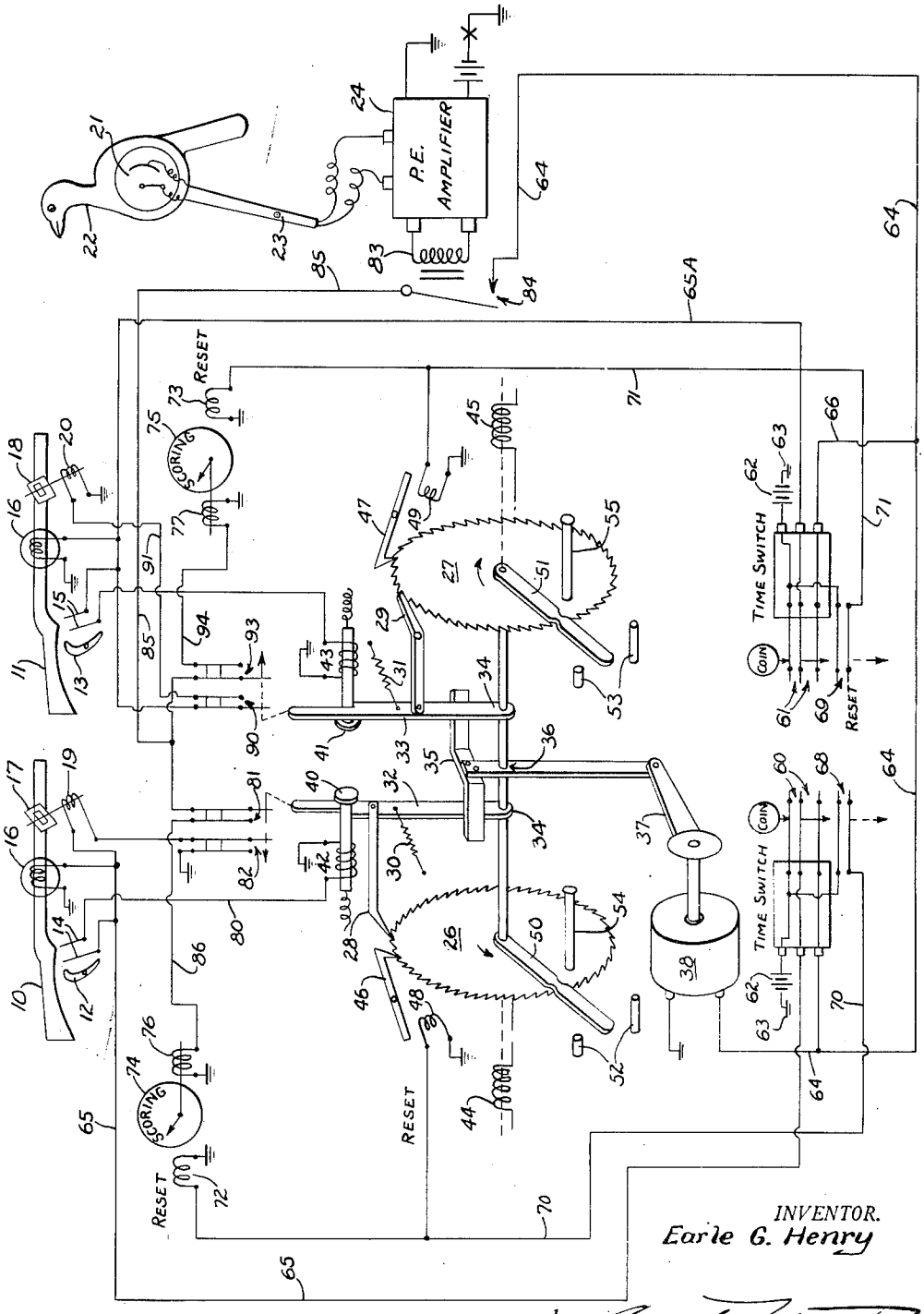
Sept. 14, 1954 E. G. HENRY 2,689,130

PHOTOELECTRIC MARKSMANSHIP APPARATUS

Original Filed Oct. 19, 1946



Patented Sept. 14, 1954

2,689,130

UNITED STATES PATENT OFFICE

2,689,130

PHOTOELECTRIC MARKSMANSHIP APPARATUS

Earle G. Henry, Wilmette, Ill., assignor to Raymond T. Moloney, Chicago, Ill.

