

E. LAZARTE.

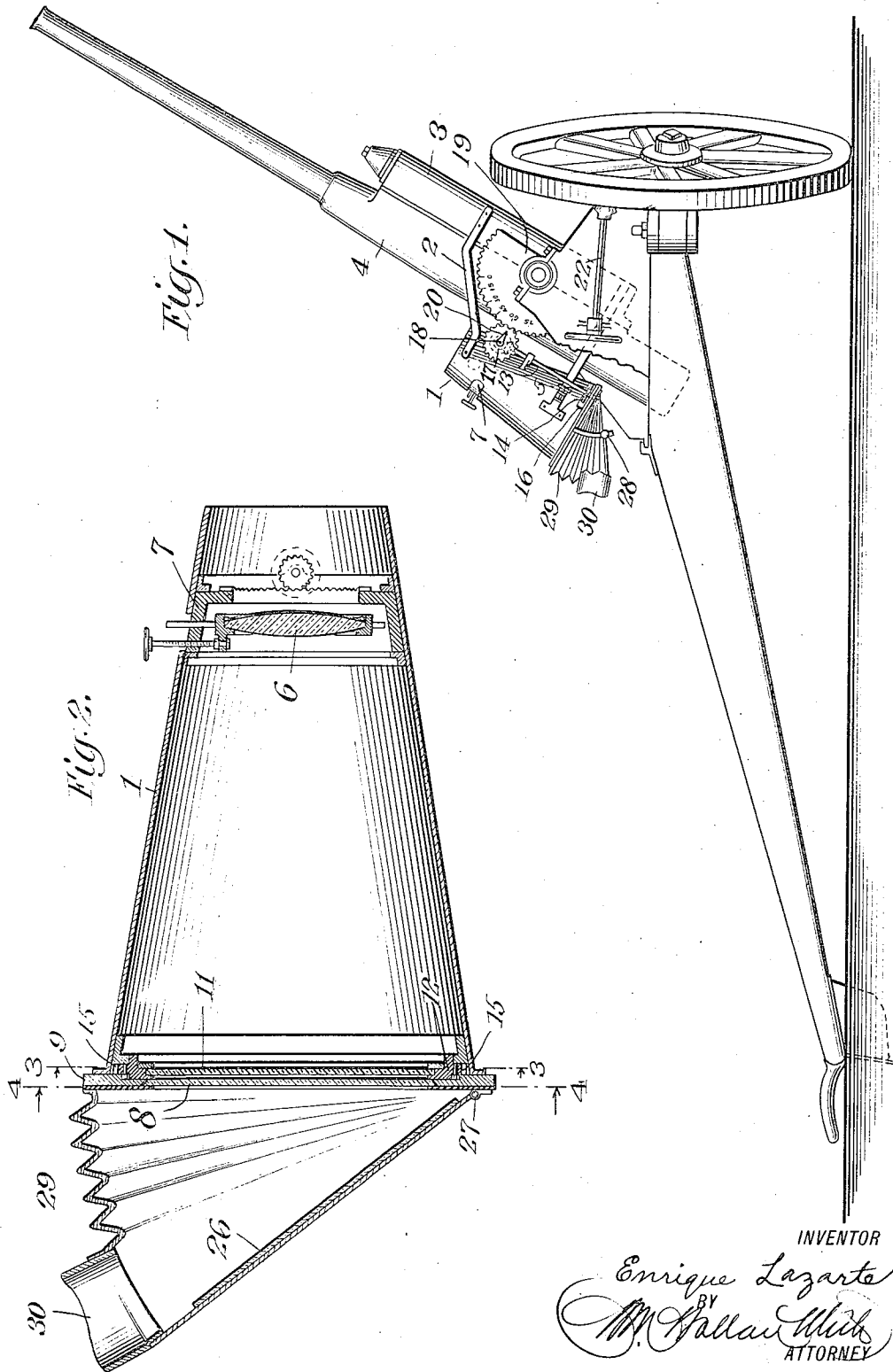
SIGHTING AND AIMING ATTACHMENT FOR GUNS AND OTHER PIECES OF ORDNANCE.

APPLICATION FILED JAN. 5, 1916.

1,207,418.

Patented Dec. 5, 1916.

2 SHEETS—SHEET 1.



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SIGHTING AND AIMING ATTACHMENT FOR GUNS AND OTHER PIECES OF ORDNANCE.

