

Sept. 27, 1949.

S. J. ZAROODNY

2,482,822

STEREOSCOPIC SIGHT

Filed Feb. 12, 1947

Fig. 1.

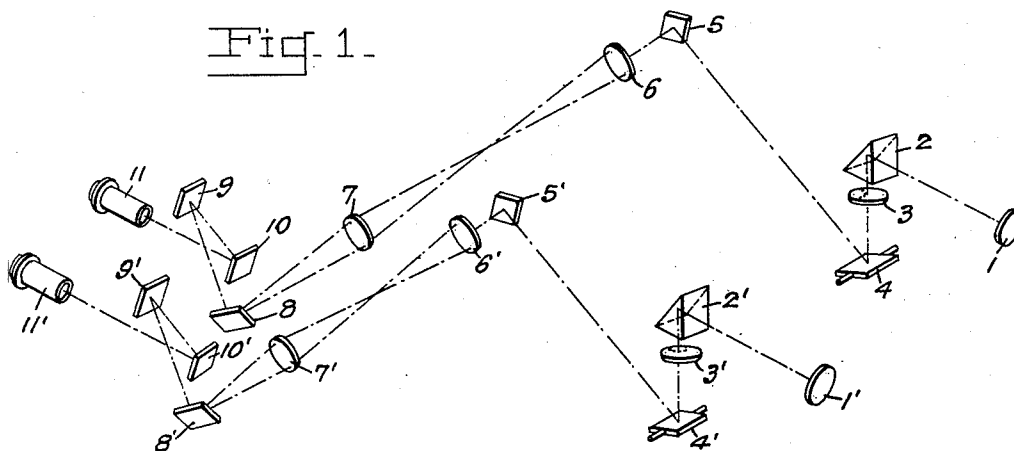
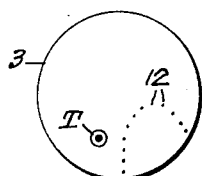
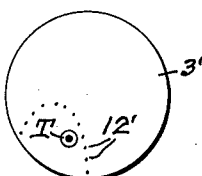


Fig. 2.



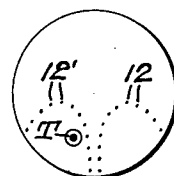
LEFT EYE

Fig. 3.



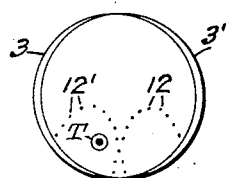
RIGHT EYE

Fig. 4.



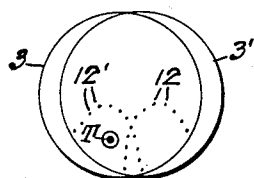
VIEW WITH BOTH EYES

Fig. 5.



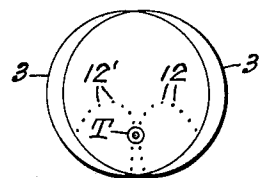
A SHORT

Fig. 6.



AN OVER

Fig. 7.



ON THE TARGET

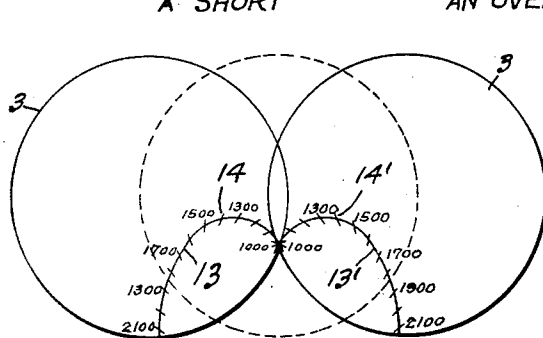


Fig. 8.

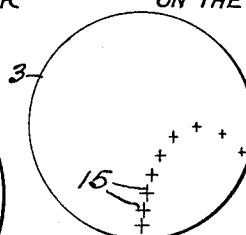


Fig. 9.

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STEREOSCOPIC SIGHT

Serge J. Zaroodny, Aberdeen, Md.

