

H. GRUBB.

SIGHTING APPARATUS FOR BARBETTE OR OTHER GUNS.

(Application filed May 23, 1901.)

(No Model.)

4 Sheets—Sheet 1.

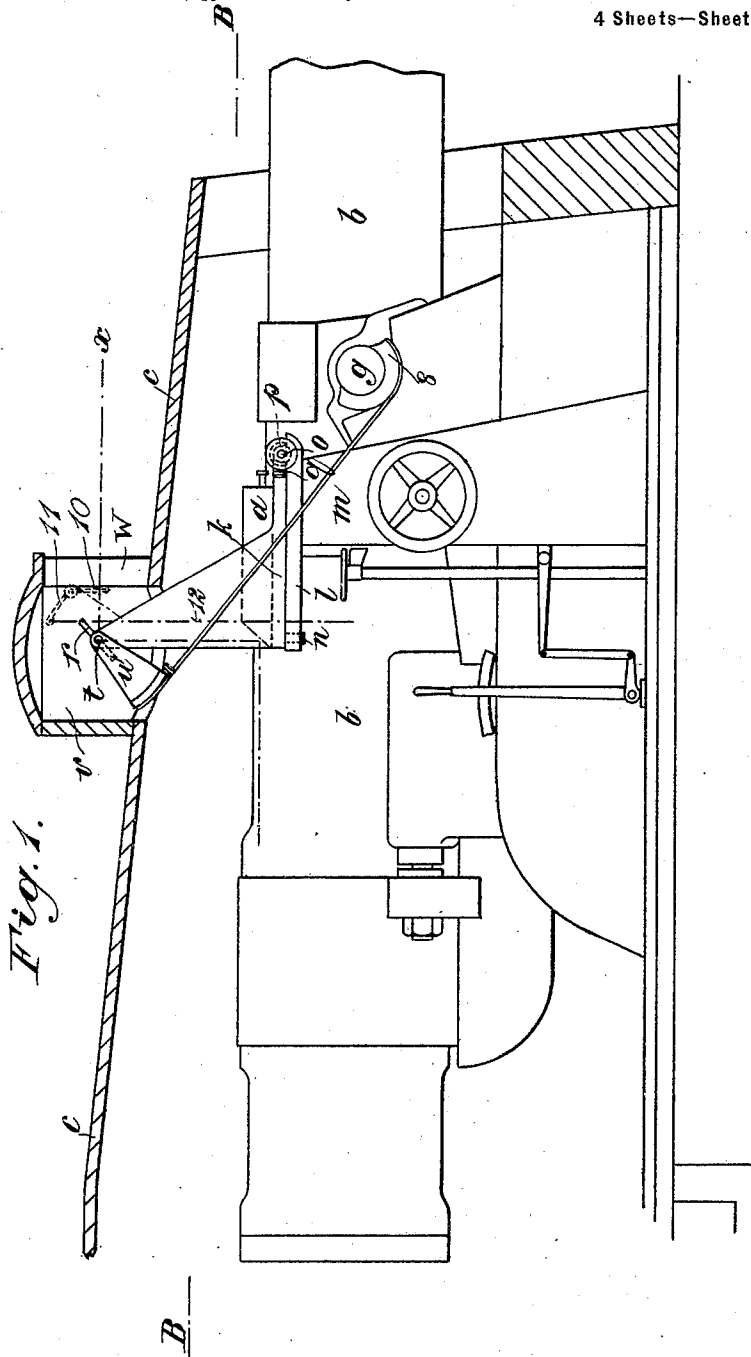


Fig. 1.

