Oct. 5, 1948. J. HARRINGTON, JR 2,450,551

FIRE CONTROL MECHANISM FOR GUNS

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Fig. 1

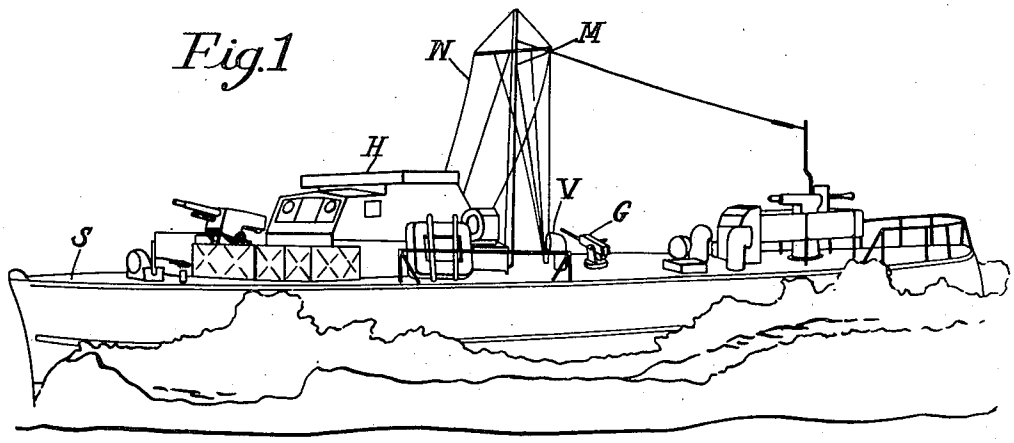


Fig. 5

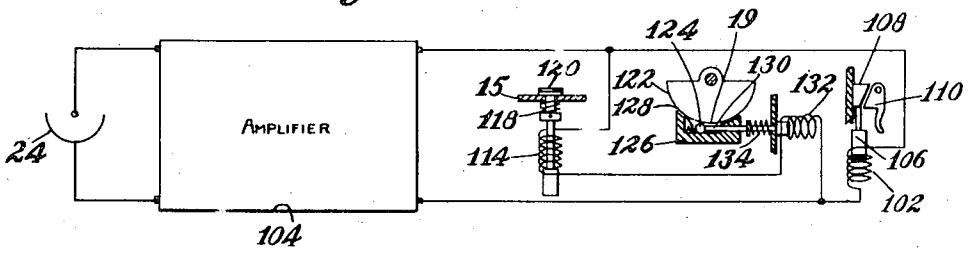
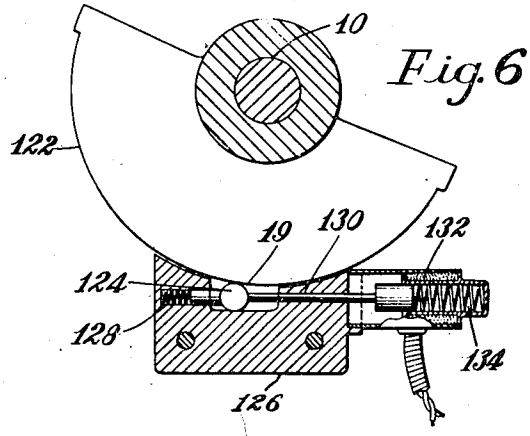