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2 SHEETS--SHEET 2.

Fig. 4.

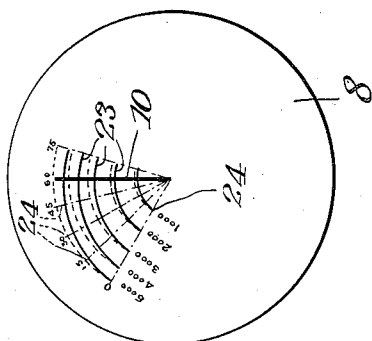


Fig. 5.

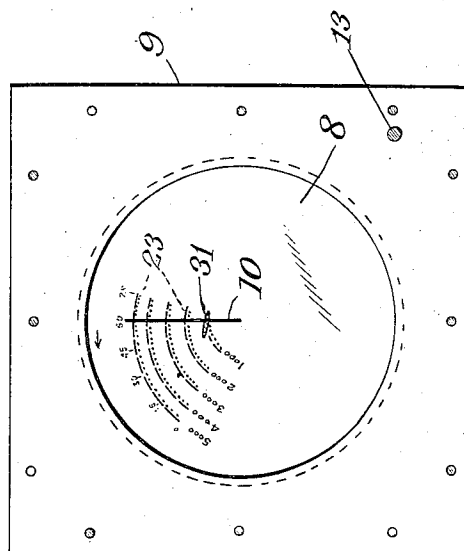
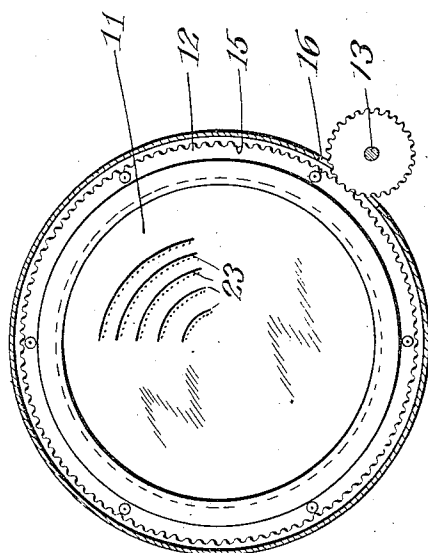


Fig. 3.



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SIGHTING AND AIMING ATTACHMENT FOR GUNS AND OTHER PIECES OF ORDNANCE.

1,207,418.

Specification of Letters Patent.

Patented Dec. 5, 1916.

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To all whom it may concern:

Be it known that I, ENRIQUE LAZARTE, a citizen of the Republic of Peru, residing at San Jose 363, Lima, Department of Lima, Republic of Peru, have invented new and useful Improvements in Sighting and Aiming Attachments for Guns and other Pieces of Ordnance, of which the following is a specification.

10 This invention relates to a sighting and aiming device for use upon cannon or other pieces of ordnance, and which involves the principle of the invention disclosed in my prior Patent No. 1,161,778, dated November 23, 1915, it being an improvement upon the same.

20 The primary object of the present invention is to provide a camera obscura having an image-receiving plate, or plates, which bear indicating means which are designed to render firing at rapidly shifting targets, such as balloons, aeroplanes, war vessels, or the like, extremely accurate.

25 A further object is to provide a sighting and aiming device of this character which is in the form of a compact unit adapted for attachment to any desired form of cannon or gun, such as coast defense guns, field pieces, balloon guns, and the like, without altering the construction of the latter.

30 Further objects should become apparent as the following description is read in connection with the accompanying drawings, in which:

35 Figure 1 is a side elevation of a balloon gun having the attachment applied thereto; Fig. 2 is a vertical sectional view through the camera obscura; Fig. 3 is a transverse sectional view on line 3—3 of Fig. 2; Fig. 4 is a rear elevation of the image-receiving plates, showing the manner in which the aiming curves are generated; and, Fig. 5 is a sectional view on line 4—4 of Fig. 2.

