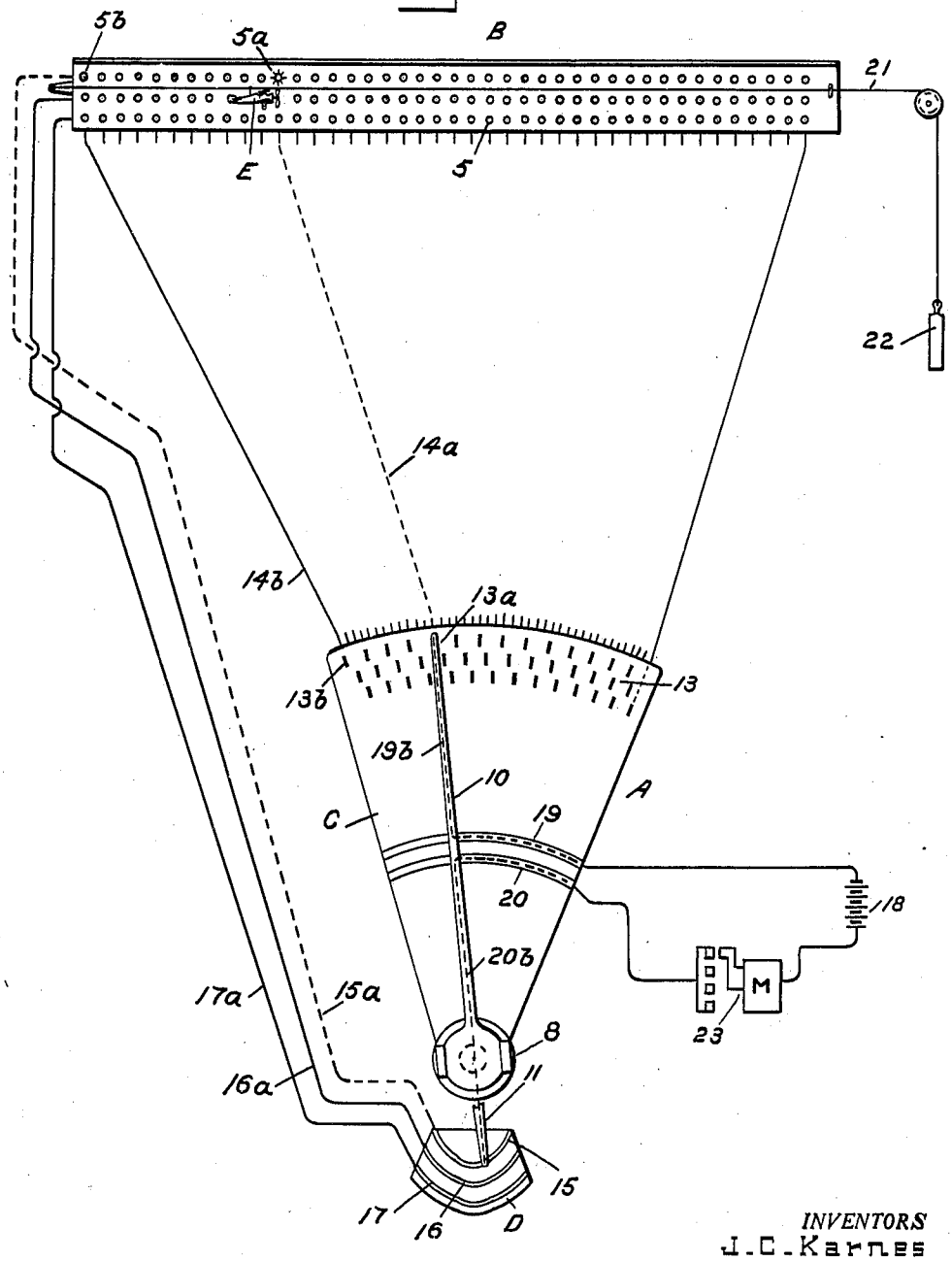
April 28, 1931. J. C. KARNES ET AL 1,803,064

APPARATUS FOR TRAINING IN GUNNERY

Filed June 12, 1930 2 Sheets-Sheet 1

Fig. 1.



INVENTORS
J. C. Karnes
C. J. Kessenich
BY W. N. Roach.
ATTORNEY

April 28, 1931. J. C. KARNES ET AL 1,803,064

APPARATUS FOR TRAINING IN GUNNERY

Filed June 12, 1930 2 Sheets-Sheet 2

Fig-2.