Fig. 6



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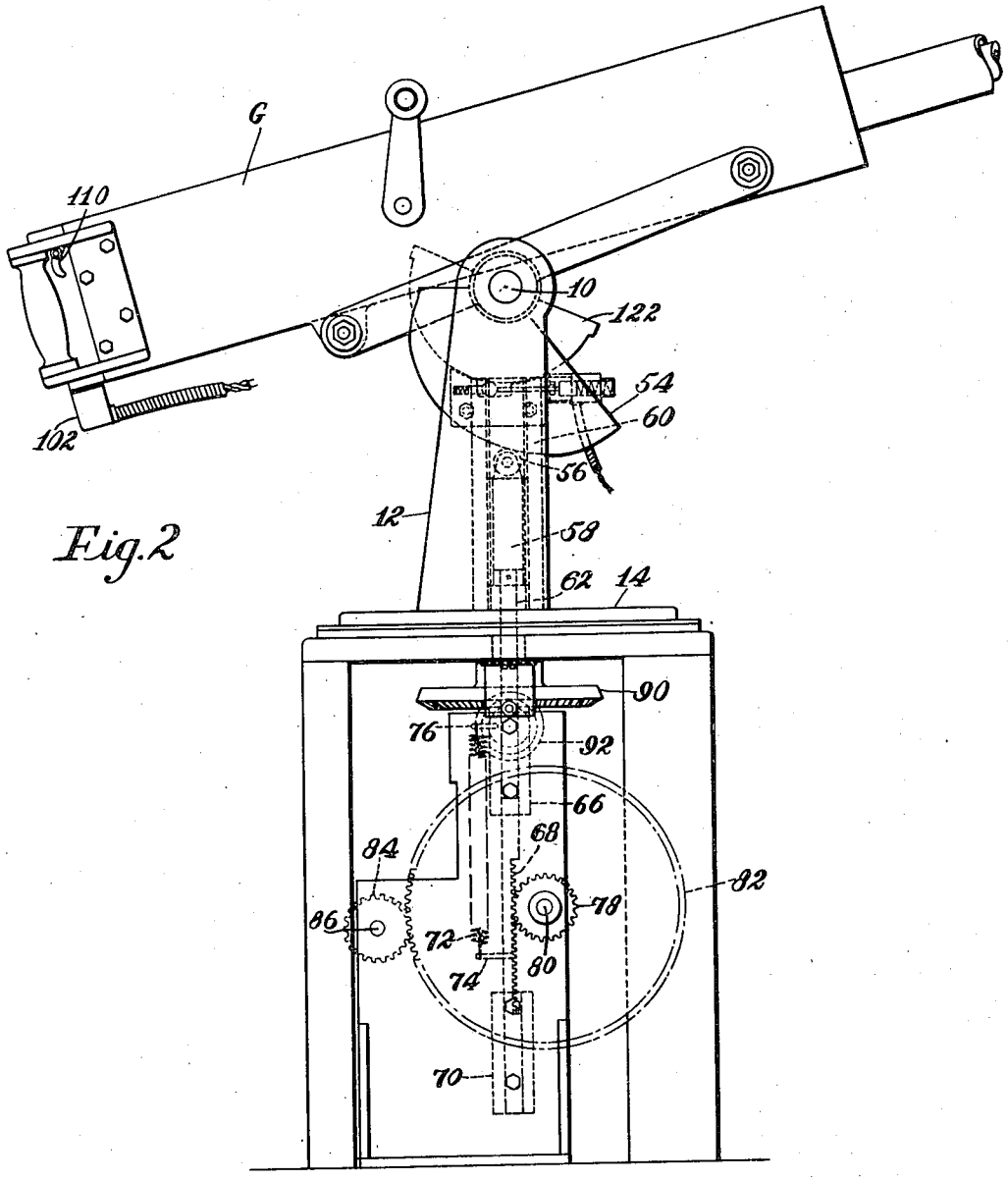


