this invention to provide a power driven target trap having an improved mechanism for cocking the trap and for automatically and continuously changing the angle at which targets are launched. Another object of the invention is to provide an improved trap for throwing targets at random angles. Another object is to provide an improved spring for actuating the target throwing arm. Still another object is to provide a trap of improved design characterized by compactness, efficiency and dependability of operation. A further object is to provide novel means for transmitting power from a spring to a target throwing arm. A still further object is to provide a trap with improved means for positioning the target on the throwing arm, means for adjusting for the influence of wind on the direction of the target, and means for effecting smooth operation of the trap throughout the cocking and throwing cycle.

The foregoing objects and advantages, as well

2

as others which may become apparent from the detail description hereinafter, are accomplished in accordance with this invention by providing a target trap of novel construction as set forth herebelow. The driving power for the trap is transmitted from an electric motor to the cocking mechanism and the target throwing angle changing mechanism through differential gearing. The motor continuously rotates one gear in the epicyclic train, another gear drives the cocking mechanism and still another gear operates the angle changing mechanism. The construction is such that the gear driving the cocking mechanism is held stationary while the trap is in cocked position and the gear operating the angle changing mechanism is held stationary during the cocking operation. The target carrier or throwing arm is mounted for rotation by a shaft which has on its end a crank fastened to one end of a strong spring. The gear above referred to as driving the cocking mechanism rotates the shaft to tension the spring until the crank arm is just past dead center, beyond which point the shaft is turned ahead of the gear by the spring until reaching cocked position whereupon the gear is stopped. The trap is maintained in cocked position by a sear controlled by an electrically operated trigger mechanism. When rotation of this driving gear is stopped, rotation of the gear operating the angle changing mechanism is automatically started. This angle changing gear rotates a disk having an eccentrically mounted link connected to the frame supporting the throwing arm, so that the frame and throwing arm are continuously oscillated in a substantially horizontal plane while the trap is in cocked position. The target is placed on the throwing arm and is launched by action of the spring when the switch controlling the trigger mechanism is turned on. The direction taken by the target is determined by the position to which the frame has oscillated at the time this switch is closed.

The mechanism permitting alternate rotation of the driving gear and angle changing gear is so designed and constructed as to introduce a variation in the time at which rotation of the angle changing gear is initiated after the trap is in cocked position. This makes it impossible for the shooter to anticipate the position of the frame and consequent target launching direction. During the target launching and cocking operations the throwing arm undergoes a complete revolution making it unnecessary to reverse the direction of motion in order to cock the trap.

3

An adjustment is provided for varying the eccentricity with which the link is mounted on the angle changing disk so that the angle through which the frame oscillates can be increased or decreased at will. The effective length of the link is also adjustable so that the angle through which the frame oscillates can be shifted to the right or to the left at will to compensate for the effect of a side-wind on the direction of flight of the targets. An adjustable stop for positioning targets on the throwing arm likewise permits a limited shifting of the angle over which the targets are thrown, but is provided primarily for the purpose of leveling the target flight. There is also an adjustment for varying the angle at which the plane in which the throwing arm revolves deviates from the horizontal so that the elevation of the target flight can be varied at will. A recoil snubber is utilized to minimize shock between moving parts of the trap occasioned by the spring operation of the throwing arm, thereby decreasing wear on the parts and improving the smoothness of operation.

Having indicated in the foregoing in a general way the nature and substance of this invention, there follows a more detailed description of a preferred embodiment thereof with reference to the accompanying drawing in which:

Figure 1 is a plan view of a trap illustrating an embodiment of this invention,

Figure 2 is a side elevational view of the trap of Figure 1,

Figure 3 is a fragmentary elevational section of the trap taken at line III—III of Figure 1 for the main body of the trap and at line a—a for the upper structure including the target carrier support, target carrier arm, and target carrier,

Figure 4 is a fragmentary plan view taken at line IV—IV of Figure 2 with parts of some of the elements broken away for clarity,

Figure 5 is a side elevational view of the angle changing adjustment mechanism of the trap,

Figure 6 is an exploded perspective view of the angle changing mechanism of Figure 5,

Figure 7 is a vertical sectional view of the recoil snubber of this embodiment taken on the center line or axis of the snubber,

Figure 8 is a plan view partly and cross section at the line VIII—VIII of Figure 2, illustrating the target carrier in cocked position and release mechanism on the target carrier support,

Figure 9 is a perspective view illustrating the device for positioning the target on the target carrier,

Figure 10 is a fragmentary sectional view taken at X—X of Figure 2 illustrating the universal joint connecting the target carrier to the main drive shaft,

Figure 11 is a diagrammatic view illustrating the electrical control system of this embodiment, and

Figure 12 is a plan view illustrating a washer utilized in mounting the target carrier.