Original application October 19, 1946, Serial No. 704,457. Divided and this application October 14, 1950, Serial No. 190,088

13 Claims. (Cl. 273—101.1)

1

This invention pertains to photoelectric marksmanship apparatus and to improvements in control mechanisms therefor, the present application being a division of my application Serial No. 704,457, filed October 19, 1946, now Patent No. 2,536,744.

A principal object of the invention is the provision of marksmanship apparatus employing at least two aiming pieces or light guns aimable at the same photoelectric target, and control mechanism of electro-mechanical nature functioning so that a hit may be scored by either gun alone, or by the two guns, as in a competitive game of skill.

A further object is the provision of apparatus of the class described in which the guns are coin-controlled so that one or the other may be used upon deposit of a proper coin, or the two guns may be used simultaneously upon deposit of two coins.

Another important object is the provision of electro-mechanical control mechanism common to the two guns but enabling registration of either or both guns' hits, said mechanism further controlling certain rapid-fire operations of either or both guns, said mechanism further limiting the number of shots afforded either gun by coin release; said mechanism further controlling certain hit and score circuits for either or both guns.

Additional objects are: the provision of control mechanism which times the shots of the guns; which insures rapid alternate action of at least two guns, which counts the shots of the guns and mechanically limits the permitted number of shots; which makes fractional shots impossible; which includes certain supervisory hit control circuit means making fraudulent or accidental actuation of the photoelectric target means difficult and practically unlikely.

Other objects and aspects of novelty and utility will appear as the following description proceeds in view of the annexed drawing, in which the single figure is a schematic circuit and structural diagram of a dual gun game employing the invention.

An illustrative embodiment of the invention is shown in the drawing, wherein there are shown two guns 10 and 11 each provided with a trigger 12 or 13 for closing associated switch contacts 14 or 15, respectively.

Each gun also has a lamp 16 for projecting light through its barrel, said light being emitted through the barrel provided the corresponding electromagnetic shutter 17 or 18 is properly actuated by the corresponding electromagnetic coil

2

means 19 or 20, the light from said guns being aimed at photocell means 21 in a preferably moving target device 22, illustrated herein as pivoting for oscillation about axis 23, the light-activated response of said photocell means being amplified by photoelectric amplifier 24 of known construction, and the output of said amplifier, responsive to a hit, actuating certain score register means as will appear hereinafter.

Circuit and electromechanical means for controlling the operation and scoring of hits by the guns includes a pair of ratchet discs 26 and 27 each arranged to be advanced from a starting position, step-by-step, by corresponding pawls 28 and 29, which in turn are advanced by springs 30 or 31 normally urging corresponding levers 32 or 33, pivoted as at 34, in such advancing action.

Advancing springs 30 and 31 are tensioned by intermittent oscillations of a Z-shaped reset lever 35, pivoted as at 36, and oscillated by crank means 37 driven by motor 38. As each advancing lever 32 or 33 is reset by alternate movements of the Z lever, and the corresponding springs 30 and 31 are tensioned, said advancing levers are automatically locked in set condition by corresponding spring-urged plungers 40 or 41, either of which may be withdrawn from locking position by energization of the corresponding solenoid coil 42 or 43 under control of trigger switches 14 and 15, respectively.

Trigger-controlled withdrawal of either locking plunger permits the associated advancing lever 32 or 33 to be moved by its spring and advance the corresponding ratchet disc one tooth, said discs tensioning their respective return springs 44 or 45 by such advance, and the discs being restrained against retrograde or return movement by corresponding holding pawls 46 or 47, either of which may be released or withdrawn by energization of a corresponding reset solenoid coil 48 or 49, thus permitting the corresponding ratchet disc to be spring-restored to starting position.

The number of teeth on each ratchet disc determines the permitted number of shots, said discs being mechanically stopped in either direction by stop arms 50 or 51 respectively pivoted thereon (coaxially with the rotative axes thereof) to strike against corresponding stop pins 52 or 53 when corresponding stop studs 54 or 55 bear against either side of the corresponding stop arms in opposite rotative motions of their respective discs.

Scoring is controlled and registered as follows: the apparatus is preferably arranged for coin

operation, there being two conventional coin chutes associated therewith, one for each gun; deposit of a proper coin in either chute closes a known type of time switch 60 or 61, thus setting up a master power circuit from either battery or power source 62, one terminal of which is grounded or common, as at 63, the remaining terminal of said power source being connected through switch contacts 60 or 61, closed for a predetermined time of play controlled by known time mechanism (not shown because common in the art) and conductor 64 to motor 38 and common power lead 65, assuming time switch 60 to be the one that has been coin-operated. If coin switch 61 has been operated, a similar power circuit is set up from source 62 through contacts 61, conductor 66 to power lead 64, which will also energize motor 38 via conductor 64.