Fig. 2

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Fig. 3

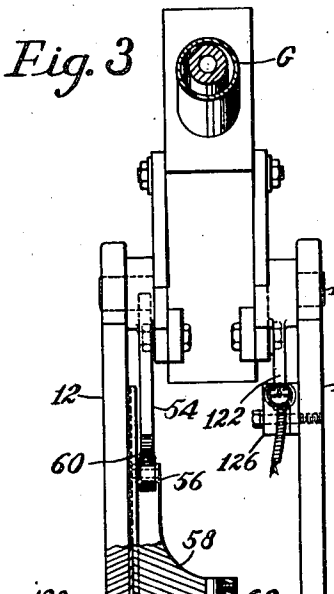
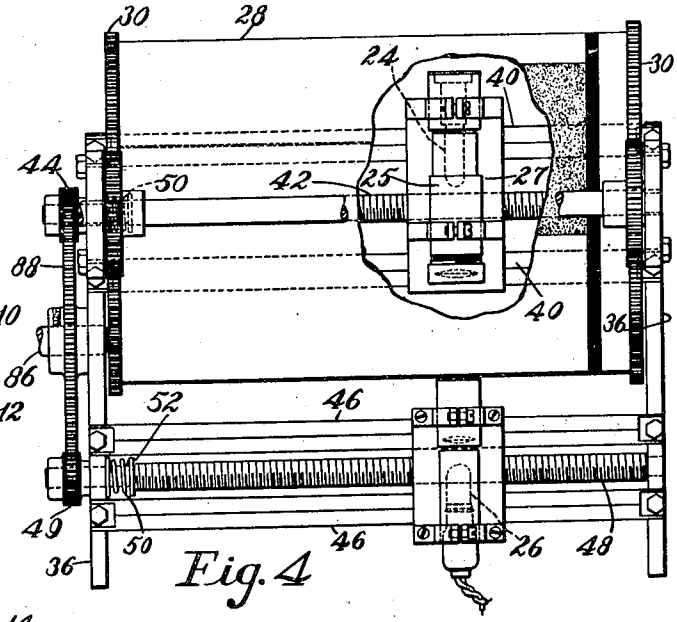
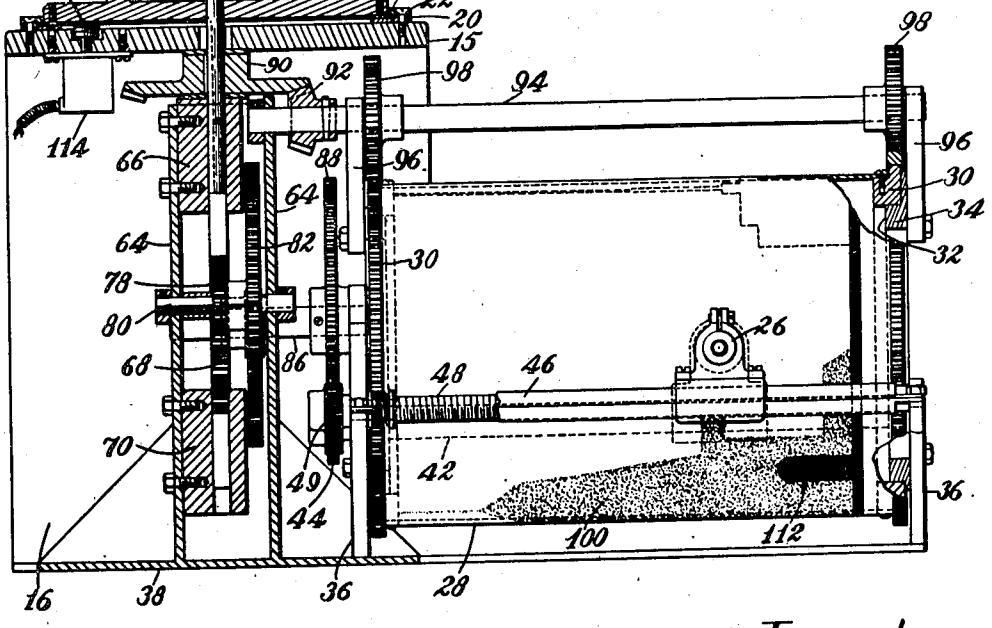


Fig. 4





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FIRE CONTROL MECHANISM FOR GUNS

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Application July 18, 1944, Serial No. 545,465

3 Claims. (Cl. 89—134)

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This invention relates to control mechanisms and more particularly to fire control mechanisms for guns. As illustrated herein the invention is applied to a gun mounted on the deck of a ship although it should be understood that it is not thus limited in its application.

Guns are frequently mounted on ships and other structures having objects that are located in the line of fire when the gun is in certain positions of its range of movement in elevation and in azimuth. In order to prevent accidental firing of the gun at such objects it has been the practice to associate with the gun mount a structure that limits the range of movement of the gun so that it cannot be aimed at such objects. This arrangement interferes with rapid aiming of the gun at the target and is not easily adapted to changing conditions or locations of objects in the line of fire.

It is an object of the present invention to provide improved mechanism for controlling the fire of a gun so that, without interfering with the movements of the gun, the firing mechanism is prevented from operating when the gun is in certain predetermined positions thereby to prevent damage to objects adjacent to the gun mount that lie within the line of fire of the gun. To this end and in accordance with a feature of the invention, photoelectrically controlled mechanism is provided to prevent actuation of the firing mechanism in response to movements of the gun into certain predetermined positions. This is accomplished in accordance with the illustrated embodiment of the invention by providing a transparent cylindrical screen having darkened areas thereon corresponding to certain positions of the gun. The screen is located between a photoelectric cell and a light source and relative movements between the photoelectric cell, the light source and the screen take place as the gun is moved in elevation and azimuth so that when the gun is pointed at some object which it is desired to guard against shooting, the amount of light reaching the photoelectric cell from the light source is decreased sufficiently to actuate mechanism which prevents firing of the gun.