Referring to the drawing, Figures 1 and 2, the trap has a base 1 on the rear end of which is mounted an electric motor 2. A gear housing 3, which encloses the entire gear mechanism, is attached to base 1 by means of gear housing support 4. On frame 5, which is journaled for oscillatory movement about a vertical axis on the forward portion of housing 3, there is mounted the carrier arm support 6. The carrier arm 7, Figure 3, is mounted on shaft 15 which is journaled in the carrier arm support

4

6. The target carrier or throwing arm 8 having a carrier rail 9 is mounted on the carrier arm 7 by means of rubber grommets 10, grommet bushings 11, carrier bolt 12, washer 13, nuts 14, and carrier shaft 15, which is threaded at its upper end 18. The carrier shaft 15 is provided below the threaded portion with flats 16 which prevent any rotary movement of the carrier arm 7 about the shaft 15, the shaft 15 being provided with shoulders 17 against which the carrier arm is held by the nut 14. The use of the rubber grommets in mounting the target carrier 8 to the carrier arm 7 provides some resilience in the mounting, the grommets tending to take some of the shock occasioned by rotation and sudden stopping of the target carrier 8 during a firing and cocking operation.

The washer 13 is designed to prevent lock nuts 14 from working loose as a result of the oscillatory action of the target carrier 8. The washer 13, Figure 12, is a sheet metal stamping having perforations 1300 for receiving carrier bolt 12 and end 18 of shaft 15, opening 1301, and ears 1302. The ears 1302 are turned up against the flat sides of nuts 14 after they have been properly tightened. Since both bolt 12 and shaft end 18 pass through the washer 13, it is not free to turn about either one and the turned up ears 1302 make it impossible for nuts 14 to work loose. The ears 1302 may be extensions within opening 1301 of the stamping 13, if so desired, instead of extensions from the ends as illustrated. The carrier shaft 15 is connected to the main shaft 28 having a vertical axis by a universal joint so that the elevation of the target carrier can be adjusted.

The carrier shaft 15, Figures 3 and 10, passes through the carrier arm support 6 and at its bottom is provided with a flange 19 and a blade extension 20 having a notch 21 forming part of the universal joint. The blade extension 20 fits into a groove 23 in a ball 22. The ball 22 is also provided with a groove 24 at right angles to groove 23. The main shaft 28 is similarly provided at its upper end with a blade extension 25 having notch 26 and flange 27. Blade 20 is thus free to move in groove 23 and blade 25 is free to move in groove 24 of the ball 22, so that upon rotation of the main shaft 28 power is transmitted through the blade 25 to the ball 22 to the blade 20 and thence to carrier shaft 15, and the main shaft 28 will thereby rotate the carrier shaft 15 through the universal joint even though they do not have a common axis. The main shaft 28, Figure 3, extends through the bottom of the frame 5 and there is mounted on the bottom end of the shaft a crank 29. A connecting member 32 is movably connected at one end to the crank 29 by means of crank pin 30 turning in crank pin bearing 31. The other end of the connecting member 32 has external threads 33 which are screwed into the end of main spring 34. A plug 35 having external threads 36 is screwed into the other end of main spring 34 and is internally threaded to receive the adjusting screw 38. The adjusting screw 38 passes through swivel block 40 and through a slotted opening 39 in frame 5. The adjusting screw has a T-head 41 so that it can be readily turned by hand to adjust the tension on the main spring 34. The swivel block 40 and slotted opening 39 permit lateral oscillation of the spring without actual bending of the spring. The spring 34 is a flat metal ribbon coiled edgewise, in order

to permit a relatively heavy spring to be utilized in small space.

The main shaft 28 is journaled at its lower end in sleeve 42 provided with shaft bearings 43 and sleeve bearing 44, the bearing 43 being fixed to the sleeve 42, the bearing 44 being fixed to the housing 3, and the sleeve 42 being fixed to the frame 5. The main shaft 28 at its upper end is journaled in sleeve 45 having shaft bearings 46 fixed to the sleeve 45 and sleeve bearing 47 fixed to housing 3, the sleeve 45 being keyed to the frame 5. The frame 5 is therefore mounted for oscillation on the housing 3. A bearing washer 48 is between the top of gear housing 3 and the frame 5. The upper portion of the frame 5 and lower portion of the carrier arm support 6 form a housing for the universal joint, the frame 5 and support 6 being joined by means of trunnions 49 in trunnion bearings 50. The trunnions thus permit the support 6 to be moved with respect to the frame 5 so as to adjust the angle of the carrier shaft 15 with respect to the main shaft 28. An internally threaded adjustment member 51 is fastened at one end to the carrier arm support 6 and to the frame 5 at the other end by means of pins 54 and adjustment screws 52 and 53, respectively. A spring 55 is stretched between the frame 5 and the carrier arm support 6, being fastened at its ends to the pins 54. The spring 55 rests in notch 56 in the member 51 and prevents it from turning except when an adjustment in elevation of the carrier arm is to be made by turning the member 51 at which time the spring 55 is readily snapped out of the notch 56.

The worm shaft 57, Figure 4, is journaled in gear housing 3 having bearings 59, gland 61 closing the housing 3 by means of seal 62, and bearing 60, and is coupled to the motor 2 by means of flexible coupling 58. The worm shaft 57 engages the worm gear 63. A sun gear 64 having a sleeve extension 37 to which the worm gear 63 is keyed has internal bearings 65 with which it is journaled upon the angle changing disk shaft 66. Angle changing disk 67 is keyed to the ring gear disk 78 and to the angle changing disk shaft 66. The sun gear 64 has a bearing 68 upon which is journaled driving gear disk 69 having a hub 71 on which is mounted the driving gear 70. The edge of the driving gear disk 69 is provided with three notches 72 unevenly spaced about its periphery. For example one notch may be 110° separated from the next notch and the third 140° separated from the second notch.

