

O. GRAUHEIDING.

SIGHTING APPARATUS FOR ORDNANCE ADAPTED TO FIRE AT ELEVATED TARGETS.

APPLICATION FILED OCT. 16, 1915.

1,411,721.

Patented Apr. 4, 1922.

3 SHEETS—SHEET 1.

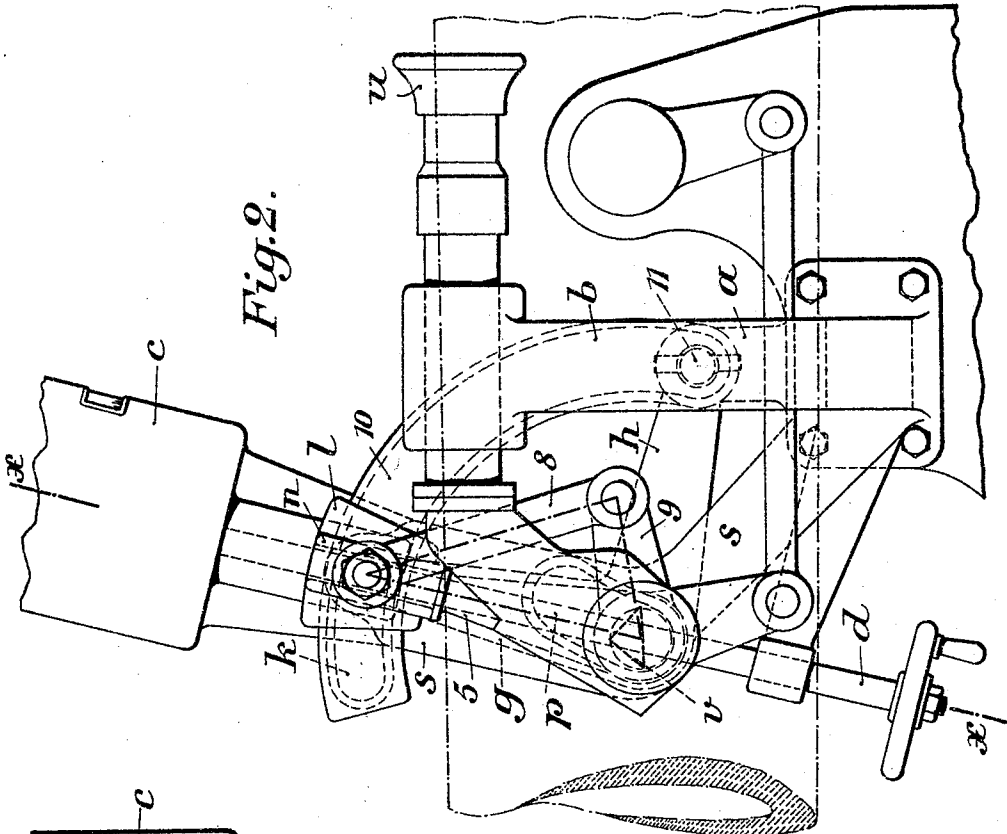


Fig. 2.

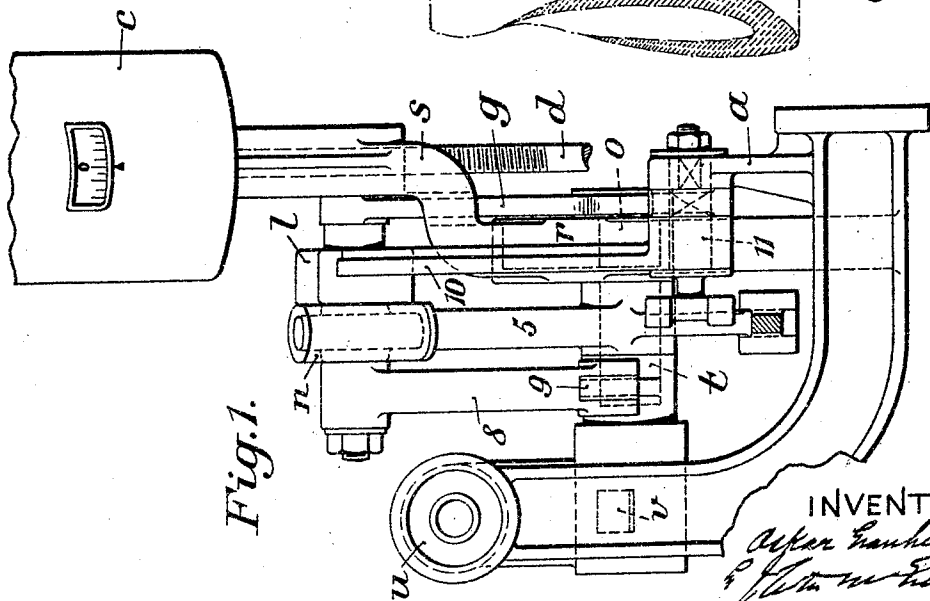


Fig. 1.