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By John A. Dowell

Inventor  
Howard Grubb  
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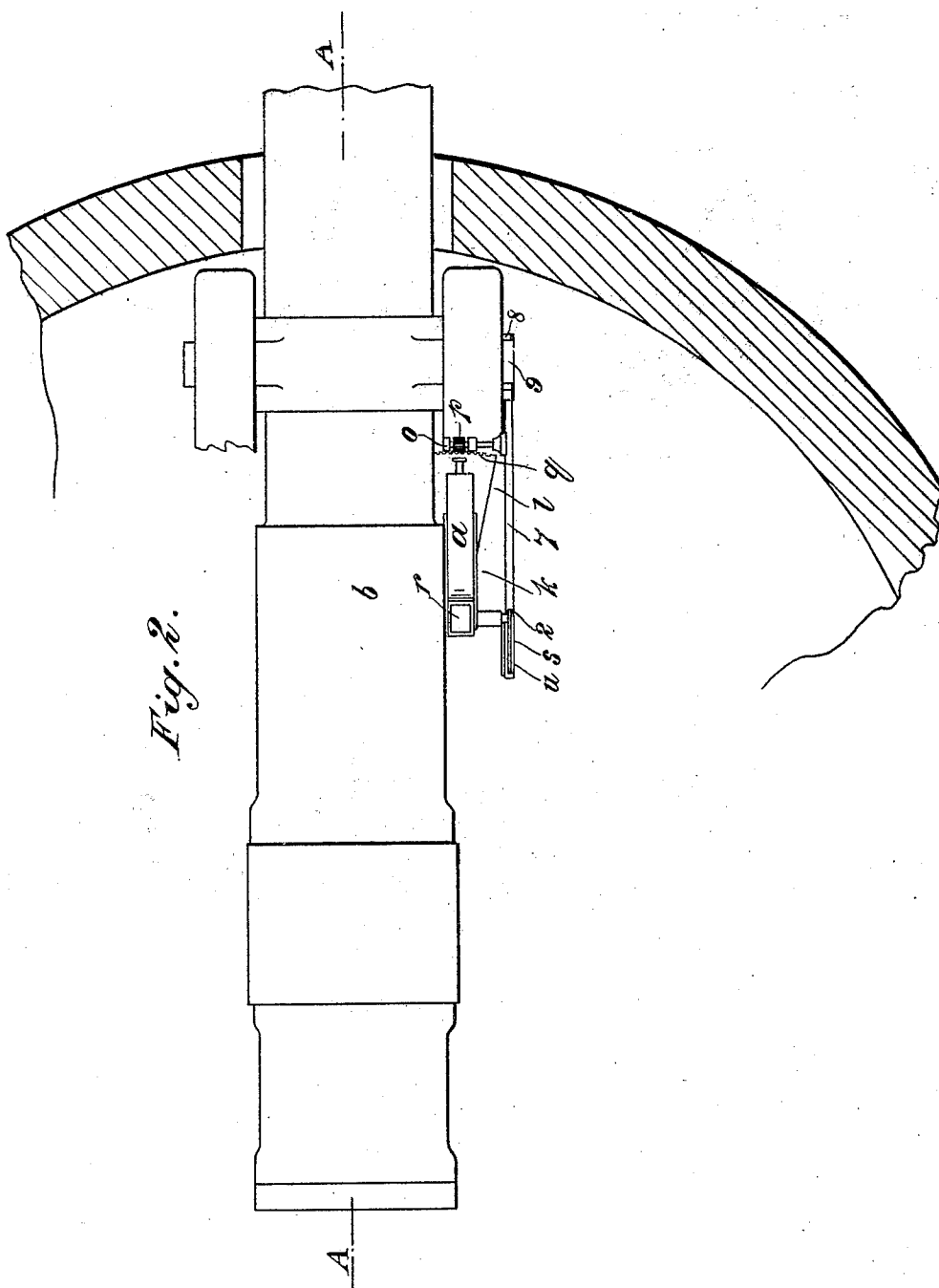


Fig. 2.

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4 Sheets—Sheet 3.