The delay or driving gear disk 69, Figures 3 and 4, also carries three studs or pins 73 on each of which is mounted a planet gear 74, which planet gears turn on planet gear bearings 75. The angle changing disk shaft 66 is journaled in a boss 76 at its bottom. The planet gears engage an internal ring gear 77 which is fixed to ring gear disk 78 provided with teeth or evenly spaced serrations 79. The ring gear disk 78 is keyed to the hub 80 of the angle changing disk 67 and to the angle changing shaft 66. The hub 80 is journaled in the closure 81 for gear housing 3, which is provided with bearing 82. Control pawl 83 is fixed to shaft 86, which is journaled in gear housing 3, and has pawl tip 84 adapted to engage notches 72 in the driving gear disk 69 and pawl tip 85 which is adapted to engage teeth 79 of ring gear disk 78. The control pawl 83 is so constructed that either pawl tip 84 is engaging notches 72 or pawl tip 85

is engaging teeth 79, but so that both tips 84 and 85 are never simultaneously in such engagement. Pawl operating lever 87 is fixed to the lower end of shaft 86. Control operating spring 88 is a compression spring bearing between housing 3 and pawl tip 84 tending to force it at all times into engagement with notches 72. Control solenoid 89 mounted on gear housing support 4 when operated acts upon pawl operating lever 87 withdrawing tip 84 from engagement with notches 72 and engaging tip 85 with teeth 79.

Angle changing link 90, Figures 1, 5 and 6, is attached at one end to ears 93 on frame 5 by means of link pin 94 in bearing 92. At the other end of link 90 there is an annulus or portion having a hole 94 in which windage adjusting hub 95 is seated, which hub has an eccentrically spaced hole 96 carrying bearing 97 in which the spread adjusting screw 98 is journaled. Threaded holes 99, 100, 101, 102, 103, and 104 in the angle changing disk 67 are each adapted to receive the spread adjusting screw 98. The hole 99 is placed in angle changing disk 67 in line with the axis of angle changing disk shaft 66 and holes 100, 101, 102, 103, and 104 are spaced successively at a greater distance radially outward from this hole, thus making it possible by changing spread adjusting screw 98 from one hole to another to change the eccentricity through which angle changing link 90 operates. Windage adjustment latch 105, provided at one end with compression spring 106 bearing on windage adjustment hub 95, is seated in slot 107 and is movably mounted on latch pivot 108. Latch tongue 109 at the other end of latch 105 is adapted for seating in notches 110, 111, 112, 113, 114, 115, 116, 117 and 118 about the circular periphery of link 90 by lifting the latch 105 to remove latch tongue 109 from the notch in which it is seated and turning hub 95. It is possible to thereby effectively lengthen or shorten the link 90 depending upon the notch in which the tongue 109 is placed.

Cocking gear 119, which is mounted for rotary movement about main shaft 28, Figures 3 and 4, engages driving gear 70 and is keyed to cocking ratchet or ratchet wheel 120 by means of compound bushing 121 having the bearing 122. Cocking pawl 123 is mounted for movement about pivot 126 on cocking pawl arm 124 which is keyed to main shaft 28. Cocking pawl compression spring 125 bearing between cocking pawl arm 124 and pawl 123 tends to force the pawl 123 into engagement with cocking ratchet 120. The bottom part of sleeve 45 serves as a cam 127 which tends for a part of its periphery, say for about 125° of a complete rotation of main shaft 28, to hold the pawl 123 out of engagement with the ratchet 120. Pawl arm key 128 which keyes the cocking pawl arm 124 to the main shaft is held in position by clamp bolt 129.

Sear 130, Figures 3 and 8, is provided with a roller 131 and is hinged to bar 132 by means of hinge pin 133. Bar 132 is mounted for movement about pivot 134 on carrier arm support 6 for the short distance permitted by slot 134 in carrier arm support 6. In cocking position the trigger 135 bears against roller 131 holding sear 130 in position against the extension of carrier arm 7 and is mounted for movement about pivot 136 on carrier arm support 6. Tension spring 137 is fastened at one end to trigger spring arm 141 and at the other end to sear bar 132 tending to hold the trigger end 138 in contact with roller 131. Trigger operating arm 139 when pushed by release solenoid 140 which is mounted on car-

7

rier arm support 6 moves the trigger 135 about the pivot 136 causing the trigger end 138 to move out of contact with roller 131. The sear 130 is then free to pivot on pin 133. Control switch 142, mounted on carrier arm support 6, has arm 143 bearing on bar 132.