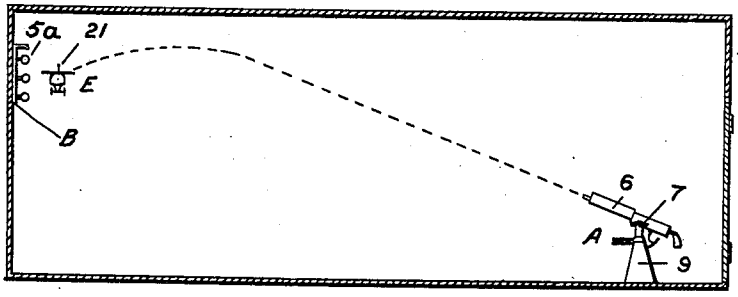


Fig-3.

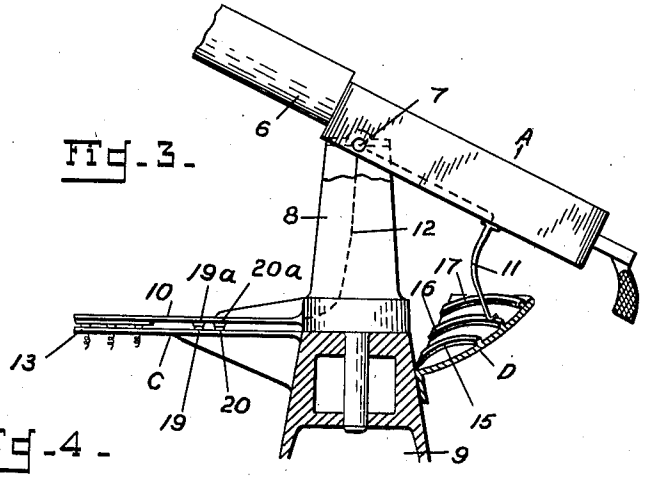
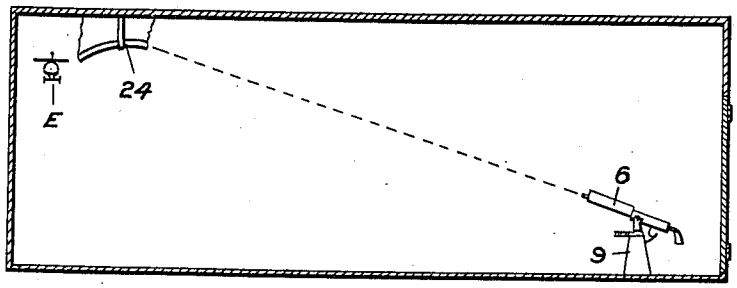


Fig-4.



INVENTORS
J. C. Karnes
BY G. J. Kessenich
W. N. Roach
ATTORNEY

Patented Apr. 28, 1931 1,803,064

UNITED STATES PATENT OFFICE

JAMES C. KARNES, OF BUFFALO, NEW YORK, AND GREGORY J. KESSENICH, OF MADISON, WISCONSIN

APPARATUS FOR TRAINING IN GUNNERY

Application filed June 12, 1930. Serial No. 460,742.

(GRANTED UNDER THE ACT OF MARCH 3, 1883, AS AMENDED APRIL 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to us of any royalty thereon.

This invention relates to an apparatus for training in gunnery.

In anti-aircraft firing with machine guns the laying or pointing of the guns is accomplished by observing tracer bullets. The purpose of the present invention is to provide a gallery practice apparatus in which tracer bullets are simulated by flashes of light. The selective formation of the flashes of light is under the control of a director which must be laid to allow for horizontal and vertical lead due to travel of a target and the angle of departure due to trajectory and range in order for a flash of light to fall on the target.

With the foregoing and other objects in view, the invention resides in the novel arrangement and combination of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed may be made within the scope of what is claimed without departing from the spirit of the invention.

A practical embodiment of the invention is illustrated in the accompanying drawings, wherein:

Fig. 1 is a more or less diagrammatic view of the training apparatus embodying the principles of the invention;

Fig. 2 is a diagrammatic view in side elevation of Fig. 1;

Fig. 3 is a view in side elevation, parts in section, of the director; and

Fig. 4 is a view in side elevation of a modified form of the invention.

