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PHOTOELECTRIC MARKSMANSHIP APPARATUS

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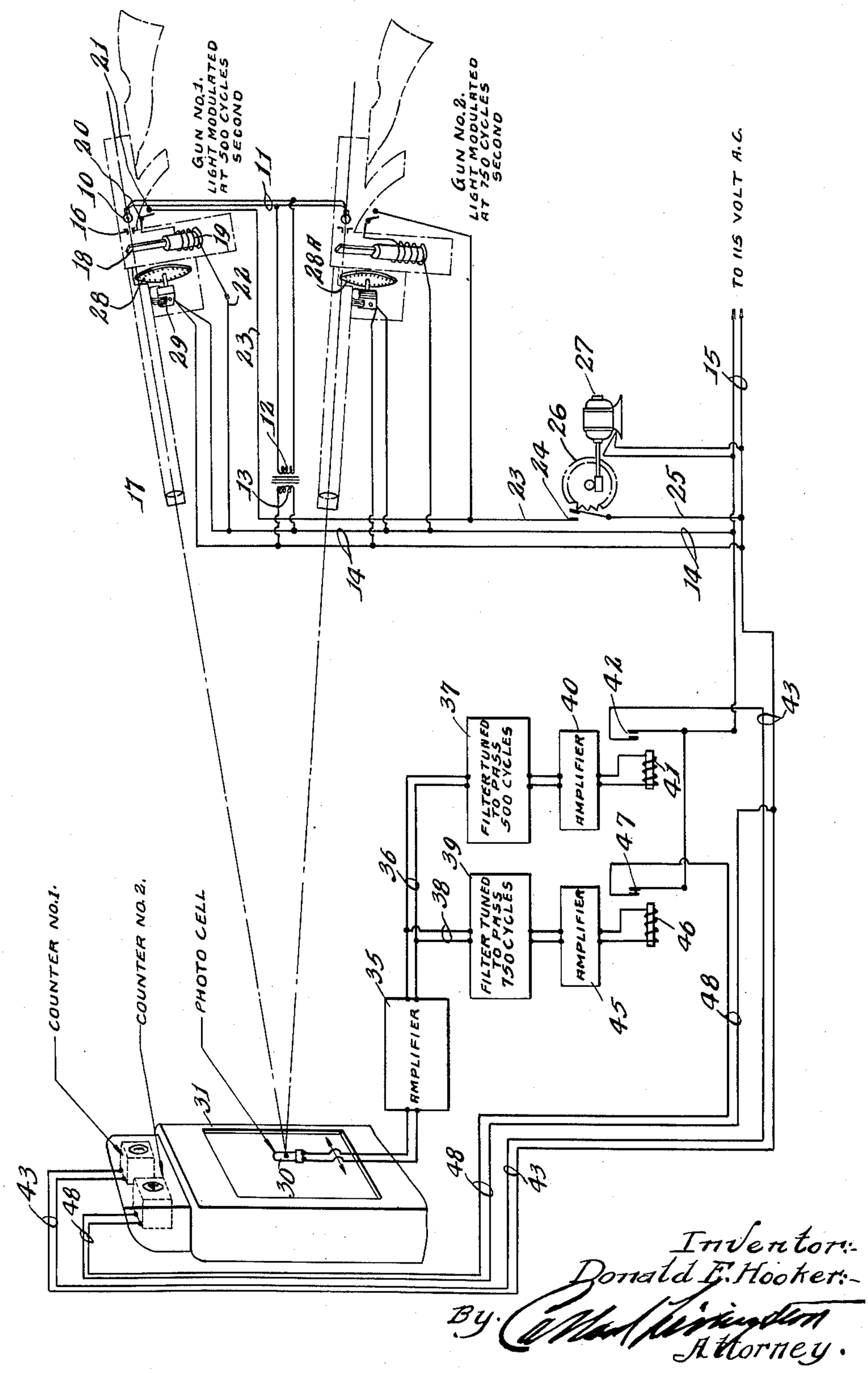

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PHOTOELECTRIC MARKSMANSHIP APPARATUS

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This invention pertains to marksmanship apparatus for amusement, practice, and training purposes, and has as its principal object the provision of apparatus of this class operating upon photoelectric principles and providing a plurality of aiming devices or light guns which may be directed at a single target, for example in a competitive target game, with separate score registers for each gun recording hits made by the corresponding gun upon the single target.

Further and more particular objects are: the provision in a target apparatus of target means to be actuated, in the sense of being hit, by one of several guns or aiming devices, and means for indicating which gun or aiming device has effected the hit; the provision in a photoelectric gun game of a plurality of guns each adapted to project a light beam which is characteristically different from the beam projected by the other guns; the provision in such a game or apparatus of a photoelectric target actuated by the light beam from any said gun; the provision in such a game of hit registering means corresponding to each gun and indicating only the hits scored by the corresponding gun.