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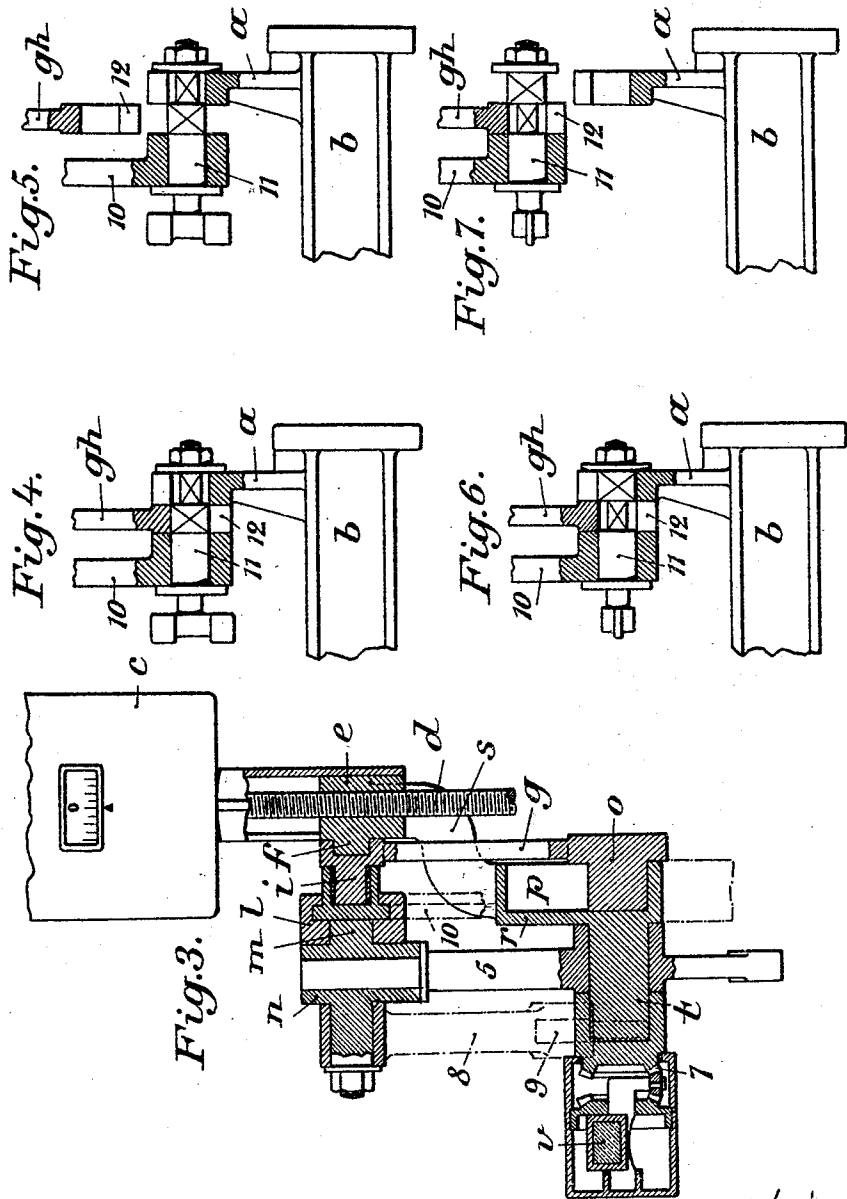
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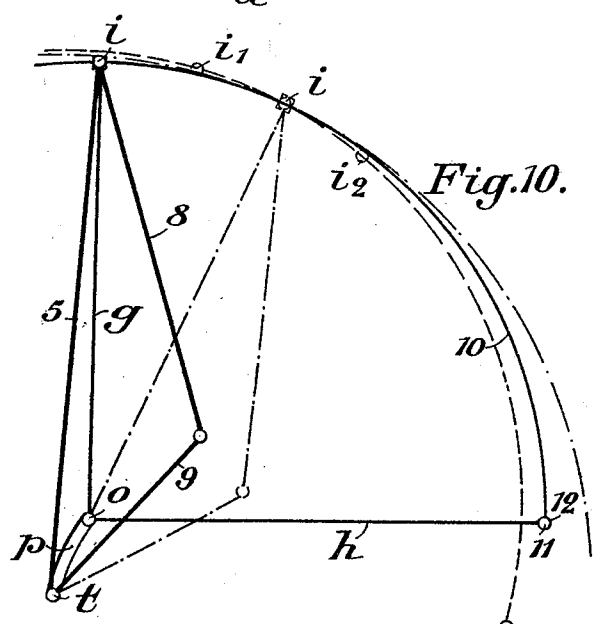
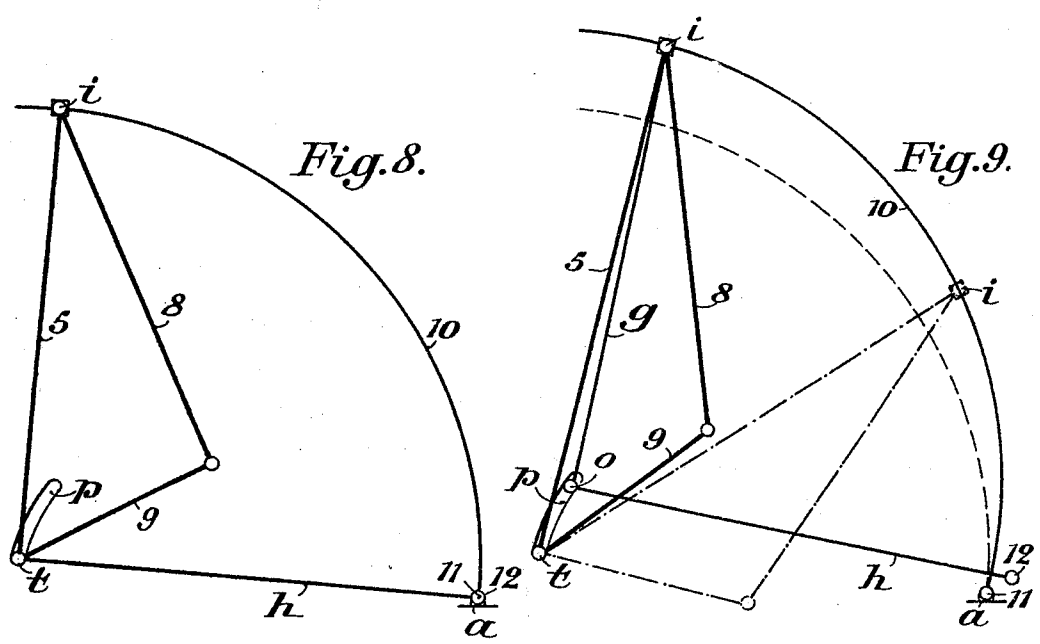
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3 SHEETS—SHEET 3.