Operation of either coin switch as aforesaid will also close to reset switch 68 or 69 momentarily by passage of the coin through the chute in the well-known manner; if reset switch 68 is the one closed, power source 62 is connected via conductor 70 to reset coil 48 for ratchet disc 26, and also to reset coil 72 for the corresponding score register device 74, which is an electromagnetically advanced and reset ratchet device similar to the ratchet devices 26 and 27 in that the score registers are advanced by electromagnetic impulse and reset to zero by electromagnetically released pawl means. Such score registers are well-known in the art and are therefore not shown in structural detail.

If reset switch 69 is the one operated, then a power circuit is momentarily closed from source 62 via conductor 71 through reset coil 73 to restore score register 75 to zero and energize reset coil 49 for ratchet disc 27.

If coins are deposited simultaneously in both coin chutes, both time switches will remain closed for the alloted time, and both score registers will be zeroized as aforesaid.

Assuming that one or the other, or both, coin switches are actuated as aforesaid, then in addition to zeroizing of the score registers, reset pawls 46 and: or 47 will be momentarily withdrawn, and ratchet discs 26 and: or 27 will return to starting position; meanwhile, motor 38 will be running to oscillate the reset lever 35, so that the advancing levers 32 and 33 are continually and rapidly being urged in restorative action, and if no shots have been taken at the guns, these levers will remain locked by their respective locking plungers 40 and 41.

Assuming that trigger 12 is pulled in accurate aim upon photocell target 21, the result is energization of release solenoid 42 from common power lead 65 via trigger switch contacts 14, closed, and conductor 80, thereby withdrawing locking plunger 40 so that spring 30 may rock lever 32 and advance pawl 28 to move ratchet disc 26 one tooth.

A further and important function of advancing lever 32 in movement as aforesaid is to close switch contacts 81 and 82 momentarily (until the lever is reset); this results in energization of shutter coil 19 from power lead 65 through contacts 82, closed, to ground, thereby causing shutter 17 to open momentarily and permit light from lamp 16 to impinge upon the photocell target 21, assuming the aim to be accurate.

Activation of the photocell 21 impulses the amplifier input of the P. E. amplifier 24, which in turn impulses relay winding 83, closing hit relay contacts 84 and applying power from lead 64 via conductor 85 to one of the now closed contacts 81, so that score register coil 76 is energized via conductor 86, thereby setting up one hit on score register 74.

Should trigger 13 on the other gun be the one closed, then a similar train of events would occur in the corresponding control circuit and mechanism, that is to say, trigger switch contacts 15 would close to energize release coil 43 from power lead 65A, causing advancing lever 33 to be spring-moved, thereby closing supervisory contacts 90 to energize shutter coil 20 via conductor 91, and also closing supervisory contacts 93 so that if a hit is scored and hit relay contacts 84 are accordingly closed, score register operating coil 77 will be energized from conductor 85 via conductor 94 to advance register 75 to indicate one hit.

The motor driven reset means 38, 37, 35 is regulated to effect closure of the supervisory switch means 81—82 or 90—93 at a rate of about 420 times per minute; thus if the triggers are held down for a minute, shutters 17 and 18 would open and close in simulated rapid-fire action equivalent to 420 shots per minute; in practice, solenoids 19 and 20 for the shutters are also sound producers, simulating gun fire at the stated rate.

If the players or marksmen do not take their allotted number of shots in the time determined by running of conventional time switch means 60, 61, the latter will open, thereby disabling or disconnecting the operating power for the corresponding gun unit; however, motor 38 will continue to run until the last time period expires, that is, the period corresponding to the last coin deposited.

If the time periods, or either of them, have not expired but the marksmen have taken the allotted number of shots, then pins 54 or 55 on discs 26 or 27 will have been rotated against the corresponding stop arm 50 or 51, respectively, and under this condition is noted importantly the inability of either advancing lever 32 or 33 to move from set position, so that neither supervisory switch will be operated upon further trigger closures; thus no further shots can be taken and no hits can be scored for that gun whose ratchet disc means has been advanced to the permitted limit of shots.

Ratchet discs 26 and 27 will stand in their respectively advanced conditions, as will the corresponding score registers, until another coin is deposited, whereupon the aforesaid zeroising operations will occur and the operative cycle may be repeated.