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2 Claims. (Cl. 33—50)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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

This application is a continuation-in-part of my co-pending application, Serial No. 535,335, filed May 10, 1944, for Stereoscopic sight, now Patent 2,422,710 dated June 24, 1947, and has for its object to provide a stereoscopic gun sight having reticles interposed in the right and left optical trains and so arranged and coordinated as to enable the gun on which the sight is mounted, to be properly trained upon a target and elevated for the proper range of the target, all without computations or resort to extraneous instruments or observations.

A further object is to provide a stereoscopic gun sight having reticles in the right and left optical trains which may be used when desired, to determine the range to a target or other object.

Other objects and advantages of the invention will appear as the description proceeds.

In the drawing:

Figure 1 is a perspective diagrammatic view of the optical elements of a system with which the invention may be used.

Figure 2 is a view of the left reticle with a target in the field of view.

Figure 3 is a view of the right reticle with the same target in the field of view.

Figure 4 is the view of Figures 2 and 3 as seen with both eyes when focused upon an object very far away.

Figure 5 illustrates the apparent view when the eyes are focused upon an object at a shorter range than in Figure 4, the gun being trained to the right of the target and aimed too low.

Figure 6 is a view similar to Figure 5 but showing the apparent relation of the reticles when the gun is aimed to the right of and for a greater range than, the target.

Figure 7 is a view showing the appearance of the fused right and left images when the gun has been properly trained and elevated onto the apparent common point of the two reticle patterns, and

Figures 8 and 9 are views showing modified reticle patterns.

Referring in detail to the drawing, 1 indicates a left objective acting to project rays from the target upon a prism 2 from whence they are deflected 90° downwardly through transparent reticle disc 3 to a reflector 4. The optical parts 1, 2 and 3 are assumed to be fixed to the cradle of a

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gun so that the principal axis is adjacent and substantially parallel with the bore axis of the gun. From reflector 4, the pencil of rays proceeds to reflector 5, through condensing lens 6 and 7 to mirrors or like reflectors 8, 9 and 10, in succession. From reflector 10 the rays proceed to ocular 11.

The system shown is intended for use in aiming the gun carried by the turret of a tank. Due to space limitations in the turret, it is impractical for the gunner to move his head with elevation of the gun. Consequently, the optical parts 5 to 11, inclusive, except for preliminary adjustments, are fixed to the turret and move as a unit therewith. Mirror 4 is then mounted with its pivot axis lying in the plane of its reflecting surface, coincident with the axis of the gun trunnions and connected with the gun by well-known mechanism so that the normal to the mirror always bisects the dihedral angle between the incident and reflected rays. One suitable form of mechanism for effecting this purpose is disclosed in the aforesaid parent application.

The optical parts 1 to 3, inclusive, are, after preliminary bore sighting, fixed to the gun and elevate therewith, the central or optical axis between objective 1 and prism 2 being parallel with the bore axis. A magnification is selected to give a field of view sufficient to keep a target in view for substantially the maximum range encountered in direct firing. As a result, the image of the target moves vertically across the field of view as the gun is elevated and depressed.

Of the optical parts just described, 1 to 5, inclusive, are mounted to lie in a normally vertical plane immediately adjacent the left hand side of the gun. The line of vision is projected across the gun by and between reflectors 5 and 8 so that ocular 11 is convenient to the left eye of the gunner.

The optical system used to convey the image of the target from objective 1' to the right ocular 11' is a substantial duplicate of the one just described and the parts thereof have been given the same reference numerals, primed, as have been used to identify corresponding parts of the left optical train. Consequently, it is deemed unnecessary to describe the right optical train or system in detail. The parts 1' to 5', inclusive, are mounted to lie in a vertical plane immediately to the right of the gun, mirror 4' being controlled by suitable linkage so that its normal bisects the dihedral angle between the incident and reflected rays for all positions of gun elevation.

As a result of the optical feature just described, the gunner, with his eyes at the fixed right and left oculars is not required to move his head as the gun elevates. The natural binocular vision is utilized, the target, where direct firing is to be done, is seen stereoscopically and it will be much easier for the gunner to judge whether a given shot is short, on the target or over. The trajectory will, in effect, be seen in space and the aiming, more or less instinctive.