45 Referring to the drawing by numerals and in particular to Figs. 1 to 3 inclusive and Fig. 5, 1 designates the casing of the camera obscura, which is in the present instance illustrated as being mounted upon a balloon gun. For this purpose, a plurality of supporting legs 2 extend from the casing 1 to the adjustable member 3 of the gun and are connected rigidly thereto. These legs are preferably arranged in pairs and the legs of each pair straddle the breech of the gun barrel 4 which is mounted for reciprocation with respect to the part 3 during recoil. Owing to this manner of mounting, the casing 1 of the camera obscura will not be affected by the recoil of the piece. Adjusting means 5 are provided upon a number of the supporting legs 2 in order that the casing 1 may be set in proper angular relation to the axis of the barrel bore at the time the device is attached to the gun to bring the axes of the said casing and barrel 4 into substantial parallelism. It is to be understood that various other forms of attaching means may be employed in practice, depending upon the particular type of gun or cannon upon which it is desired to mount the sighting and aiming device.

The camera obscura is provided with the usual lens 6 which is mounted for adjustment adjacent to the forward end of the casing 1 within the holder 7. At the rear end of the casing 1 a stationary plate 8 of transparent material, such as glass, mica, or the like, is mounted in the holder 9, which latter is fixedly secured to the casing. This plate is arranged at right angles to the axis of the lens 6 and is provided with a radial indicating line 10, preferably on its innermost, front surface, for a purpose which will be fully described hereinafter. It is obvious that this line may be delineated upon the plate by scoring the same or by marking an ink line or the like thereon. However, it is desirable to have the line opaque or nearly so, so that it will be readily distinguishable when the device is used in the night time especially. Immediately in front of the plate 8, a movable plate 11 is mounted in parallel relation to the first-named plate in a rotatable holder 12. It is necessary for the purposes of the present invention that the holder 12 for the movable plate shall oscillate or partially rotate in its bearings automatically in reverse directions during the raising or lowering of the gun barrel and other vertically adjustable parts by the usual means provided for that purpose. It is manifest that the said holder may be connected operatively with the said movable parts of the gun by any suitable transmission mechanism, but a convenient form of this mechanism is illustrated in the present drawing. In this instance, an axially extending shaft 13 is journaled upon the casing 1 and preferably exteriorly with respect thereto. At the rear end of this

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shaft a pinion 14 is fixedly secured and is in mesh with gear teeth 15 which are provided exteriorly upon the plate holder 12. Since the shaft 13 is exteriorly mounted, the pinion 14 projects into the casing through a slot 16 therein. The forward end of the said shaft is connected by means of bevel gears with a pinion 17 which is mounted for rotation upon a transversely extending pintle 18, the axis of which is parallel to that of the pivot for the gun barrel and associated vertically movable parts. This pinion is in mesh with an arcuate rack 19 which is stationarily mounted upon the carriage of the gun.

Hereinafter the gun barrel and the parts associated therewith which are mounted for vertical adjustment upon a common pivot will be termed the "gun" proper, as distinguished from the gun-carriage.

A pointer 20 is fixedly secured to the pintle 18 and projects in the direction of the gun pivot for coöperation with a scale 21 of angular measurement which is provided upon the rack 19. This scale is graduated so as to represent the vertical angles through which the gun is adjusted when raising or lowering the same. For the sake of convenience these angles will be termed "normal angles." When the pointer 20 is at "0," it will be known that the gun has a normal angle of elevation of 0° , or, in other words, is horizontal. When the gun is elevated by means of the elevating screw 22, the holder 12 and its plate 11 will be caused to move in counter-clockwise direction (see the arrow in Fig. 5.)

Referring now specifically to the sighting and aiming means proper, it is to be noted that the movable plate 11 is provided with a translucent rear surface adjacent to the transparent plate 8. This surface is provided preferably by grinding the said surface by means of a sand-blast or in any other suitable manner. Upon this surface the image will be cast of any target which comes within the field of the lens 6 of the camera. Furthermore, this plate 11 is situated at such a distance from the optical center of the lens that the range of any particular target may be estimated readily from the length of the image which is cast by the same upon the translucent image-receiving surface of this plate. First considering Fig. 5 of the drawing, it will be seen that a plurality of sighting curves 23 are delineated upon the image-receiving surface of the movable plate so as to intersect the radial base line 10 on the stationary plate 8. These curves, which are substantially in the form of logarithmic spirals, are related directly to the optical axis of the camera lens with which the inner end of the base line 10 is coincident. The manner in which these curves are generated