Referring to the drawings by characters of reference:

The training apparatus consists generally of a director A and an indicator B formed of rows or groups of electric lamps 5.

The director A serving as a switch for making and breaking electric circuits is preferably in the form of a gun 6 (Fig. 3) supported for movement in elevation by trunnion 7 in a standard 8, which standard is rotatably mounted in a pedestal 9. Fixed to the pedestal are a pair of contact plates C and D, the former associated with a switch arm 10 on the traversing standard 8 and the latter associated with a switch arm 11 carried by the director A. The two switch arms are connected by a lead wire 12. By virtue of this arrangement the switch arms are always in operative relation to the contact plates while the director is being traversed or elevated.

The plate C is provided with a plurality of contacts 13, one for each vertical group or series of lamps 5. As shown in Fig. 1, the contacts 13 are offset laterally with respect to the line of sight from the traversing axis of the director to the corresponding lamp for that contact. For example, the contact 13*a* is connected by the lead wire 14*a* to the series 5*a* of the lamps and the contact 13*b* is connected by the lead wire 14*b* to the series 5*b* of the lamps. The offset relation between the contacts and the lamps represents the horizontal angle between the vertical plane containing the line of sight of a gun at the instant of firing and the vertical plane containing the axis of bore of the gun or in the present instance the director A. The horizontal angle or the lead is dependent on the speed of the target and the angle of approach and corrects for the lateral travel of the target during the time of flight of a projectile.

The contact plate D presents a spherical surface relative to the intersection of the axes of rotation of the director. This plate is provided with three contacts 15, 16 and 17 extending across the entire width of the plate. The lowermost contact 15 is connected by lead wire 15*a* to the uppermost horizontal row of lamps, the intermediate contact 16 is connected by the lead wire 16*a* to the intermediate row and the uppermost contact 17 is connected by the lead wire 17*a* to the lowermost row of lamps.

As seen most clearly in Figs. 2 and 3 the contacts 15, 16 and 17 are offset vertically with respect to the line of sight from the director to the lamps. This offset corresponds to the angle of elevation and is dependent on the angular height of the target, the angle of superelevation due to trajectory and the

vertical travel of the target during the time of flight of a projectile.

Inasmuch as the angle of elevation varies according to the range of the target an increased angle of elevation being required for an increased range, the contacts 15, 16 and 17 will be in the form of a curve, as seen in Fig. 1. This curve and also the offset positioning of the contacts 13 are laid out in accordance with the firing tables for a particular gun and for convenience in adapting the device for gallery practice, a scale of one inch to one yard is employed.

A source 18 of electric current is led to spaced conductors 19 and 20 in the contact plate C and the switch arm 10 is provided with complementary contacts 19*a* and 20*a* respectively associated with conductors 19 and 20.

The target E is mounted on the wire 21 which is positioned between the intermediate row of lamps and the director. The target is moved over the course at a predetermined speed, the motive force being conveniently obtained through a gravity actuated member 22.

An interrupter designated at 23 is placed in the electric circuit and is operable at a rate corresponding to the rate of fire of a gun. When the apparatus is set up on a scale of one inch to one yard the target simulating an airplane traveling at one hundred miles per hour will move at the rate of 3,000 inches in a minute. The rate of fire of a machine gun is about 600 rounds per minute.

In operation the target is positioned a short distance to the left of the indicator B to permit the operator of the director to preliminarily track the target. When the director is on the extreme left end contact 13*b* of the plate C and on the intermediate contact 16 of the plate D the first or left hand lamp of the intermediate row will flash to simulate a tracer bullet passing through that point. If the target at the particular moment of flash is between the flash and the director then the director must have been correctly laid both laterally and vertically.

Movement of the director will produce flashes in the vicinity of the target and by observing the positional relation of the flashes with respect to the target the operator moves the director to the end that the flash will be on the target. This is exactly the procedure adopted by a machine gunner in firing on an aerial target with tracer bullets.

In Fig. 4 the illuminating means are placed between the target and the director and they are disposed in laterally and vertically offset relation in the same manner as in Fig. 1. In this instance, however, neon lamps 24 are employed to actually show the curvature of the trajectory.

It is to be understood that the course of lamps may be arranged to simulate various angles of approach and may be of any desired length. Likewise any number of vertical and horizontal rows of lamps may be employed.

It is to be further understood that other forms of energy besides electricity may be used to energize the recorder while maintaining the offset relations between the director and target.