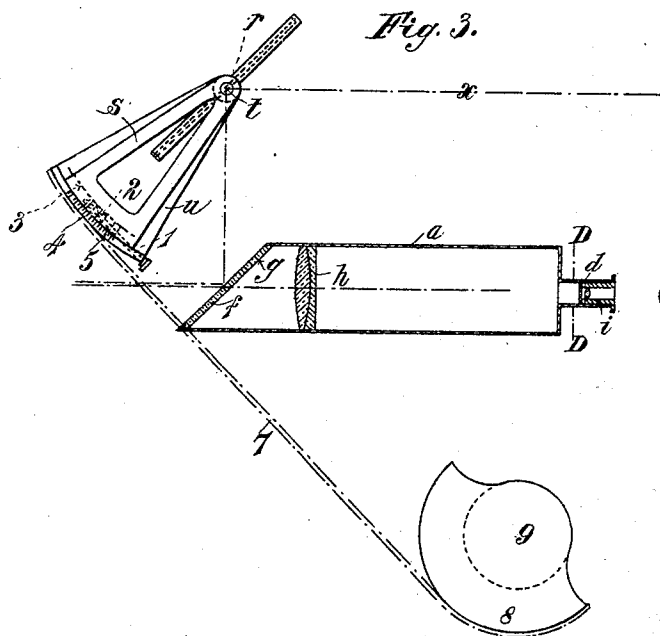
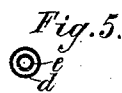
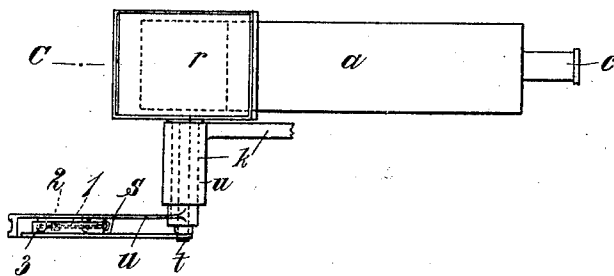


Fig. 4.



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4 Sheets—Sheet 4.

Fig. 6.

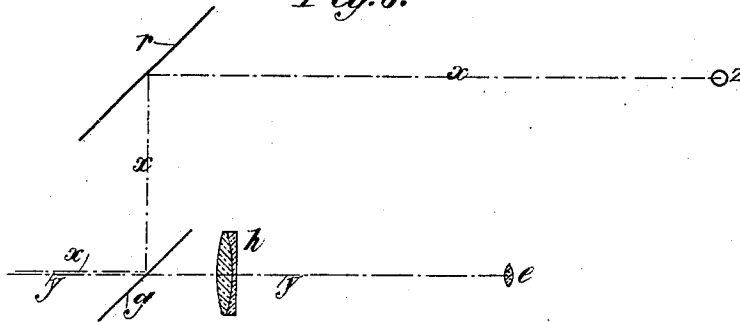


Fig. 7.

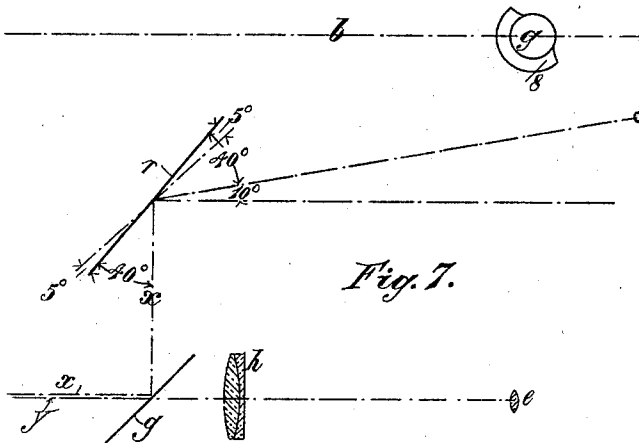
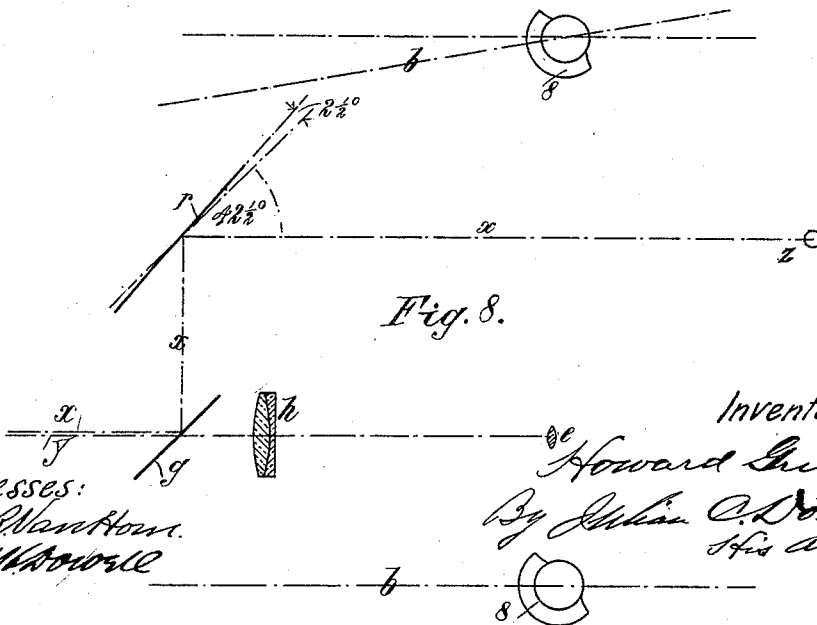