Master switch 144, Figures 1 and 2, is mounted on gear housing support 4. Release switch 145, which is hand operated and designed to permit momentary electrical connection to fire the trap, is provided with cord 146, and plug 147 adapted to fit receptacle 148 mounted on gear housing support 4, Figure 3. Power inlet plug 149 is adapted to fit receptacle 150 mounted in gear housing support 4. One side of the power supply is connected to switch 142 and to one side of the motor 2, Figure 11. The other side of the motor 2 is connected to one side of control solenoid 89 and to one side of the master switch 144. The other side of control solenoid 89 is connected to one contact of control switch 142 which is a double throw switch. The other contact of switch 142 is connected to one side of the release switch 145. The other side of the release switch 145 is connected to release solenoid 140. The other side of the release solenoid 140 along with the other side of the master switch 144 is connected to the other side of the power supply. The master switch 144 is a double throw switch which when not connecting the power source to the motor 2, shorts the release switch 145, as illustrated in Figure 11.

A piston rod 154 of a recoil snubber, Figures 1, 2, and 7, is attached at one end to an ear or projection 151 on frame 5 by means of clevis 153 and clevis pin 152 and at the other end to piston 155 in cylinder 156. The cylinder is closed at the far end by means of a cap 157, sealing ring 160, and cap locking ring 166. At the near end the cylinder is closed by means of gland 158, gland sealing ring 159, piston rod sealing ring 161, piston rod scraper 162, scraper retaining ring 163, seal back-up ring 164, and gland locking ring 165. The cylinder is enclosed in a housing 167 provided with a filling plug 168. The housing is mounted on ears or projections 169 on gear housing support 4 by means of trunnions 170, the cylinder housing 167 being provided with bearings 171. Port 172 in the far end of cylinder 156 permits fluid to leave the cylinder as the piston 155 moves forward or enter the cylinder as the piston 155 moves backward. Port 173 in the near end of the cylinder permits fluid to enter the cylinder as the piston moves forward and permits fluid to leave the cylinder as the piston moves backward. Pressure equalizing port 174 tends to prevent leakage of the fluid from the cylinder between the piston rod 4 and the gland 158. Expansion chamber 175 within the housing 167 tends to minimize the effect of the external temperature on the recoil chamber system. The trunnions 170 permit the cylinder 156 and housing 167 to oscillate on a vertical axis in accordance with the movement of frame 5.

A rod 176, Figures 8 and 9, which may if desired have its surface roughened or threaded, is mounted at its ends in projections 177 from the edge of target carrier 8. Clip members 178 and 179 have holes 183 through which rod 176 passes. Clip members 178 and 179 have right angle projections 180 and 181, respectively, bent in opposite directions from the planes of the clip members. The projections 180 and 181 extend above the surface of the target carrier 8 and are pulled toward each other by means of a rubber band or

8

other tensioning member 182 which serves as a stop for positioning the target on the target carrier 8. The potential position of the target can be adjusted merely by squeezing the clip members 178 and 179 between the fingers to release the frictional or locking engagement of the edges of the holes 183 with the rod 176 and sliding the members along the rod to the desired position. Upon releasing the clip members 178 and 179, the rubber band 182 again brings the projections 180 and 181 closer together which causes the edges of the holes 183 to frictionally engage the rod 176.

In operation, plug 149 from the electric power line is plugged into receptacle 150, and master switch 144 is turned on. Electric motor 2 is thereby started, driving worm shaft 57, worm gear 63, and sun gear 64. Upon turning on switch 144 solenoid 89 is energized causing pawl tip 85 of pawl 83 to engage teeth 79 and hold ring gear 77 stationary. With sun gear 64 rotating and ring gear 77 held stationary, planet gears 74 are caused to revolve about sun gear 64 turning driving gear 70, cocking gear 119 and cocking ratchet 120. Ratchet 120 engages cocking pawl 123 which turns main shaft 28. Crank 29 on the bottom of main shaft 28 stretches main spring 34 during such rotation and carrier shaft 15, carrier arm 7, and target carrier 8 are rotated until the projection on arm 7 engages the sear 130. When the sear 130 is thus engaged the movement causes bar 132 to move arm 143 of control switch 142 disconnecting control solenoid 89 from the power source and connecting release switch 145 and release solenoid 140 to the power circuit. When control solenoid 89 is cut out of the circuit by the switch 142, spring 88 acting on pawl 83 disengages pawl tip 85 from teeth 79 of ring gear 78 permitting the ring gear to turn and simultaneously brings pawl tip 84 into position to engage a notch 72 in driving gear disk 69 to stop movement of driving gear 70 and ratchet 120 on cocking gear 119.

During the rotation of the main shaft 28 just prior to the time that the projection on carrier arm 7 engages sear 130, crank 29 at the bottom of main shaft 28 reaches a point past center and cocking pawl 123 reaches a position such that a cam 127 disengages the pawl 123 from the ratchet 120, and the completion of the cocking stroke bringing the projection on arm 7 into contact with sear 130 is accomplished through the action of the main spring 34. The spring 137 is under tension at all times and returns trigger 135 to normal position, blocking roller 131, immediately upon release of switch 145 and prior to completion of the cocking cycle. When arm 7 contacts sear 130, the roller moves across the flat end of trigger 135 and moves bar 132 to operate switch 142, and de-energize solenoid 89. At this point therefore drive gear disk 69 is held stationary by pawl tip 84 which disk 69 also holds driving gear 70, cocking gear 119, and ratchet 120 stationary, while pawl 123 is held out of engagement with ratchet 120 by cam member 127.