It is important to observe that no hits can be scored unless the trigger switch means and associated supervisory switch means are closed, so that fraudulent or accidental running up of scores, as by use of a flashlight, is rendered very difficult. If both guns are "fired" simultaneously, only one will score a hit during the interval of a single "shot," which is to say a single oscillation of the reset lever means 35, so that fractional shots are avoided. However, the oscillation of lever 35 is so very rapid that as a practical matter both guns have equal opportunity to score competitively.

In the prior art, dual gun games are known, there being a type which operates upon frequency discriminative principles in the photoelectric circuits. Mechanical and electromechanical types are also known, but this present invention and disclosure affords a unitary gun and score control means (which is itself novel

and the subject of my U. S. Patent No. 2,536,744), as well as control circuits providing a relatively simple, inexpensive, easily serviced, and functionally attractive apparatus which is equally satisfactory for individual or competitive operation.

I claim:

1. Photoelectric marksmanship apparatus comprising at least two light guns, light sources for said guns, electromagnetic light shutter means for each gun, trigger switch means for each gun, a photoelectric target actuated by light from said guns, electromagnetic score register means for each gun operated by light-actuation of said target, supervisory switch means for each gun and severally operable to actuate the shutter means for the corresponding gun and complete an operating circuit between said target and the corresponding score register means, releasable means for operating said supervisory switch means, and means actuated by the trigger switch means of each gun for releasing said releasable operating means.

2. Apparatus as defined in claim 1 and further characterized in that said releasable means operates said supervisory switch means in alternation.

3. Apparatus as defined in claim 1 and further characterized in that said releasable means is yieldingly urged into released, supervisory-switch-operating condition, and is further locked into non-released, set condition by said trigger switch actuated releasing means, and there is further provided automatic means alternately urging said releasable means into set condition, whereby said releasable means is prevented from simultaneous operation of the supervisory switch means.

4. Photoelectric marksmanship apparatus comprising a photoelectric target, at least two light-emitting guns each provided with rapid fire light-emission control means, trigger switch means for each gun, score register means for each gun operably controlled by light hits on said target, supervisory switch means for each gun and each including circuit connections for the corresponding register means and corresponding emission control means, and control mechanism operated by the trigger switch means of either gun for rapidly operating said supervisory switch means in rapid alternation, whereby to render operative the score register means and the emission control means for either gun the trigger switch of which is operated.

5. Apparatus as set forth in claim 4 and further characterized by the provision of means cooperable with said control mechanism for mechanically limiting the number of operations of either supervisory switch means by said mechanism for either gun.

6. Photoelectric apparatus including a photoelectric cell, a plurality of light sources for directing light upon said cell, a like plurality of electromagnetic registers, circuit connections between said cell and said registers for actuating the latter responsive to light-activation of said cell, a normally open supervisory switch for each register in said circuit connections permitting operation of the corresponding register only if closed, electromagnetic light shutter means for each light source and normally blocking light emission therefrom, a supervisory switch normally opening operating circuit for each shutter means, trigger controlled release means for each light source, oscillatory mechanism normally locked against operation for closing all of the supervisory switches for a given light source in alternation responsive to release thereof from locked condition, said trigger controlled release means when trigger-released unlocking said mechanism for closure of the corresponding supervisory switches only, and means for automatically restoring said oscillatory mechanism to locked condition following unlocking thereof as aforesaid.

7. Apparatus as set forth in claim 6 and further characterized by the provision of means cooperable with said oscillatory mechanism for limiting the number of supervisory switch operating actions thereof for any given light source.

8. Apparatus as set forth in claim 6 and further characterized by the provision of means cooperable with said oscillatory mechanism for limiting the number of supervisory switch operations thereof for any light source, and coin-controlled means for conditioning the limiting means for any light source for a further like number of switch operations.

9. In marksmanship apparatus of the class described, a plurality of light guns each having a trigger switch and an electrically operated light shutter, a light target common to said guns, an electrically operated register for each gun, a like plurality of rotatable ratchet discs, spring-urged levers moving in opposite directions and corresponding in number to said guns, pawl means actuated by each said lever for stepping a corresponding one of said ratchet discs in opposite directions, trigger switch operated means for each gun releasably locking one corresponding lever aforesaid in set condition for release in spring-urged movement to step the corresponding disc, supervisory switch means actuated by each said lever in stepping operation, oscillatory means common to said levers for restoring the same in alternation to set condition if released from locked condition, and circuit connections including the supervisory switch means, the shutter means, and the register means for each gun operative responsive to trigger release of the corresponding lever for effecting emission of light from the corresponding gun and connecting the corresponding register in circuit for operation responsive to light-actuation of said target for the duration of release of the corresponding lever.