Fig. 8.



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# UNITED STATES PATENT OFFICE.

HOWARD GRUBB, OF DUBLIN, IRELAND.

## SIGHTING APPARATUS FOR BARBETTE OR OTHER GUNS.

SPECIFICATION forming part of Letters Patent No. 683,204, dated September 24, 1901.

Application filed May 23, 1901. Serial No. 61,613. (No model.)

*To all whom it may concern:*

Be it known that I, HOWARD GRUBB, a subject of the King of Great Britain and Ireland, residing at Dublin, Ireland, have invented Improvements in Sighting Apparatus for Barbette or other Guns, of which the following is a specification.

For sighting barbette, turret, and like protected guns it is usual to provide the armored hood, turret, or equivalent protecting means with a conning or lookout chamber, through which the object to be sighted and the gun sight or sights can be simultaneously and directly viewed by a person looking through an opening in the wall of the chamber. As will be readily understood, this mode of sighting a gun involves danger to those who have to perform the duty.

Now this invention has for its object to enable barbette and other protected guns to be sighted without the necessity of looking directly through a chamber of the kind referred to or through or over the armored hood or other device used for protecting the gun, so that the sighting can be effected by a person completely under cover. For this purpose there are used in conjunction with the gun a sighting device that comprises a sight proper, means for rendering luminous rays proceeding therefrom parallel to one another, and a reflecting-surface (hereinafter called for distinction the "lower" reflector) through which an image of the sight produced by the parallel rays can be seen, and a reflecting device (hereinafter called for distinction the "upper" reflector) which is so arranged in relation to the gun or its cradle or mounting and the sighting device that luminous rays proceeding from a distant object situated in the longitudinal axis of the gun or at any vertical angle from the same and falling upon the surface of the upper reflector will be reflected downward and caused to fall directly upon the lower reflector, so that images of both the distant object and the sight can be superposed and viewed simultaneously and under practically the same optical conditions as and for the purposes set forth in the specification of another application for Letters Patent filed by me, dated December 26, 1900, Serial No. 41,152, the sighting device and the upper reflector being so connected to the gun or its cradle or

mounting or barbette or equivalent that they will turn in a horizontal plane with the gun, and the upper reflector being further mounted to turn about a horizontal axis and being so connected to the gun or its cradle that when the gun is turned in a vertical plane to suit any given range or position of object the said upper reflector will be moved about its horizontal axis in a vertical plane through an angle equal to half the angle through which the longitudinal axis of the gun is moved in a vertical plane. The sighting device and upper reflector are so mounted that they can be adjusted in a lateral direction about a vertical center to compensate for drift and wind-pressure, and the upper reflector is further so mounted that it can be adjusted about a horizontal axis for elevation adjustment independently of the gun or its cradle or mounting.