We claim:

1. Apparatus for training in laying a gun including in combination, a course of lamps, a director mounted for movement in azimuth and elevation, a contact plate having contacts electrically connected to the lamps, each contact offset laterally with respect to the line of sight from the traversing axis of the director to the corresponding lamp, a second contact plate having contacts electrically connected to the lamps, each contact offset vertically with respect to the line of sight from the director to the lamps, a switch arm from the director to each of the contact plates, a conductor between the switch arms, a source of electric current for the circuit, an interrupter in said circuit, and a target movable across the course of lamps.

2. Apparatus for training in laying a gun, including in combination, a course of lamps, a director mounted for movement in azimuth and elevation, a contact plate having contacts electrically connected to the lamps each contact offset laterally with respect to the line of sight from the traversing axis of the director to the corresponding lamp, a second contact plate having contacts electrically connected to the lamps, each contact offset vertically with respect to the line of sight from the director to the lamps, a switch arm from the director to each of the contact plates, a conductor between the switch arms, a source of electric current for the circuit, and a target movable across the course of lamps.

3. Apparatus for training in laying a gun, including in combination, a plurality of illuminating indicators, a switch representing a gun and movable in azimuth and elevation, contacts offset with respect to the line of sight to the indicators an amount corresponding to lateral and vertical lead to be given a gun, an electrical circuit, an interrupter in the circuit operable at a rate corresponding to the rate of fire of a gun, and a target movable across the indicators.

4. Apparatus for training in laying a gun, including in combination, a plurality of illuminating indicators, a switch representing a gun and movable in azimuth and elevation, contacts offset with respect to the line of sight to the indicators an amount corresponding to lateral and vertical lead to be given a gun, an electrical circuit, and a target movable across the indicators.

5. Apparatus for training in laying a gun,

including in combination, electrically actuated indicators, a switch representing a gun and movable in azimuth and elevation, contacts offset with respect to the line of sight to the indicators an amount corresponding to lateral and vertical lead to be given a gun, an electrical circuit, an interrupter in the circuit and a target movable across the indicators.

6. Apparatus for training in laying a gun including in combination, electrically actuated indicators, a switch representing a gun and movable in azimuth and elevation, contacts offset with respect to the line of sight to the indicators an amount corresponding to lateral and vertical lead to be given a gun, an electrical circuit, and a target movable across the indicators.

7. Apparatus for training in laying a gun including in combination, a director, an indicating means, a target movable across the indicating means, electrically operated means associated with the director and indicating means whereby the indicating means indicates in line with the target when the director is laid to a predetermined lateral and vertical lead.

8. Apparatus for training in laying a gun including in combination, a target, a director and means under control of the director for illuminating the target when the director bears a predetermined lateral and vertical lead with respect to the target.

9. Apparatus for training in laying a gun, including in combination, a target, a director and means under control of the director for indicating with respect to the target the correct lateral and vertical lead of the director.

10. Apparatus for training in laying a gun including in combination, a target, a director, and means associated with and responsive to the director for issuing flashes in the vicinity of and across the course of the target.

11. Apparatus for training in laying a gun including in combination, a target, a director, and an indicator for representing a trajectory in the vicinity of the target, said indicator energizable by the director.

12. Apparatus for training in laying a gun including in combination, a target, a director, and means responsive to the laying of the director for indicating an offset relation between the director and the target.

13. In apparatus for training in laying a gun, a support, a standard mounted in the support for movement in azimuth, a director trunnioned in the standard for movement in elevation, a pair of contact plates carried by the support, a switch arm carried by the standard and movable over one of the contact plates, a switch arm carried by the director and movable over the other contact plate, a conductor between the switch arms, spaced conductors on the first contact plate, and a source of electric current leading to the spaced conductors.

14. In apparatus for training in laying a gun, a support, a standard mounted in the support for movement in azimuth, a director trunnioned in the standard for movement in elevation, a pair of contact plates carried by the support, a switch arm carried by the standard and movable over one of the contact plates, a switch arm carried by the director and movable over the other contact plate, and a conductor between the switch arms.

15. A miniature gallery practice apparatus including in combination a target, an indicating means, a pointing member, electrical connections between the pointing member and indicating means including contacts offset from the line pointing member-indicating means in accordance with firing tables of a gun and determined by the range and position of the target.

JAMES C. KARNES.
GREGORY J. KESSENICH.