As an aid to this instinctive aiming in correlating range with gun elevation, I propose to provide each of the discs 3 and 3' with reticles which may have several different forms but which are shown in the form of spaced dots. The dots of each reticle define a curve in the nature of a parabola in correspondence with the trajectory of the projectile. In the left reticle the curve defined by dots 12 begins adjacent the lower vertical diameter and extends upwardly and to the right. At its maximum height, the curve defined by the spaced dots closely approaches the horizontal diameter of the reticle and then extends downwardly to a right terminal at the lower right of the reticle. The dots 12' in the right reticle define a curve which is the mirror image of the one in the left reticle. That is, the curve thus defined begins adjacent the lower end of the vertical diameter and proceeds upwardly and to the left, again descending to its terminus at the lower left portion of the reticle. The number of dots or other point-identifying indicia is, of course, the same on both reticles and corresponding points or pairs are at the same elevation in each field of view. Figures 2 and 3 show the reticle patterns as they appear when viewed separately, with a target T occupying the same relative position in each field of view. Figure 4 shows the appearance of the stereoscopically combined reticles when the gunner directs his view to a very remote point such that the lines of sight of his two eyes are practically parallel. Under such a condition the image of an object occupies the same place on both reticles and if the two telescopes or optical trains are properly adjusted to the observer's eyes, his sensation is that of the target being very far away. If the observer now directs his gaze to an object or target T at a certain finite distance away, his eyes turn inwardly by angles proportional to the distance or range of the object and the image of the object does not occupy the same place in each reticle. The two curves defined by the respective families appear to intersect. Figure 5 shows the pattern for a relatively large range. Figure 6 shows the pattern for a lesser range. In both figures, the two images of the target are fused and, merely for clarity of illustration, the fused image of the target or object is shown at the left in the fused field of view.

Furthermore, each reticle point may be spaced from the next adjacent points by distances corresponding to a predetermined constant increase or decrease in range, say, 100 yards, while each pair of points, as previously defined, is at an elevation in the field of view such that, when the gun is moved in elevation to bring the target image into the same horizontal line with that of the fused pair of reticle points, the gun is properly elevated for the range of the target. In Figure 5, the fused pair of points is positioned below and to the right of the target. Hence a shot fired from the gun in this position, will fall short and to the right of the target. In Figure 6, the fused

pair of points lies above and to the right of the target so that a shot fired from the gun when in this position will be over and to the right of the target. In Figure 7, the gun has been properly elevated and trained to be on the target.

The degree to which the brain of the gunner integrates the images seen by each eye, is a matter of psychology, training and the increase in stereoscopic power, that is, the product of the magnification and the ratio of the distance between the telescopes to the interpupillary distance. By practice and training, it will be possible for the gunner to concentrate on the target, then to select the merged or fused pair of points corresponding to the range of the target, and to so train and elevate the gun as to properly lay it by bringing the selected fused pair onto the target.

It will be noted that at no time is the gunner required to know the range of the target. Provided his brain properly fuses and identifies the two points corresponding to the range closest to that of the target, the gun may be correctly laid.

This enables the gunner to concentrate more closely upon the adjustment of fire since he is not primarily concerned with the specific range. However, the invention may be used, if desired, to determine the range. This might be effected by memorizing the range corresponding to each pair of dots or by referring to a previously prepared chart. Alternatively, a range scale may be applied directly to one or both reticles, as exemplarily shown at Figure 9, where the range in yards is shown applied adjacent alternate point-identifying marks. This figure, too, shows a different form of reticle pattern, consisting of continuous lines 13 and 13' having selected range points identified thereon by short crossing lines such as 14 or 14'.