Sighting apparatus of the kind described can be constructed in various forms and used with protected guns of various types.

Figures 1 and 2 of the accompanying drawings show, respectively, in side elevation and plan one arrangement of sighting apparatus according to this invention applied in connection with a barbette-gun, the barbette in Fig. 1 being shown in vertical section on the line A A of Fig. 2, and in Fig. 2 in horizontal section on the line B B of Fig. 1. Fig. 3 shows the sighting device with part of the barbette-gun and attached parts, partly in side elevation and partly in vertical section, on the line C C of Fig. 4 and to a larger scale than Fig. 1. Fig. 4 is a plan of the parts shown in Fig. 3. Fig. 5 is a cross-section on the line D D of Fig. 3. Figs. 6, 7 and 8 are diagrams.

In the arrangement shown the sighting device proper comprises a tube *a*, arranged horizontally above the gun *b* and below the top of the barbette or armored hood *c* and provided at its forward end with an opaque diaphragm *d*, Figs. 3 and 5, formed with a transparent design—for example, a cross or a circle *e*, (a circle is shown)—through which light can pass from a suitable source and which constitutes the sight proper, and at its rear end with a transparent body *f*, having an inclined reflecting-surface *g*, (herein called the "lower" reflector,) there being arranged at an intermediate part of the tube *a* an object-

glass *h*, whereby rays of light proceeding from the sight *e* will be rendered parallel before they pass through the transparent body *f* to the eye of an observer. The diaphragm *d*, Figs. 3 and 5, may be of glass covered with some opaque material—for example, a coating of silver or other metal or paint—through which the design in the form of a thin line or lines to constitute the sight *e* is cut so as to appear as a bright design upon a black ground when viewed by transmitted light. The said design or sight may advantageously be illuminated by a lamp—for example, an electric incandescent lamp. The transparent body *f*, which constitutes the lower reflector, may conveniently be a piece of parallel glass, and the reflecting power of one of the inclined surfaces thereof—say the lower and inner surface *g* thereof—may advantageously be increased by coating the same with a film of a reflecting medium, such as silver or sulfid of lead, made so thin as to enable an image of the sight *e* to be readily seen through it. The said sighting device is fixed to a frame or carriage *k*, mounted on a suitable support *l*, which is fixed to a stationary part *m* of the gun-mounting, so that when the gun is trained in a horizontal direction the said support, frame or carriage, and sighting device will turn therewith. The support *l* is provided with a vertical pin *n*, to which the rear end of the frame or carriage *k* is pivoted, so that it and the sighting device carried thereby can by means of suitable traversing means be adjusted in a lateral angular direction about the vertical pin *n* as a center to compensate for drift, wind-pressure, or other purpose. The traversing means may be of any known or suitable construction. Conveniently it may be a spindle *o*, mounted to turn in bearings on the support *l* and provided with a worm *p*, in gear with a segment *q* of a worm-wheel fast on the lower part of the frame or carriage *k*.

The reflecting device constituting the upper reflector comprises a plane mirror *r*, that is fixed to a carrier *s*, pivoted to turn about a horizontal axis *t* in a holder *u*, which is also arranged to turn about a horizontal axis coinciding with *t* in the upper part of the frame or carriage *l*, to which the sighting device proper is fixed. The mirror *r* is arranged within the conning-chamber *v*, Fig. 1, or equivalent chamber of the barrette *c* and opposite the sight-opening *w* therein or in any other convenient position, so that normally—that is to say, when the longitudinal axis of the gun *b* is horizontal—the surface of the mirror will be at an angle of forty-five degrees to the said axis, so that horizontal luminous rays *x* from a distant object falling upon the mirror *r* or upper reflector will be reflected vertically downward and fall upon the inclined reflecting-surface *g* or lower reflector, where the image of the distant object can be caused to become superposed upon

the image of the sight *e* as seen through such lower reflector.