will be most clearly apparent from the illustration in Fig. 4 of the drawing. Turning to this figure, it will be seen that a number of radial lines 24 are delineated upon the movable plate 11 and outline normal angles which correspond directly to the angles indicated upon the stationary scale 21. Considering for the moment that the gun has a normal angle of elevation of 0° , then the zero line of the temporary angular scale which has been provided upon the movable plate 11 will be coincident with the base line 10. Owing to the effect of the force of gravity upon the trajectory of a projectile fired from the gun, it is necessary to give the latter a minute additional angle of elevation above the normal. Therefore, instead of sighting along the optical axis of the camera lens when aiming, or adjusting the gun so that the image of the target to be fired upon will be located at the inner end of the base line 10, which is the equivalent operation, it is necessary to have this image appear upon the image-receiving surface of the plate 11 at a point 24 which is marked upon the zero line of the angular scale. This point is located upon the zero line with direct reference to the actual trajectory of the piece. Assuming that this sighting point 24 is that to be used for firing at a range of one thousand yards, then sighting points for two thousand, three thousand and similarly graded, successively increasing ranges may be marked upon the zero line. The additional angles of elevation for the successive ranges will vary in degree in indirect proportion to the increase in range. Consequently, the distance between the inner end of the base line 10 or the optical of the lens, and the sighting point on the zero line of the angular scale for one thousand yards will be greater than the distance between this latter point and the sighting point for two thousand yards. Thus, continuing outward from the central point of the scale along the zero line, the distances between sighting points will gradually decrease as the range is increased. After the required number of sighting points for a normal elevation angle of zero degrees have been located, the gun is elevated through a normal angle of an arbitrary number of degrees, but preferably until the next radial line of the angular scale has moved into coincidence with the base line 10. Then the sighting points for the different ranges are marked upon this radial line in the same manner that the corresponding sighting points were located upon the zero line. Owing to the fact that the force of gravity will have less distorting effect upon the trajectory as the elevation is increased, the distance between the center of the scale and the sighting point for one thousand yards upon this radial line now under consideration will be somewhat

less than the distance between the center of the scale and the point 24 upon the zero line. This reduction in the additional angle of elevation will obtain in connection with each of the consecutive ranges for this new normal angle. After all of the sighting points have been marked upon this second line, the gun is elevated through other successive normal angles and the more minute additional angles of elevation are marked upon the corresponding radial lines of the angular scale upon plate 11. Finally, the sighting curves are plotted upon the image-receiving surface of plate 11 through the sighting points for the respective ranges. It is in this manner that the sighting curves which are alone shown upon plate 11 in Fig. 5 of the drawing are generated.

In order that the respective sighting curves may be readily distinguishable, as to the ranges represented, the proper numerals may be placed upon the plate 11 opposite to the proper curves. At night time, it will be difficult to read these numerals, so a row of transparent dots of colored material 25 is arranged co-extensive with, and contiguous to, each sighting curve. For instance, dots of a certain color will extend along the sighting curve for one thousand yards range and readily distinguishable and differing colors will be employed in the dots for the other sighting curves. At night time, when an image is cast upon the image-receiving surface of the movable plate by a target, such as an aeroplane or balloon that is illuminated by a searchlight directed toward the same, this image will illuminate the colored dots which are associated with at least one of the sighting curves. When the range has been determined by the length of the image cast upon the said image-receiving surface, then the gun is adjusted quickly through the required normal angle to bring the image into a position wherein it will illuminate dots of a color which indicates that the corresponding sighting curve is that of the range of the target. In explanation of the use of any particular sighting curve, whether in firing in the day time or at night, it will be assumed that it is desired to hit a balloon which is flying so high in the air that it is necessary to elevate the gun through a large normal angle to bring the target into the field of the camera lens. This is accomplished by manipulation of the elevating screw 22, while the operator is watching the image-receiving surface for the image which is to appear thereon. Just as soon as the image does appear, its length is noted and the range is calculated therefrom readily by the experienced operator, while the gun is being adjusted further to cause the image to fall upon the point of intersection of the base line 10 with the sighting curve

for the proper range. At the instant that this has been accomplished, the gun may be fired by the firing mechanism provided for that purpose. In the case of a rapidly shifting target, it may be found most practicable to adjust the gun so that the point of intersection of the proper sighting curve and the base line 10 will be situated in an imaginary line which represents the path of movement of the target, and then, when the image has approached to the required distance from this point, the firing is effected so as to give the projectile the proper amount of lead.