Still further objects are the provision, in apparatus of the class described of light guns and means therein for modulating the light projected thereby at a particular frequency; the provision of means in each gun for effecting a rapid fire or machine gun action in emission of the projected light, with corresponding noise and recoil effects; the provision whereby each gun emits light of predetermined or assigned frequency, differing in frequency from the rate of frequency of modulation of light emitted by the other guns associated with the apparatus; the provision of a photoelectric target operable by properly aimed light from any or all of said guns; the provision of hit-indicating or score-registering means for each gun and operable controlled by said photoelectric target; the provision of frequency or modulation discriminative means associated with the photoelectric target means and the hit-indicating means and operating to cause an operation of the latter dependently upon the light frequency or light-modulation characteristic of the gun scoring the hit.

Additional objects, aspects of novelty, and features pertain to details of the illustrative embodiment described hereinafter in view of the annexed drawing, in which the single figure is a schematic layout of a target apparatus equipped with a single photoelectric target, two light guns, a score register for each gun; and selective means for controlling the score registers.

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Referring to the drawing, the illustrative embodiment employs two guns, No. 1 and No. 2, the bodies of which are constructed in the form of submachined guns. Each gun is provided with a high-intensity electric lamp **10**, energized from conductors **11** connected to transformer secondary **12**, the primary of this transformer, indicated at **13**, connecting via conductors **14** to the power source lines **15**.

Light from lamps **10** is first directed through an aperture plate **16** and thence through a lens **17** in the fore part of the gun barrel.

Normally blocking emission of the light in each gun is a shutter element **18**, forming part of the plunger of an electromagnetic solenoid including winding **19**, said shutter and plunger means being normally elevated in light-blocking position, as shown, by spring means (not seen) contained in the solenoid.

One terminal of each solenoid connects with a contact **20** on a trigger switch, which contact is closed by depressing the trigger with a companion contact **21**, while the remaining terminal of the solenoid winding connects via conductor **22** to one of the power leads **14**, such that when the trigger switch is closed, winding **19** will be energized from said lead to conductor **14**, and a conductor **23** which completes circuit through an interrupter switch **24** and conductor **25** to the remaining power lead **14**.

The interrupter switch **24** is opened and closed at some predetermined rate, for example six times per second, by an interrupter disc **26** driven by motor **27** powered from leads **15**, the purpose of this arrangement being to provide a simulated machine gun firing action in the operation of the solenoid shutter means.

Means for modulating the light from each gun to provide the characteristic discriminative frequency for the corresponding gun, includes an apertured disc **28** in the gun and rotated at determined rate by a small motor **29**, also powered from conductors **14**.

The frequency of interruption or modulation of the projected light beam is a function of the number of apertures in disc **28** and the speed at which the disc is rotated by motor **29**; in the present case, the light from gun No. 1 is modulated at 500 cycles per second, while the light from gun No. 2 is modulated at 750 cycles per second.

Light modulating means which may be employed in these guns are shown and described in my copending applications Serial Nos. 378,645 now Patent No. 2,516,319, granted July 25, 1950,

and 431,672 now Patent No. 2,442,240, granted May 25, 1948.

Excepting only that disc **28A** in gun No. 2 is contrived to give a different modulation frequency from that effected by disc **28** in gun No. 1, the construction and operation of the two guns is identical, and it is intended that the simulated rapid-fire projection of modulated light by the two guns is to be aimed upon a single photoelectric target means in the form of a photoelectric cell **30**.

The photoelectric target member **30** is shown as movable back and forth horizontally before the window of a cabinet **31**, in accordance with well-known practices in this art, it being understood that any desired form of target element, such as a simulated bird in flight, a submarine, or the like, is usually provided in association with the photoelectric cell **30** to give a realistic scenic effect, such additional target structure being omitted herein to simplify the drawing.

Score counters No. 1 and No. 2, respectively corresponding to guns No. 1 and No. 2, are situated in cabinet **31** in view of the players or marksmen; these devices are electromagnetically operated and may be of any of the several types well-known in the art.

Assuming that gun No. 1 scores a hit by directing light therefrom onto the target cell **30**, photoelectric current fluctuating at the modulating frequency of said gun will be passed to an input amplifier **35** which is common to the control circuits for the score counters, and the relatively feeble photoelectric currents will be considerably amplified and passed via conductors **36** to filter means, including filter means **37**, tuned or peaked to give minimum attenuation at 500 C. P. S., and also, via conductors **38**, to filter means **39**, tuned or peaked to give minimum attenuation to frequencies of 750 C. P. S., both filters giving maximum attenuation to frequencies above and below their designated or tuned response frequencies.

In the assumed case, output amplifier **40** would receive a sufficient actuating voltage at 500 cycles to pull up its relay **41**, closing contacts **42** to energize the corresponding score counter No. 1 via conductors **43** from power source or line connections **15**, thereby indicating a hit for gun No. 1.