The mirror-carrier *s* and holder *u* are provided with a screw adjustment with scale, so that the said carrier, with mirror, can be adjusted about a horizontal axis on the said holder to provide for elevation adjustment. In the example the screw adjustment comprises a spindle 1, mounted to rotate in the holder *u* and provided with a worm 2, gearing with a segmental worm-wheel 3 on the carrier *s*, which is provided with an index 4, arranged adjacent to a scale 5 on the holder *u*, representing degrees of elevation. By this screw adjustment the mirror *r* can be moved independently of the holder *u* through half the angle which the gun *b* will need to be elevated to suit the range of a distant object. Then whenever the image of the object is caused by the elevation and training of the gun to become superposed upon the center of the sight *e* the gun will be properly set for firing at the object. To cause the mirror *r* to turn through a vertical angle half that of the gun *b*, the mirror-holder *u* may, as shown, be made as a sector and be connected at its periphery by a metal strip or ribbon 7 or like connection to the periphery of a circular segment or sector 8, connected to the trunnion 9 of the gun *b* or equivalent pivoted part about which the gun turns in a vertical plane and having a radius one-half that of the sector-shaped mirror-holder *u*. When a flexible strip or ribbon 7 is used as the connector between the mirror-holder and the gun, the mirror-holder must be provided with means, such as a weight or spring, that tends to cause a pull on the said connector and cause the mirror-holder to turn in a backward and upward direction when the gun is depressed.

The working of the apparatus is as follows: For point-blank firing the upper reflector *r* is arranged at forty-five degrees to the longitudinal axis of the gun *b*. Then if the object *z* to be fired at be not an elevated one the longitudinal axis of the gun will be maintained in a practically horizontal position and the upper reflector will be maintained in its inclined position of forty-five degrees, (see Fig. 6,) and when the gun, with sighting apparatus, has been correctly trained on the object horizontal luminous rays *x* coming from such object will by the upper reflector *r* be reflected downward onto the lower reflector *g* of the sighting device, from which they will be reflected backward in a horizontal direction with the parallel rays *y* from the luminous sight *e*, so that images of both the object and sight will be seen simultaneously and under practically the same optical conditions. If the object *z* be an elevated one—say at an elevation of 10°, (ten degrees)—but still sufficiently near to be fired at point-blank, the upper reflector *r* will upon the gun being elevated through an angle of 10° (ten degrees) be turned by the sector 8, con-

sector 7, and sector-shaped holder *u*, Figs. 1 and 3, through half that angle, or  $5^\circ$ , (five degrees,) Fig. 7, so that when the gun has been correctly laid on the object the luminous rays *x* coming from the object will after reflection from the upper and lower reflectors *r* and *g*, respectively, again pass rearward parallel to the rays passing rearward from the sight and admit of the images of the object and sight being seen simultaneously. When the object *z* is at such a distance as to require an elevation of, say,  $5^\circ$  (five degrees) of the gun to compensate for the range, in addition to any elevation that may be necessary on account of the object being an elevated one, then this  $5^\circ$  (five degrees) is allowed for by getting the mirror-carrier *s* to read half the required elevation—viz.,  $2\frac{1}{2}^\circ$  (two and a half degrees) in the example—on the holder *u*, so that the upper reflector *r* will be inclined at  $42\frac{1}{2}^\circ$ , (forty-two and a half degrees,) Fig. 8, to the longitudinal axis of the gun. Then when the image of the object is by reflection again brought opposite the center of the image of the sight *e* by sufficiently elevating the gun the gun will point five degrees above the object and will be correctly laid for firing at the object.

As will be obvious, sighting apparatus of the kind hereinbefore described is specially suitable for use on war-ships that are liable to roll, because notwithstanding the rolling of the ship when the gun and sighting apparatus have been properly trained on the object and adjusted, if necessary, to compensate for the range of the object the gun will be correctly laid for firing at the object each time the image of the object is caused by the rolling of the ship to coincide with the image of the sight.