Figure 8 shows a third form of reticle using short vertical and horizontal intersecting lines 15 each intersection identifying a range point corresponding to 12, Figure 2. In this latter arrangement the length of the horizontal sections correspond with the proper lead for a target moving at a customary speed transversely of the gun-target line. Thus, for example, for a target travelling at 30 miles per hour right to left transversely of the vertical plane through the gun bore, the length of each horizontal section is such that the correct lead for each range is effected when the target is aligned with the right end of the line. Similarly, lead for a target travelling left to right could be effected by a similar use of the left end of the selected horizontal line. The vertical sections may be utilized to properly elevate the gun for three kinds of ammunition having slightly different ballistic characteristics, such, for example, as standard high explosive, armor piercing, and shrapnel. In this case, the middle of the vertical section, that is, the point determined by the intersection therewith of the horizontal section, gives the proper elevation when using standard ammunition. The length of the upper half of each vertical section could then be such that the top thereof, when used for sighting gives the correct elevation when using armor piercing ammunition. The lower end of the vertical section would be used to give the proper gun elevation when using shrapnel. This is merely by way of example as it will be recognized that the top, middle and bottom of each vertical line section may be dimensioned and located in the field of view for other types and kinds of ammuni-

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tion. Figure 8 shows the left reticle only. The right reticle will be a mirror image of the left one, as in Figure 3.

While the two sights combined and related with the gun as disclosed herein and more specifically in my previously-identified co-pending application, coact in a highly useful manner to eliminate parallax errors and afford stereoscopic observation of the target, either sight may be used for monocular sighting in event the other one is damaged.

I have thus provided a sight that affords a stereoscopic view wherein the gunner, concentrating his vision on the target, is enabled to determine and select an apparently common or fused point of the two apparently intersecting lines of reticle points corresponding to the range of the target. The lines are so positioned in the field of view that, when a fused pair of points is aligned with the target by traversing an elevation of the gun, the latter is correctly laid for firing upon that target.

In the claims, the term "principal axis" as referred to each of the left and right optical trains or systems identified, respectively by numerals 1 to 11, inclusive, and 1' to 11', inclusive, refers to the optical axis between elements 1 and 2, and 1' and 2', parallel with the bore axis of the gun, and their lines of projection into the respective oculars 11 and 11'. Thus, the vertical central axis of the reticles, as mentioned in the claims, will pass through the principal axis. This will also be true for the horizontal central axes of the reticles. While the principal axis will normally pass through the centers of the reticle discs, this is not an essential. So long as the lines of sight determined by the respective pairs of reticle points make the proper elevation angle with respect to the bore axis of the gun, the central optical axis of the objective may have an inclination with respect to the bore axis and the "principal axis" as just defined.

It will be noted that the reticle curves extend downwardly and outwardly. After a target is approached within a certain range, further depression of the gun will tend to throw the projectile too low. The downward and outward curvature of the reticle curve thus corrects this tendency and causes the projectile to strike the target on the upper and more vulnerable parts thereof, such as the superstructure of tanks and tank destroyers, the roofs and upper stories of buildings and observation posts, etc. This is an added advantage of my invention. However,

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when desired, this feature may be omitted and the reticles graduated so that the gun will be progressively depressed for progressive decreases in range. The exact position of the reticle points, in accordance with the general pattern disclosed, may be modified as dictated by experience in combat.

Having now fully disclosed the invention, what I claim and desire to secure by Letters Patent is:

1. A reticle for a gun sight comprising a transparent disc having a series of spaced consecutive crosses whose points of intersection collectively define a regular curve extending upwardly from the lower terminus of the vertical central axis of said disc, and divergently from said axis, each said cross being formed of a pair of vertical and horizontal intersecting lines, each point of intersection corresponding to a predetermined range of a target, each said horizontal line having its termini positioned to afford the correct lead for a target moving at a predetermined speed transversely of the line of sight when a corresponding said terminus is aligned with said target.

2. A reticle for a gun sight comprising a transparent disc having a series of spaced consecutive crosses whose points of intersection collectively define a regular curve extending upwardly from the lower terminus of the vertical central axis of said disc, and divergently from said axis, each said cross being formed as a pair of short vertical and horizontal intersecting lines, each cross corresponding to a predetermined target range and being located below the central horizontal axis of said disc by an amount proportional to the angle of gun superelevation for that range, each vertical line having its upper terminus, intersection with its horizontal line, and lower terminus, located to determine the proper angle of superelevation for that range, of three respective and different kinds of ammunition.

SERGE J. ZAROODNY.

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