A further object of the invention is to provide improved means for preventing movement of the gun into actual engagement with objects which may be located adjacent to the gun mount in the range of movement of the gun. This is accomplished in accordance with a further feature of the invention by utilizing the same photoelectric cell and screen arrangement and providing additional darkened portions on the screen corresponding to the location of the object or objects adjacent to the gun, these latter darkened portions further reducing the amount of light reaching the photoelectric cell after the gun has moved into certain positions thereby actuating a mechanism which locks the gun against movement into engagement with the object.

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The above and other features of the invention will now be described by reference to the accompanying drawings and pointed out in the claims.

In the drawings,

Fig. 1 is a view of a ship showing a gun mounted thereon in such position that portions of the superstructure lie within the range of fire of the gun;

Fig. 2 is a side elevation of the gun and a portion of the control mechanism;

Fig. 3 is a vertical section through the gun and the control mechanism;

Fig. 4 is a plan view, certain parts being broken away, illustrating the arrangement of the screen, the photoelectric cell and the light source;

Fig. 5 is a diagrammatic view of the control apparatus, and

Fig. 6 is a vertical section through one of the gun trunnions showing the mechanism for locking the gun against downward movement.

The invention is herein illustrated as associated with a gun G (Fig. 1) mounted on the deck of a ship S in such position that certain portions of the superstructure of the ship such as a deck house H, a mast M and wires W lie within the line of fire of the gun in certain of its positions. A ventilator V is illustrated in such proximity to the gun as to be within its range of movement.

As illustrated in Fig. 3, the gun is supported on a shaft 10 for movements in elevation, the shaft being carried by vertical arms 12 of a carriage 14 which is in turn mounted for movement in azimuth about a vertical axis on a top wall 15 of a base 16. To the under surface of the carriage 14 is secured an outwardly extending flange 18 which rides in a groove formed between rings 20 and 22 secured to the base 16. The gun mount is illustrated herein as being a manually operated one but it will be understood that any suitable form of gun mount, in accordance with the requirements for the particular gun to which the invention is applied, may be employed.

The photoelectric control mechanism for the gun comprises three elements, namely a photoelectric cell 24 (Fig. 4) a light source in the form of a lamp 26 and a screen 28. This screen is illustrated as being cylindrical in form and transpar-

ent except for certain shaded areas thereon as shown in Fig. 3 and has secured to its ends ring-shaped gears 30. These gears are supported by inwardly extending flanges 32 on rings 34 carried by walls 36 extending upwardly from a bottom wall 38 of the base 16. The photoelectric cell 24 in a housing 25 is located within the cylindrical screen 28 and is supported on a carriage 27 guided for movement lengthwise of the screen by tracks 40 secured to the walls 36 and passing through the screen. Through the carriage on which the photoelectric cell is mounted is threaded a screw 42 journaled in bearings carried by the walls 36 and having a projecting end portion carrying a pinion 44 by which rotative movement is imparted to the screw and the photoelectric cell is moved lengthwise of the screen. The lamp 26 is similarly mounted on a pair of tracks 46 on the outside of the screen 28 opposite the photoelectric cell 24 and is moved lengthwise of the screen by a screw 48 journaled in bearings carried by the walls 36 and provided with a pinion 49 by which it is rotated to move the lamp along the screen. Springs 50 are associated with the left ends of each of the screws and act between collars 52 carried by the screws and the adjacent bearing thereby to hold the screws against end play.