To enable a wider field of view to be taken at the commencement of a sighting operation, a concave lens 10 may be mounted in front of the plane mirror *r* for more readily locating a distant object which it is desired to fire at, after which the concave lens may be removed by some convenient means to enable more accurate sighting of the object to be effected by the plane mirror. The concave lens 10 may be fixed in a frame or holder 11, that is hinged or otherwise so mounted—as, for example, upon the frame or carriage *l*, as shown—that by pulling a string 12 or operating some other convenient means in a suitable direction from below the said frame or holder 11, with lens 10, can be easily moved into the operative or inoperative position at will.

What I claim is—

1. In sighting apparatus for a barbette or other protected gun, the combination with the gun and its protecting means, of a sight proper, means for rendering luminous rays proceeding therefrom parallel, a reflecting-surface through which an image of the sight produced by the parallel rays can be seen, reflecting means arranged to receive luminous

rays from a distant object and reflect them onto said reflecting-surface so that images of the distant object and sight can be superposed and viewed simultaneously, and mechanism for causing said reflecting means to turn through a vertical angle half that through which said gun is turned in a vertical plane.

2. In sighting apparatus for a barbette or other protected gun, the combination with the gun and its protecting means, of a sighting device comprising a sight proper, means for rendering luminous rays proceeding therefrom parallel, and a reflecting-surface constituting a lower reflector through which an image of the sight produced by the parallel rays can be seen, an upper inclined reflector arranged to receive luminous rays from a distant object and reflect them onto said lower reflector so that images of the distant object and sight can be superposed and viewed simultaneously, means for causing said sighting device and upper reflector to turn horizontally with and to the same extent as said gun, and means for causing said upper reflector to turn through half the vertical angle through which said gun turns when the same is elevated.

3. In sighting apparatus for a barbette or other protected gun, the combination with the gun and its protecting means, of a sighting device comprising a sight proper, means for rendering luminous rays proceeding therefrom parallel, and a lower reflector inclined to the horizontal and through which an image of the sight produced by parallel rays can be seen, an upper reflector inclined to the horizontal and arranged to receive luminous rays from a distant object and reflect them downward onto said lower reflector so that images of the distant object and sight can be superposed and viewed simultaneously, means for causing said sighting device and reflecting means to turn horizontally with and to the same extent as said gun, means for adjusting said sighting device and upper reflector in a lateral angular manner relatively to said gun, and means for causing said upper reflector to turn through half the vertical angle through which said gun turns when the same is elevated.

4. In sighting apparatus for a barbette or other protected gun, the combination with the gun and its protecting means, of a sighting device comprising a sight proper, means for rendering luminous rays proceeding therefrom parallel, and a lower reflector inclined to the horizontal and through which an image of the sight produced by parallel rays can be seen, an upper reflector inclined to the horizontal and arranged to receive luminous rays from a distant object and reflect them downward onto said lower reflector so that images of the distant object and sight can be superposed and viewed simultaneously, a holder mounted to turn about a horizontal axis and wherein said upper reflector is mounted to also turn about a horizontal axis,

means for adjusting said upper reflector about its horizontal axis relatively to said holder, means for causing said sighting device and upper reflector with its holder to turn horizontally with and to the same extent as said gun, and means for causing said holder and upper reflector to turn through a vertical angle half that through which said gun turns when the same is elevated.

5. In sighting apparatus for a barbette or other protected gun, the combination with the gun and its protecting means, of a sighting device comprising a sight proper, means for rendering luminous rays proceeding therefrom parallel, and a lower reflector inclined to the horizontal and through which an image of the sight produced by parallel rays can be seen, an upper reflector inclined to the horizontal and arranged to receive luminous rays from a distant object and reflect them downward onto said lower reflector so that images of the distant object and sight can be superposed and viewed simultaneously, means for causing said sighting device and reflecting means to turn horizontally with and to the same extent as said gun, means for causing said upper reflector to turn through half the vertical angle through which said gun turns when the same is elevated, and a concave lens adapted to be brought in front of said upper reflector and to be afterward moved out of position, substantially as described for the purpose specified.