When observing the image upon the image-receiving surface of plate 11 directly, if the target is shifting in a given direction, the image will appear to move in the opposite direction. With practice, the operator will by coördination become expert in training the piece upon the target irrespective of this false movement of the image. However, to avoid this difficulty, a mirror 26 is mounted at the proper angle in rear of the stationary plate 8, and is preferably pivotally connected as at 27 to the part 9 of the camera casing in order that its angular relation to the image-receiving surface may be varied to meet the conditions of practice. Means, such as those indicated by the numeral 28 are provided for use in securing the mirror in adjusted position. To exclude light as much as possible from the mirror and the image-receiving surface, with the exception of the light coming from the target, a collapsible hood 29 connects the mirror with the casing. An eye-piece 30 is connected with the mirror at its free edge and is joined with the hood so that, when the said eye-piece is placed against the forehead of the operator, unnecessary light will not enter into the space between the mirror and the image-receiving surface. Consequently, the operator may have a clear view of the image, which, owing to the provision of the mirror, will appear to move in the exact direction in which the target is actually moving. The difficulties of operation of the device will thus be reduced to a minimum. Owing to the specific position of the eye-piece 30, and the provision of the mirror, the operator may view the image upon the image-receiving surface readily, no matter whether the gun be in a horizontal position or at a very large normal angle of elevation.

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

1. A sighting and aiming device of the class described comprising a camera obscura having a lens and a member provided with an image-receiving surface movably associated with the lens, the said camera being adapted to be applied to a piece of ordnance

- with the optical axis of its lens substantially fixed with relation to the axis of the barrel bore, the image-receiving surface of the movable member of the camera being provided with an indicating mark related to the position of the optical axis of the camera lens, and means for adjusting the said member during angular adjustment of the gun barrel.
2. A sighting and aiming device of the class described comprising a camera obscura having a lens and a member provided with an image-receiving surface movably associated with the lens, the said camera being adapted to be applied to a piece of ordnance with the optical axis of its lens substantially fixed with relation to the axis of the barrel bore, the image-receiving surface of the movable member of the camera being provided with an indicating mark related to the position of the optical axis of the camera lens, and means for automatically adjusting the said member during, and with reference to, the angular adjustment of the gun barrel.
3. A sighting and aiming device of the class described comprising a camera obscura having a lens and a member provided with an image-receiving surface associated with the lens, the said camera being adapted to be applied to a piece of ordnance with the optical axis of its lens substantially fixed with relation to the axis of the barrel bore, a second member positioned contiguous to the first member of the camera, one of the said members being movably mounted and the other stationary, and means for adjusting the first member during angular adjustment of the gun barrel, one of the said members being provided with a sighting line established by successive points located in proper relation to the optical axis of the camera lens for sighting at a given range for varying normal angles of elevation of the gun barrel and the other member being provided with a base line intersecting the sighting line of the last-mentioned member and being disposed so that the point of intersection of both lines will be the proper sighting point for the range represented.
4. A sighting and aiming device of the class described comprising a camera obscura having a lens and a member provided with an image-receiving surface associated with the lens, the said camera being adapted to be applied to a piece of ordnance with the optical axis of its lens substantially fixed with relation to the axis of the barrel bore, a second member positioned contiguous to the first member of the camera, one of the said members being movably mounted and the other stationary, and means for adjusting the movable member during angular vertical adjustment of the gun barrel, one of the said members being provided with a series of sighting lines for respective successive ranges, each of said sighting lines being established by successive points located in proper relation to the optical axis of the camera lens for sighting at a given range for varying normal angles of elevation of the gun barrel, and the other member being provided with a base line intersecting the sighting lines of the last-mentioned member and being disposed so that the point of intersection of the same with either of the sighting lines will be the proper sighting point for the range represented.
5. A sighting and aiming device of the class described comprising a camera obscura having a lens and a member provided with an image-receiving surface associated with the lens, the said camera being adapted to be applied to a piece of ordnance with the optical axis of its lens substantially fixed with relation to the axis of the barrel bore, a second member positioned contiguous to the first member of the camera, one of the said members being stationary and the other being mounted for partial rotation upon the optical axis of the camera lens as a pivotal axis, and means for adjusting the said movable member angularly during corresponding angular adjustment of the gun barrel, one of the said members being provided with a sighting line established by successive points located in proper relation to the optical axis of the camera lens for sighting at a given range for varying normal angles of elevation of the gun barrel and the other member being provided with a base line intersecting the sighting line of the last-mentioned member and being disposed so that the point of intersection of both lines will be the proper sighting point for the range represented.
6. A sighting and aiming device of the class described comprising a camera obscura having a lens and a member provided with an image-receiving surface mounted for partial rotation upon the optical axis of the lens as a pivotal axis, the said camera being adapted to be applied to a piece of ordnance with the optical axis of its lens substantially fixed with relation to the axis of the barrel bore, the image-receiving surface of the movable member of the camera being provided with a sighting mark delineated with relation to the position of the optical axis of the camera lens, and means for adjusting the said member during angular adjustment of the gun barrel.
7. A sighting and aiming device of the class described comprising a camera obscura having a lens and a transparent member provided with a translucent image-receiving surface associated with the lens, the said camera being adapted to be applied to a piece of ordnance with the optical axis of its lens substantially fixed with relation to the axis of the barrel bore, a second trans-