The screws are turned simultaneously in the same directions during movement of the gun in elevation so that the photoelectric cell and the lamp move in unison lengthwise of the screen 28 into alined positions corresponding to the position of the gun in elevation. For this purpose a cam 54 (Figs. 2 and 3) is carried by the gun for movement about the axis of the shaft 10 as the gun moves in elevation. This cam has a curved surface engaged by a cam roll 56 journaled in a vertically movable slide 58 which is in turn guided for movement by a track 60 formed in one of the arms 12 of the carriage 14. Secured to the lower end of the slide 58 is a shaft 62 coaxial with the vertical axis of the carriage 14 and passing down through the top wall of the base 16 into a gear housing formed by vertical walls 64 carried by the bottom wall 38 of the base. The shaft 62 is guided for vertical movement by a block 66 secured to one of the walls 64. Movable vertically with this shaft is a rack 68 guided by the block 66 and a similar block 70 on the lower portion of the wall 64, the rack being maintained in engagement with the lower end of the shaft 62 by a spring 72 (Fig. 2) secured between a pin 74 on the lower portion of the rack and a pin 76 extending laterally from the block 66. Engageable with the rack 68 is a pinion 78 journaled on a shaft 80 carried by the walls 64 of the gear housing. A gear 82 fast to the pinion 78 meshes with a small gear 84 (Fig. 2) on a shaft 86 journaled in the walls 64 and carrying on its outer end a large gear 88 (Figs. 3 and 4) engageable with the pinions 44 and 49 on the screws 42 and 48. From the above it will be seen that as the gun is moved in elevation the cam 54 causes vertical movements of the rack 68 which through the gearing described above causes rotation of the screws 46, 48 whereupon the photoelectric cell and the lamp move lengthwise of the screen 28 in unison.

The screen 28 is turned with respect to the photoelectric cell and the lamp upon movement of the gun in azimuth. For this purpose, to the shaft 62 is keyed a bevel gear 90 held between the top wall 15 of the base 16 and the block 66, the shaft being splined to permit vertical movements thereof with respect to the gear during movement of the gun in elevation. The bevel gear 90

meshes with a bevel gear 92 on the end of a shaft 94 journaled in arms 96 secured to the upper portions of the rings 34. This shaft carries pinions 98 which mesh with the ring gears 30 which carry the screen 28. Consequently as the gun is moved in azimuth the screen 28 will be turned to a position corresponding to the position of the gun.

As shown in Fig. 3 the screen 28 has a lightly shaded area 100 the shape of which corresponds to those portions of the superstructure which lie in the line of fire of the gun. In other words whenever the gun is aimed at a portion of the superstructure such as the mast M or the deckhouse H, the relative movements between the screen 28 and the photoelectric cell and its light source will result in a portion of the area 100 intersecting the beam of light from the source to the photoelectric cell thereby reducing the light reaching the cell sufficiently to operate mechanism which prevents firing of the gun. It should be understood of course that the light and dark portions of the screen may be interchanged so that the mechanism to prevent firing of the gun is operated in response to an increase in the intensity of light reaching the photoelectric cell instead of by a decrease thereof, by the use of appropriate control circuits.

The mechanism to prevent firing of the gun is illustrated diagrammatically in Fig. 5 and includes a solenoid 102 connected to an amplifier 104 to which the photoelectric cell 24 is also connected. When the light reaching the photoelectric cell is thus reduced, a sufficient amount of current flows through the solenoid 102 to attract an armature 106 whereupon a wedge 108 connected thereto moves into engagement with a trigger 110 of the gun and prevents operation of the trigger to fire the gun. In those instances in which the gun is remotely controlled as by electrical means, the photoelectric cell may be utilized to operate a relay which will open the firing circuit when the gun is aimed at a portion of the vessel by which it is carried and it will be understood that the mechanical means shown herein for preventing firing of the gun is for purposes of illustration only.

It may happen that the gun is so mounted on the vessel that if it is turned sufficiently in certain positions of the gun in elevation, objects on the vessel might be hit by the gun tube and in Fig. 1 a ventilator V is illustrated as being located in such proximity to the gun that this might happen. Accordingly, the screen 28 and the photoelectric cell are further utilized to apply a braking action to the gun preventing its movement into engagement with any existing obstructions. As illustrated in Fig. 3, the screen 28 in addition to the lightly shaded area 100 includes a densely shaded area 112 which corresponds to the ventilator V. Just prior to engagement of the gun with the ventilator the densely shaded portion 112 of the screen intersects the beam of light from the lamp 26 to the photoelectric cell 24 and actuates the braking means. This means is shown to comprise a pair of brakes one of which locks the gun against movement in azimuth and the other of which prevents depression of the gun but permits the gun to be elevated above the top of the ventilator in which position the densely shaded area 112 no longer intersects the beam of light from the source 26 and the brakes are released. These brakes are illustrated diagrammatically in Fig. 5, that for locking the gun for movement in azimuth, being operated by a solenoid 114 secured to the under side of the top wall 15 of the base 16. The