When the spring 88 operates to move pawl tip 84 in position to engage notch 72 on disk 69, pawl tip 85 is pushed out of engagement with teeth 79 on ring gear disk 78 thereby permitting ring gear disk 78 and ring gear 77 to turn and be driven by planet gears 74, whose studs 73 are mounted in disk 69 and no longer revolve about shaft 66. Thus, while the trap is in cocked position sun gear 64 through planet gears 74 drives ring gear 77 turning disk 78 and angle changing disk 67.

Angle changing disk 67 in rotating oscillates frame 5 through the action of angle changing link 90. The main shaft 28, cocking pawl arm 124, carrier shaft 15, carrier arm support 6 and all parts mounted thereon, including target carrier 8, oscillate with the frame 5 through a large or small angle depending upon the position of spread adjusting screw 98. For example, if spread adjusting screw 98 is positioned in hole 99 in angle changing disk 67, no oscillation of the frame 5 and other parts occurs due to the fact that this hole is in line with the axis of shaft 66. When screw 98 is positioned in hole 100 the frame oscillates through a small angle. Holes 101 through 104 provide successively larger oscillation angles for frame 5, since they are each respectively at a greater distance from the axis of rotation of shaft 66. With the trap in cocked position and frame 5 oscillating a target is placed on target carrier 8 against the stop 182 and the trap is ready for firing, Figures 1, 2, 3, 4, and 8. The target is thrown merely by momentarily closing the release switch 145.

When the release switch 145 is turned on, release solenoid 140 is energized pushing on arm 139 of trigger 135, further tensioning spring 137, and moving trigger end 138 out of contact with roller 131 of the sear 130. The sear 130 moves about hinge pin 133 momentarily out of engagement with carrier arm 7, leaving it free to rotate and throw the target from the target carrier 8 through the action of main spring 34 rotating main shaft 28 and carrier shaft 15. When the arm 7 leaves the sear 130, spring 137 causes bar 132 to move about pivot 134 for the short distance permitted by slot 184, which movement permits action of control switch 142 to connect control solenoid 89 into the circuit, and to cut switch 145 and release solenoid 140 out of the circuit. The instant that current to solenoid 140 is turned off, the tension on spring 137 operates to move trigger 135 so that end 138 thereof, by its cam action on roller 131, again moves sear 130 into position for engaging carrier arm 7. When solenoid 89 is thus energized it pulls on pawl operating lever 87 operating pawl 83 to disengage pawl tip 84 from notch 72 and causes pawl tip 85 to engage teeth 79, which holds ring gear 77 stationary, and thereby stops oscillation of frame 5. Planet gears 74 then revolve about sun gear 64 turning driving gear 70, cocking gear 119, and cocking ratchet 120. As the target carrier 8 reaches the end of its target throwing stroke cam 127 permits cocking pawl 123 to engage ratchet 120 completing the revolution of main shaft 28 to bring the trap into cocked position with the carrier arm 7 engaged with sear 130. The main spring 34 is tensioned through action of crank 29. The tension on spring 137 maintains bar 132 in a position such that switch 142 keeps control solenoid 89 energized from the time switch 145 is turned on until arm 7 again engages sear 130. The tension on spring 137 likewise maintains arm 139 of trigger 135 butted up against the armature of solenoid 140. Control solenoid 89 is thus cut out of the circuit through the movement of bar 132 occasioned by engagement of arm 7 with sear 130 and pawl 83 is operated to hold driving gear 70 stationary and cause oscillation of frame 5, all as described hereinbefore.

Inasmuch as the notches 72 in driving gear disk 69 are unevenly spaced around its periphery, there is occasioned a greater delay in some instances than in others in the engagement of pawl tip 84 with notch 72 thus interrupting the

cycle of positions of the frame 5 with respect to the instant that the trap is fired, so that it is impossible for a shooter to predict the angle at which the target will be thrown. Frame 5 does not commence its oscillation until rotation of driving gear 70 is prevented by the engagement of pawl tip 84 with a notch 72. When the arm 7 has engaged the sear 130 the trap is again in cocked position and after placing a target on the target carrier 8 it may again be fired merely by turning on the switch 145 and the firing and cocking cycle again repeated as often as desired.

The master switch 144 is a double throw switch, which when turned off, Figure 11, disconnects the motor 2 and solenoid 89 from the circuit and shorts the switch 145 thereby energizing release solenoid 140 to fire the trap, releasing the tension on main spring 34, and causing target carrier 8 to rotate to a position where cam 127 permits pawl 123 to engage ratchet 120. When the arm 7 leaves the sear 130, the switch 142 is operated by spring 137 to disconnect solenoid 140 and leave all circuits dead. Thus, when master switch 144 is again turned on, the trap will go through the cocking cycle as described hereinbefore. Upon turning off the master switch 144 the trap is therefore in fired position with no torque on shaft 28 due to its main spring 34, so that the trap is safe to handle for the purpose of making adjustments and the like. If it is desired to have greater or lesser tension on main spring 34 this is accomplished merely by turning the adjusting screw 38. If it is desired to change the elevation of the target carrier 8 this is accomplished by turning adjustment member 51.