10. In a conventional photoelectric marksmanship apparatus of the type including in combination with a photoelectric target, an amplifier actuated thereby, at least two score electromagnetic registers actuated by said amplifier, and at least two light guns, improvements comprising, to wit: a light source, a trigger switch, and an electromagnetic light shutter for each said gun, a coin-actuated time switch for each gun and operable to connect the corresponding trigger switch, light source, and electromagnetic shutter to a source of power; a pair of normally open supervisory switches associated with each gun, one of the said switches of each pair being connected in series with said power source and said electromagnetic shutter, and the other switch of each pair being connected in series with the corresponding register and said power source, oscillatory lever means for intermittently closing said pairs of supervisory switches in alternation, electrical means controlled by said time switch means for oscillating said levers, alternately releasable locking means normally holding said levers against oscillation, and electro-

magnetic lock release means for each said locking means and respectively energized from said power source by a corresponding one of said trigger switches.

11. Photoelectric marksmanship apparatus comprising a plurality of light guns each having an operating circuit, a trigger-operated switch, and trigger-controlled electrically operated light-shutter means; a photoelectric target means common to all guns and upon which the same are to be aimed; electrically-operated score-register means and circuit connections therefor connected to be actuated by said photoelectric target means responsive to triggered hits scored as a result of pulling the trigger of any of said guns under correct aim thereupon; and means including an electrically actuated switching mechanism and circuit connections therefor with each said trigger switch for actuating said mechanism responsive to operation of any trigger switch; together with circuit connections controlled by the switching means of said switching mechanism intermittently and selectively disabling the operating circuits for each gun one at a time rapidly for short intervals in a timed succession, such that only one gun at a time is effectively operable for trigger-controlled operation to actuate said score-registering means, the intermittent switching operation of the switching mechanism as aforesaid being of a predetermined high rapidity such that the intervals of effective operability for each gun follow in rapid succession, but not more than one of any two or more guns controlled by the switching mechanism as aforesaid, and correctly aimed upon said target means and whose trigger switches are simultaneously operated, can effectively operate said score-register means to register a hit.

12. Photoelectric marksmanship apparatus comprising a plurality of light-emitting guns; trigger-switch means for each gun; photoelectric target means adapted to be actuated by light aimed thereupon from any of said guns; score-signalling means for each gun; control-switch means for each gun; a shot-limiting device for each gun; spring-drive means normally acting from a set condition to actuate the appertaining control-switch means and limiting device for each gun; electrically-releasable restraining means associated with each said spring-drive means to restrain the latter from acting from the set condition aforesaid; setting means common to said releasable restraining means for moving the latter one after another into said set condition; rapid-action light-shutter means for each gun connected for operation by the appertaining control switch means to rapidly interrupt light therefrom; circuit means controlled by the trigger switch means of each gun for effecting release of the appertaining restraining means responsive to operation of the appertaining trigger switch means for a predetermined minimum time; hit-switch means connected for scoring operation by said photoelectric target means responsive to a change in illumination upon the latter; together with circuit means controlled by trigger-released actuation of the control-switch means of any said gun and the simultaneous scoring operation of said hit-switch means for operating the score-signalling means appertaining to such gun a maximum number of times permitted by the appertaining shot-limiting device.

13. In a multi-gun aim-testing apparatus having one target device common to all guns; hit-indicating means for each gun; trigger means for each gun; a control device for each gun; spring-driven means for each gun releasable from a set condition to actuate an appertaining control device; means operated by actuating each trigger means for releasing the corresponding spring-driven means and causing operative release of the appertaining control device; resetting means acting continually in the operation of said apparatus for restoring any released spring-driven means rapidly to set condition; means controlled by the trigger means of each gun for releasing from the latter a target-operating agent directed by the gun aimed upon said target device to actuate the latter in a hit operation if the aim be correct; and means jointly controlled by the simultaneous hit-operation of the target device and any of the control devices released as aforesaid for actuating the appertaining hit-indicating means.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,187,989	Squire	Jan. 23, 1940
2,294,558	Hooker	Sept. 1, 1942
2,309,614	Jensen	Jan. 26, 1943
2,536,744	Henry	Jan. 2, 1951
2,629,598	Hooker	Feb. 24, 1953

FOREIGN PATENTS

Number	Country	Date
513,825	Great Britain	Dec. 28, 1937
832,178	France	June 27, 1938