In the event gun No. 2 scores a hit, photoelectric impulses at 750 cycles would be amplified by the input amplifier **35**, and sufficient energy at this frequency would pass filter **39** to actuate the second output amplifier **45** to operate its relay **46**, closing contacts **47**, to energize the second score counter No. 2 via conductors **48** from line connections **15**. Filters **37** and **39** and the circuits for their respective amplifiers **40** and **45** are designed, with regard to the interval between the modulation frequencies so that simultaneous hits may be scored.

While two guns are shown for use in a competitive gun game, preferably of the coin-controlled variety, it is to be understood that a greater number of guns may be employed, in which case the additional guns would each have a light modulating disc, similar to discs **28, 28A**, but modulating the light projected thereby at frequencies different from each other and from the remaining guns, there being additional filter means, such as filters **37** and **39**, each tuned to the modulation frequency of one of the additional guns, together with amplifier means, such as amplifiers **40** and **45**, and relay-controlled counters, such as counters Nos. 1 and 2, corresponding in number to the number of additional

filters and guns, it being desirable in the interest of accurate response and operation, where additional guns and score circuit means are provided, as aforesaid, to widen the frequency interval and adjust the time constants for the several output amplifiers so that simultaneous hits may be accurately scored, the arrangement shown being satisfactory for two guns.

It will now appear that by providing each gun with a characteristic modulation frequency, it is possible to actuate separate score counters for each gun while using only one target element. Moreover, the use of modulated light has the additional advantage, as set forth in said copending applications, of preventing fraudulent or false operation of the score register or hit-indicating means by extraneous light, that is light from sources other than the guns, as light from such sources is rarely if ever encountered at the indicated frequencies in places where the apparatus is intended to be installed. The apparatus closely simulates actual firing conditions, even to the inclusion of machine-gun action and sound effects afforded by the solenoid shutter means **18—19**.

Various means for keying or modulating or otherwise discriminatively distinguishing and characterising the light emitted from each aiming device or gun, may be employed in place of the interrupter-disc means shown; and other modifications and changes may be made in the illustrative arrangement depicted or described, all within the scope of the claimed invention and the important disclosures and teachings thereof which, among other things, afford in operative association and combination, photosensitive target and aiming means with hit or score-indicating and discriminating apparatus contrived and arranged to indicate and control the achievement of separate scores by proper aim-alignment of any aiming device with the target means.

Thus, in one of its broader aspects, the invention discloses the combination, with a single photo-sensitive target, of a number of aimable members, such as guns, each equipped to emit a characteristic light, preferably in rapid-fire simulation of machine-gun action with rapidly recurring bursts of light, together with an indicator for each aimable member and filter means cooperable therewith so that only the characteristic light of the corresponding aimable member will actuate a corresponding indicator as a result of aim-alignment of any aimable member with the common target.

Having thus described my invention for purposes of disclosure to the public in Letters Patent of the United States, what I claim as my invention is:

1. Photoelectric target apparatus including a photoelectric target, a plurality of light guns aimable at said target, an electrically actuated hit-indicator for each gun, relay means connected to actuate each indicator, amplifying means connected to amplify photoelectric currents originating in the photoelectric target responsive to impingement of light thereon, frequency-sensitive means receiving amplified photoelectric target currents from said amplifying means and operating to selectively pass amplified photoelectric currents of a certain predetermined frequency for operation of the relay means for a certain corresponding indicator, means for amplifying the frequency-selected photoelectric currents for each relay means, and means causing the light from each said gun to excite in said

photoelectric target photoelectric currents of predetermined characteristic frequency, each said characteristic frequency corresponding to one of said first-mentioned predetermined frequencies.

2. In a photoelectric aiming apparatus, a plurality of aiming devices each having a light source, a motor-driven light modulation device of unique modulation frequency, and an electromagnetic light shutter and control switch therefore, a power circuit common to all said aiming devices for energizing said light sources, modulation devices and shutters, and a rapid-action switch in the common circuit for said shutters, together with a single photo-sensitive aim objective common to all said aiming devices.

3. Apparatus as set forth in claim 2 and further characterized by the provision of an amplifier for said aim objective, a number of filters corresponding to the number of said aim devices, an output amplifier for each filter, an electrically actuated register operated by each said output amplifier, each said filter having a band-pass range corresponding to the frequency of only a particular one of said modulation devices.

4. In a competitive photoelectric target apparatus, in combination, a single photoelectric target, a plurality of electricaly operated score registers, an amplifier connected to said photoelectric target to amplify impulses therefrom, a plurality of electrical filters, each selectively passing a certain impulse frequency different from that passed by any other said filter, one of each of said filters being connected to operate a corresponding one of said registers, and a plurality of light guns corresponding in number, at least, to the number of said registers, and each operable to project upon said target light interrupted at a frequency corresponding to the frequency of one of said filters, whereby each said gun can actuate a certain one of said registers by projection of light upon a common photosensitive target; a light modulating means in each said gun for determining the light frequency thereof, and an electromagnetic rapid-fire light shutter in each said gun, a common shutter actuating circuit for all said guns, and common rapid-fire interrupter means in said shutter actuating circuit.

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