The exact angle at which the target is thrown depends upon the position to which the frame 5 and target carrier 8 have oscillated at the instant the carrier arm 7 is freed through the action of the trigger 135. As pointed out hereinbefore the spread or angle through which the frame 5 and target carrier 8 oscillate is determined by the position of the screw 98 in the angle changing disk 67. If it is desired to have the angle through which the frame 5 and target carrier 8 oscillate displaced more to the right or displaced more to the left, this can be accomplished by changing the position of the windage adjustment latch 105 with respect to the notches 110 through 118 in link 90. Likewise, by moving the stop 182 closer to the free end of the target carrier 8, targets tend to be thrown more to the right, whereas by moving the stop 182 further away from the free end of the target carrier 8, the targets tend to be thrown more to the left. Normally the latch tongue 109 on windage adjustment latch 105 will be in notch 114 so that the targets will be thrown evenly to the right and left of the front of the trap. If it is desired, however, to move the angle of spread over which the targets are thrown more to the left, latch 105 is moved so that latch tongue 109 is in one of the notches 113 through 110 depending upon how far to the left one wishes to shift the angle. Such action is accomplished because the link 90 is successively made effectively shorter in moving the latch tongue 109 successively from notch 114 into 113, 112, 111, and 110. Likewise by moving the latch tongue successively from notch 114 into notches 115, 116, 117, and 118, the link 90 is made successively longer and the angle of spread is shifted to the right with the maximum shift to the right being accomplished by placing the latch tongue 109 in notch 118. The windage adjustment hub 95 remains in fixed po-

sition within hole 94 in the angle changing link 90 except when rotated by movement of windage adjustment latch 105. Such adjustments make it possible to throw the targets over the desired angle even though there be a strong side wind, since the angle over which the targets are thrown can be adjusted to the right or the left to compensate for the effect of wind on the direction of flight of the targets.

The recoil snubber acting between the frame 5 and the gear housing support 4 serves to cushion sudden movements of the frame 5. As the frame 5 oscillates while the trap is in cocked position, the piston 155 is moved backwards and forwards within the cylinder 156 at relatively low velocity, with the fluid therein entering and leaving ports 172 and 173 with little resistance to the movement. Any sudden movement of the frame 5, however, is resisted or cushioned due to the resistance offered by the oil or other fluid in entering or leaving 172 and 173. Sudden or shock movements of the frame 5 are sometimes occasioned by action of the main spring 34 in producing a torque on frame 5, during the very short period of time when tip 85 of pawl 83 is not in engagement with teeth 79 and tip 84 is not in engagement with notches 72. Such shock may cause the target to accelerate on the target carrier 8 leaving the rail 9 and then bumping into the rail 9 again before it leaves the carrier 8, with a subsequent breaking of the target on the carrier. The recoil snubber minimizes the effect of such shock movements of the frame 5 and target carrier 8, preventing such breakage of targets and wear on the parts.

Thus, in accordance with this invention a novel, sturdy, efficient, and compact trap for throwing clay pigeons is provided having the advantages, among others, of being electrically operated, smooth running, and capable of continuously throwing targets at varied angles without possibility of the shooter anticipating the direction of flight of successive targets. It is to be understood that the embodiment of the present invention as shown and described is only illustrative and that many changes may be made therein without departing from the spirit and scope of the invention.

Having thus described the invention what is claimed and desired to secure by Letters Patent is:

1. In a target trap having a base, a support thereon, a frame mounted for oscillation on said support, and a spring actuated target throwing arm movably mounted on said frame, the combination comprising means for oscillating said frame and arm, means for cocking said spring, means for firing said trap, control means for actuating alternately said cocking and said oscillating means, means operating in conjunction with said control means for varying the time said oscillation is commenced, means preventing target-damaging shock movements of said throwing arm, means for positioning targets on said arm, means for varying the angle through which said frame oscillates, and means for shifting the position of said angle.

2. A target trap having in combination a base, a support thereon, a frame mounted for oscillation on said support, electrically controlled mechanism for oscillating said frame, a spring actuated target throwing arm, electrically controlled mechanism for cocking said spring, mechanism for holding said spring in cocked position, electrically controlled trigger mechanism for re-

leasing said holding mechanism and firing said trap, a motor for operation of said trap, a differential gear train continuously driven by said motor for transmitting power from said motor alternately to said cocking and said oscillating mechanisms, means for varying the time oscillation of said frame is initiated after said trap is fired, means preventing target-damaging shock movements of said throwing arm, adjustable means for positioning targets on said arm, adjustable means for varying the angle through which said frame oscillates, and adjustable means for shifting the position of said angle.