armature of the solenoid is held in a down position by a spring 118 so that a braking pad 120 is held out of engagement with the under surface of the carriage 14. Upon energization of the solenoid the armature is pulled upwardly against the force of the spring 118 forcing the pad 120 into engagement with the carriage 14 and locking the gun against movement in azimuth. For locking the gun against downward movement a brake shoe 122 is mounted for movement with the gun and has a curved surface concentric with the gun arranged to be engaged by a roll 124 supported by a housing 126 carried by one of the arms 12. A spring 128 urges the roll 124 into locking engagement with the brake shoe 122 but the roll is normally held in inoperative position against the force of the spring 128 by the armature 130 of a solenoid 132. A spring 134 acts on the armature to force the roll 124 into an inoperative position out of engagement with the brake shoe 122 and the coil of the solenoid is connected in series with the coil of the solenoid 114 so that these solenoids are energized simultaneously only upon the intensity of the light reaching the photoelectirc cell dropping to a sufficiently low value. When this happens and the solenoid 132 is energized sufficiently to attract the armature 130 and move it against the force of the spring 134, the spring 128 moves the roll 124 into contact with the brake shoe 122 preventing movement of the gun downwardly, the arrangement of the housing 126 relative to the brake shoe 122 being such as to permit the gun to be elevated at all times so that the ventilator V or other obstruction may be cleared. It will be understood that the solenoids 114 and 132 require a greater amount of current to attract their armatures than is required by the solenoid 102 so that only the solenoid 102 is actuated when the lightly shaded portion 100 intersects the beam of light to the photoelectric cell. However, when the current becomes high enough due to the densely shaded portion 112 intersecting the beam of light the other solenoids are actuated and the gun is locked aganst movement into engagement with the obstruction represented by the densely shaded portion.

The gun illustrated herein is manually directed but it should be understood that the invention is applicable to a power operated mount in which the directing of the gun is effected through electric motors, fluid pressure mechanism or the like. In such cases the solenoids 114 and 132 might be utilized to control the power operated mechanism so that the gun could not be moved into engagement with an obstruction. In such event, the brakes described herein could be used in addition if desired or could be eliminated if they proved to be unnecessary.

From the above it will be seen that by the use of a relatively simple mechanism the firing of the gun is readily controlled so that in predetermined positions thereof the firing mechanism is rendered inoperative. By the use of a transparent screen utilizing shading the apparatus can be easily adapted to take care of changes in positions of objects which might lie in the line of fire. It will be understood that the apparatus may be readily applied to any type of gun mount whether manually operated or power operated.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, a gun, means mounting said gun for movement in azimuth and elevation, a photoelectric cell, a light source therefor, means operative in response to movement of the gun into a predetermined position for varying the intensity of light from the source to the photoelectric cell and operative in response to movement of the gun into another predetermined position for increasingly varying the intensity of light from the source to the photoelectric cell, means controlled by said cell in response to the variation of light thereto for preventing firing of the gun, and means controlled by said cell in response to an increased variation of intensity of light thereto for locking the gun against movement in certain directions.

2. In combination, a gun, a photoelectric cell, a light source therefor, a transparent screen having darkened areas of different intensities, said screen being positioned between said light source and said photoelectric cell, means for relatively moving said screen, said light source and said cell so that the light from the source to the cell is diminished by a darkened area of the screen in response to movement of the gun into certain predetermined positions and so that the light from the source to the cell is further diminished by another darkened area of the screen in response to movement of the gun into certain other predetermined positions, and means controlled by the photoelectric cell for preventing firing of the gun in response to movement of the gun into the first of said predetermined positions and for locking the gun against movement in certain directions when the gun is moved into said other of said predetermined positions.

3. In combination, a gun, means mounting said gun for movement in elevation and azimuth, a rotatable transparent cylinder, means connecting said cylinder to said gun for turning movement of said cylinder in response to movement of the gun in azimuth, a light source and a photoelectric cell mounted at opposite sides of a wall of the cylinder, means for moving said light source and said photoelectric cell in unison lengthwise of the cylinder in response to movement of the gun in elevation, said cylinder having a darkened area for diminishing the intensity of light to the photoelectric cell in response to movement of the gun into a predetermined position and a still darker area for further diminishing the intensity of light to the photoelectric cell in response to movement of the gun into another predetermined position, means operated by the diminution of light to the cell for preventing firing of the gun, and means operated by the further diminution of light to the photoelectric cell for locking the gun against movement in certain directions.

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