parent member positioned contiguous to the first member of the camera, one of the said members being movably mounted and the other being stationary, and means for adjusting the movable member during angular vertical adjustment of the gun barrel, one of the said members being provided with a series of sighting lines for respective successive ranges, each of said sighting lines being established by successive points located in proper relation to the optical axis of the camera lens for sighting at a given range for varying normal angles of elevation of the gun barrel, each of the said lines being outlined in transparent material of a color differing from the colors of the other lines, and the other member being provided with a base line intersecting the sighting lines of the last-mentioned member and being disposed so that the point of intersection of the same with either of the sighting lines will be the proper sighting point for the range represented.

8. A sighting and aiming device of the class described comprising a camera obscura having a lens and a member provided with an image-receiving surface associated with the lens, the said camera being adapted to be applied to a piece of ordnance with the optical axis of its lens substantially fixed with relation to the axis of the barrel bore, the image-receiving surface of the said camera member being provided with a sighting mark related to the position of the optical axis of the camera lens, and a mirror positioned in angular relation to the image-receiving surface to reflect the image cast upon the latter laterally with respect to the axis of the lens to a convenient view point.

9. A sighting and aiming device of the class described comprising a camera obscura having a lens and a member provided with an image-receiving surface associated with the lens, the said camera being adapted to be applied to a piece of ordnance with the optical axis of its lens substantially fixed with relation to the axis of the barrel bore, the image-receiving surface of the said camera member being provided with a sighting mark related to the position of the optical axis of the lens, a mirror mounted for angular adjustment with relation to the

said image-receiving surface and adapted to reflect an image cast upon the latter laterally with respect to the lens axis to a convenient view point, and means for securing the mirror in adjusted position.

10. A sighting and aiming device of the class described comprising a camera obscura having a lens and a transparent member provided with a translucent image-receiving surface associated with the lens, the said camera being adapted to be applied to a piece of ordnance with the optical axis of its lens substantially fixed with relation to the axis of the barrel bore, the image-receiving surface of the said camera member being provided with a sighting mark related to the position of the optical axis of the camera lens, and a mirror positioned upon the opposite side of the said camera member with respect to the lens and disposed in angular relation to the image-receiving surface thereof to reflect the image cast upon the said surface laterally with respect to the axis of the lens to a convenient view point.

11. A sighting and aiming device of the class described comprising a camera obscura having a lens and a transparent member provided with a translucent image-receiving surface associated with the lens, the said camera being adapted to be applied to a piece of ordnance with the optical axis of its lens substantially fixed with relation to the axis of the barrel bore, the said image-receiving surface being provided with a sighting mark related to the position of the optical axis of the camera lens, a mirror positioned at the opposite side of the image-receiving surface with respect to the lens and arranged at an angle thereto so as to reflect the image cast upon the said surface laterally with respect to the lens axis to a convenient view point, an eye-piece positioned at the said view point, and an opaque hood surrounding the said member of the camera and connected with the edges of the mirror and eye-piece.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ENRIQUE LAZARTE.

Witnesses:

DUDLEY B. HOWARD,
WILLIAM F. PALMER.