3. A target trap having in combination a base, a support thereon for gear mechanism, a frame mounted for oscillation on said support, mechanism for oscillating said frame, a target throwing arm resiliently mounted for rotation on said frame, a spring for actuating said arm, means for transmitting power from said spring to said target throwing arm, mechanism for cocking said spring, mechanism for holding said spring in cocked position, trigger mechanism for releasing said holding mechanism and firing said trap, electrical means for actuating said trigger mechanism, a motor for operation of said trap, a differential gear train for transmitting the power from said motor to said cocking and said oscillating mechanisms, a gear in said train for driving said oscillating mechanism, a gear in said train for driving said cocking mechanism, electrical control means operated by said holding means for alternately actuating said cocking gear and said oscillating gear, means operating in cooperation with said control means for varying the time oscillation of said frame is initiated after the trap is fired, a recoil snubber for preventing target-damaging shock movements of said throwing arm, adjustable stop means for positioning targets on said arm, means for adjusting the spread of the angle through which said frame oscillates, and adjustable means for shifting the position of said angle.

4. In a target trap, the combination comprising a base, a housing for the gear mechanism mounted thereon, a frame movably mounted on said housing for oscillation in a substantially horizontal plane, a main shaft extending through said housing and journaled in said frame, a target throwing carrier mounted on the upper end of a carrier shaft inclined to the vertical and having its bottom end connected to the upper end of said main shaft by means of a universal joint, a carrier support in which said carrier shaft is journaled provided with an adjustable link to said frame to permit adjustment of the inclination of said carrier shaft, a crank secured to the lower end of said main shaft, a main spring connected to the end of said crank for driving said carrier to eject a target therefrom, means on said frame for anchoring said main spring and adjusting the tension thereof, sear means on said carrier support for holding said carrier in cocked position, trigger means for releasing said carrier, manually operable means for electrically actuating said trigger means, eccentric drive means for oscillating said frame extending from and journaled in said housing, a link connecting said frame and eccentric drive, a differential gear train journaled within said housing, a motor for continuously driving said gear train, a ring gear in said train adapted to drive said eccentric drive, a cocking gear movably mounted on said main shaft and having a cocking ratchet coaxial therewith and fixed

thereto, a cocking pawl keyed to said main shaft and adapted to engage the teeth of said cocking ratchet, a cam mounted on said frame adapted to disengage said cocking pawl and cocking ratchet during oscillation of said frame by said eccentric drive, a drive gear in said train adapted to drive said cocking gear, control pawl means for holding said ring gear stationary during a cocking operation and for holding said drive gear stationary while said frame is oscillated by said eccentric drive, means cooperating with said control pawl means for effecting a variable delay in initiation of oscillation of said frame after the trap is fired, electrical means for operating said control pawl, adjustable means for changing the eccentricity of said eccentric drive to permit adjustment of the angle through which said frame is oscillated, adjustable means for effectively changing the length of the link between said frame and said eccentric drive to permit the angle of oscillation of said frame to be shifted, adjustable means on said carrier for positioning the target thereon, and a recoil snubber acting between said frame and housing adapted to resist shock movements of said frame and said carrier.

5. In a target trap, the combination of a base, a support thereon, a frame mounted for oscillation on said support, mechanism for oscillating said frame, a spring actuated target throwing arm mounted on said frame, mechanism for cocking said trap, a motor for operation of said trap, and means for transmitting power from said motor to said cocking and said oscillation mechanisms comprising a differential gear train with planetary gears whose axes rotate about a sun gear.

6. The target trap of claim 5 in which the spring is a flat metal ribbon coiled edgewise and fastened at one end to said frame for pivotal movement and at the other end to said mechanism for cocking said trap.

7. In a target trap having a base, a support thereon for gear mechanism, a frame mounted for oscillation on said support, mechanism for oscillating said frame, a spring actuated target throwing arm movably mounted on said frame, mechanism for cocking said trap, means for firing said trap, and a motor for operation thereon, the gear mechanism comprising differential gearing with one gear in the train adapted to drive the mechanism for oscillating said frame, another gear in the train adapted to drive the mechanism for cocking the trap, and another gear in the train operated by said motor and adapted to drive alternately said frame-oscillating gear and said trap-cocking gear, means for holding said frame-oscillating gear stationary during the trap cocking operation and means for holding said trap-cocking gear stationary while the trap is in cocked position.

8. In a target trap, the combination of a base, a housing thereon for gear mechanism, a frame mounted for oscillation on said housing, mechanism for oscillating said frame, a spring actuated target throwing arm movably mounted on said frame, mechanism for cocking said trap, means for firing said trap, a motor for operation thereon, and gear mechanism within said housing comprising differential gearing with one gear in the train adapted to drive the oscillation mechanism for said frame, another gear in the train adapted to drive the trap-cocking mechanism, and another gear in the train adapted to be continuously rotated by said motor and drive

alternately said frame-oscillating gear and said trap-cocking gear, and pawl and ratchet means for holding said frame-oscillating gear stationary during the trap-cocking operation and for holding said trap-cocking gear stationary while the trap is in cocked position.

9. In a target trap having a base, a support thereon for gear mechanism, a frame mounted for oscillation on said support, mechanism for oscillating said frame, a spring actuated target throwing arm movably mounted on said frame, mechanism for cocking said trap, means for firing said trap, and a motor for operation thereof, the gear mechanism comprising differential gearing with one gear in the train adapted to drive the mechanism for oscillating said frame, another gear in the train adapted to drive the mechanism for cocking the trap, and another gear in the train operated by said motor and adapted to drive alternately said frame-oscillating gear and said trap-cocking gear, means for holding said frame-oscillating gear stationary during the trap-cocking operation, means for holding said trap-cocking gear stationary while the trap is in cocked position, and means for varying the time oscillation of said frame is initiated after the trap is fired.