6. In sighting apparatus for a barbette or other protected gun, the combination with the gun and its protecting means, of a sighting device carried by the gun-mounting and comprising a sight proper, means for rendering luminous rays proceeding therefrom parallel, and a lower reflector inclined to the horizontal and through which an image of the sight produced by parallel rays can be seen, an upper reflector inclined to the horizontal and arranged to receive luminous rays from a distant object and reflect them downward onto said lower reflector so that images of the distant object and sight can be superposed and viewed simultaneously, a holder connected to said sighting device, mounted to turn about a horizontal axis and wherein said upper reflector is mounted to also turn about a horizontal axis, means for adjusting said upper reflector relatively to said holder, and means for causing said holder and upper reflector to turn through a vertical angle half that through which said gun turns when the same is elevated.

7. In sighting apparatus for barbette and other protected guns, the combination with a gun and its protecting means, of a sighting device comprising a tube provided at one end with a diaphragm bearing a luminous sight, at the other end with a reflecting-surface arranged at an angle to the horizontal and through which an image of the sight can be seen, and at an intermediate part with means for rendering luminous rays coming from the

sight parallel before they reach the said reflecting-surface, a reflecting device comprising a plane mirror arranged directly above the inclined surface of the sighting device and at an angle of forty-five degrees to the longitudinal axis of the gun, when this axis is horizontal, a holder mounted to turn about a horizontal axis and wherein said mirror is mounted to also turn about a horizontal axis, means for adjusting said mirror about its horizontal axis relatively to said holder, and means whereby said holder and mirror will, when the gun is elevated, be caused to turn about their common horizontal axis through a vertical angle half that through which the gun is turned, substantially as described for the purpose specified.

8. In sighting apparatus for a barbette or other protected gun, the combination with the gun and its mounting and protecting means, of a sighting device mounted to turn about a vertical axis on said gun-mounting and comprising a sight proper, means for rendering luminous rays proceeding therefrom parallel, and an inclined lower reflector through which an image of the sight produced by the parallel rays can be seen, means for adjusting said sighting device in a lateral direction on said gun-mounting, a sector-shaped mirror-holder attached to said sighting device and capable of moving about a horizontal axis, a mirror-carrier mounted to turn about a horizontal axis in said holder, an inclined mirror fixed to said carrier above the lower inclined reflector, a sector-shaped segment fixed to one of the gun-trunnions and having half the radius of the mirror-holder, and a flexible connector between said mirror-holder and trunnion-segment, substantially as described.

9. The combination with a gun and a barbette inclosing the same and provided at the top with a chamber having an opening in its front wall, of a sighting device capable of being adjusted in a lateral angular direction on a normally stationary part of the gun-mounting and comprising a sight proper, means for rendering luminous rays proceeding therefrom parallel, and an inclined reflecting-surface through which an image of the sight produced by parallel rays can be seen, an inclined reflector located in the barbette-chamber opposite the opening therein, a pivoted holder connected to said sighting device so as to turn therewith in a lateral angular manner when the same is adjusted relatively to the gun and wherein said inclined reflector can be adjusted about a horizontal axis independently of the gun, and means for causing said holder and inclined upper reflector to move through half the angle through which said gun turns when the same is elevated.

10. The combination with a gun and a barbette inclosing the same and provided at the top with a chamber having an opening in its front wall, of a sighting device comprising a sight proper, means for rendering luminous

rays proceeding therefrom parallel, and an inclined reflecting-surface through which an image of the sight produced by parallel rays can be seen, a carriage capable of being adjusted in a lateral angular direction on the gun-mounting about a vertical axis and to which said sighting device is attached, a sector-shaped holder mounted to turn about a horizontal axis in said carriage, an inclined mirror located in said barbette-chamber opposite the opening therein, a carrier mounted to turn about a horizontal axis on said holder and to which said mirror is fixed, means for

adjusting said carrier and mirror in said holder for elevation adjustment, a circular segment secured to one of the gun-trunnions and made of half the radius of said holder, and a flexible connection between said holder and segment, substantially as described for the purposes specified.

Signed at Dublin this 13th day of May, 1901.

HOWARD GRUBB.

Witnesses:

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