10. In a target trap, the combination of a base, a support thereon, a frame mounted for oscillation on said support, a spring actuated target throwing arm movably mounted on said frame, mechanism for cocking said trap, mechanism for firing said trap, a motor for operation thereof, and mechanism for oscillating said frame comprising a link movably connected at one end to said frame and at the other end to a crank arm, means for adjusting the length of said crank arm to vary the angle of oscillation, and means to vary the effective length of the said link.

11. In a target trap having a base, a support thereon, a frame mounted for oscillation on said support, a spring actuated target throwing arm movably mounted on said frame, mechanism for cocking said trap, mechanism for firing said trap, and a motor for operation thereof, the combination comprising a link movably connected at one end to said frame and having an annulus at its other end with notches spaced about the periphery of said annulus, a hub having an eccentrically spaced hole and adapted to fit the hole in said annulus, a screw having a portion journaled in said hole in said hub and a threaded portion for movably mounting said link on said support, and a latch movably mounted on said hub adapted to engage any one of said notches to hold said hub in fixed position in said annulus.

12. In a target trap having a base, a support thereon, a frame mounted for oscillation on said support, a spring actuated target throwing arm movably mounted on said frame, mechanism for cocking said trap, means for firing said trap, and a motor for operation thereof, mechanism for oscillating said frame including an adjustable eccentric drive which comprises: a link movably connected at one end to said frame and having an annulus at its other end with notches spaced about the periphery of said annulus, a hub having an eccentrically spaced hole and adapted to fit the hole in said annulus, an adjusting screw having one portion journaled in said hole in said hub and a threaded portion, a shaft journaled in said support and driven by said motor, a disk mounted on the end of said shaft with spaced threaded holes therein with each of said holes adapted to receive the threaded

15

portion of said screw, and a latch movably mounted on said hub and adapted to engage any one of said notches to hold said hub in position in said annulus.

13. In a target trap, the combination of a base, a support thereon for gear mechanism, a frame mounted for oscillation on said support, mechanism for oscillating said frame, a spring actuated target throwing arm movably mounted on said frame, mechanism for cocking said trap, a motor for operation thereof, and means for preventing target-damaging shock movements of said frame and throwing arm comprising a recoil snubber acting between said frame and said support.

14. In a target trap, the combination of a base, a support thereon for gear mechanism, a frame mounted for oscillation on said support, mechanism for oscillating said frame, a spring actuated target throwing arm movably mounted on said frame, mechanism for cocking said trap, a motor for operation thereof, and a recoil snubber acting between said frame and said support for preventing target-damaging shock movements of said frame and throwing arm comprising a cylinder, a piston therein, and ports at each end of said cylinder connected by a passage-way external of said cylinder.

15. In a target trap, the combination of a base, a support thereon for gear mechanism, a frame mounted for oscillation on said support, mechanism for oscillating said frame, a spring actuated target throwing arm movably mounted on said frame, mechanism for cocking said trap, a motor for operation thereof, and means for transmitting power from said spring to said target throwing arm comprising a main shaft passing vertically through said housing and having a crank fixed to its lower end operated by said spring, a carrier shaft having said arm secured to its upper end and inclined to the axis of said main shaft, and a universal joint connecting the upper end of said main shaft to the lower end of said carrier shaft.

16. In a target trap, the combination of a spring actuated target throwing arm, and means for resiliently mounting said arm comprising spaced openings in said arm, rubberlike grommets in said openings, a washer provided with openings spaced in accordance with the openings in

16

said arm, and fastening bolts disposed in the openings in said grommets and said washer securing said arm to said trap.

17. In a target trap, the combination of a spring actuated target throwing arm, and adjustable stop means for positioning targets on said arm comprising a rod, clip members face to face having holes in which said rod is disposed with each clip member having a projection extending at an angle back from its face, and a tension member about said projections tending to pull said projections together and yieldably hold the edges of said holes in locking engagement with said rod.

18. In a target trap having a base, a support thereon for gear mechanism, a frame mounted for oscillation on said support, mechanism for oscillating said frame, a spring actuated target throwing arm mounted for rotation on said frame, mechanism for cocking said trap, mechanism for holding said trap in cocked position, trigger mechanism for firing said trap, a motor for operation of said trap, and a differential gear train transmitting the power from said motor to said cocking and oscillating mechanisms, an electrical control system comprising: a manually operable release switch for firing the trap, a manually operable master switch, an automatically operated control switch, a control solenoid for actuating said cocking mechanism, and a release solenoid actuated by said release switch for operating said trigger mechanism, said control switch being automatically operated to disconnect said control solenoid while said trap is in cocked position and to connect said control solenoid while the trap is not in cocked position to said power source, said master switch in the "on" position connecting said motor and said control solenoid to the power source and in the "off" position shunting said release switch to fire the trap.

HARRY CLARK FOSTER.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
918,432	Fulford	Apr. 13, 1909
1,728,595	Carothers	Sept. 17, 1929
2,063,284	Winans	Dec. 8, 1936