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# UNITED STATES PATENT OFFICE.

OSKAR GRAUHEDEING, OF DUSSELDORF, GERMANY, ASSIGNOR TO RHEINISCHE METALLWAAREN- UND MASCHINENFABRIK, OF DUSSELDORF-DERENDORF, GERMANY, A CORPORATION OF GERMANY.

SIGHTING APPARATUS FOR ORDNANCE ADAPTED TO FIRE AT ELEVATED TARGETS.

1,411,721.

Specification of Letters Patent.

Patented Apr. 4, 1922.

Application filed October 16, 1915. Serial No. 56,208.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

*To all whom it may concern:*

Be it known that I, OSKAR GRAUHEDEING, engineer, a subject of the German Emperor, residing at Dusseldorf, 26, Fischerstrasse, Germany, have invented certain new and useful Improvements in Sighting Apparatus for Ordnance Adapted to Fire at Elevated Targets (for which I have filed an application in Germany November 30, 1914;) and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The invention relates to improvements in sighting apparatus for ordnance adapted to fire at elevated targets and has for its particular object to improve the apparatus described in the U. S. Patent 1143428, so that the said device when used in connection with a gun mounted on a ship is enabled to fire correctly as well at elevated targets as also at targets situated on the sea or elsewhere in or nearly in the horizontal plane of the muzzle of the gun.

If guns of the said kind are used on ships and if it is desired to fire in any moment without regard to the rolling of the ship it will be necessary to take into consideration the said rolling, which normally does not exceed an angle of say  $10^\circ$  in each direction, by rotating the elevating mechanism in such a manner that the gun barrel and the line of sight are elevated or depressed together so that the line of sight is constantly directed at the target in spite of the rolling of the ship.

If that is done with the device described in the Patent 1143428 an alteration of the range angle will take place also if the target is in or nearly in the horizontal plane of the muzzle of the gun. It will be evident that in such cases the alteration of the range angle is not desired but on the contrary would cause a fault in the said angle.

Now the present invention consists in an arrangement, by which the said alteration of the range angle can be prevented if the gun is to be fired at targets being in the horizontal plane of the muzzle of the gun even if the gun barrel with the line of sight is moved up

or down in accordance with the rolling of the ship.

In the accompanying drawings an embodiment of the invention is shown. In the drawings Figure 1 is a front elevation, Figure 2 a side elevation, Figure 3 a section in the line  $x-x$  of Figure 2. Figures 4 and 5 show two different positions of some parts of the device, when firing on elevated targets. Figures 6 and 7 show two different positions of the same parts when firing at targets situated in the horizontal plane of the muzzle of the gun. Figures 8-10 are diagrammatical representations of several positions of the principal parts of the device.

The mechanism shown in the drawings has the same general construction as that described in the U. S. Patent 1143428 and comprises particularly a curved member 10 pivoted on a bolt 11 arranged in a holder  $a$  of a bracket  $b$  fastened at the gun carriage.

The curved member 10 is adjusted according to the distance of the target by rotating the screw spindle  $d$  and by means of a nut  $e$  (Figure 3), through which the screw spindle passes and which is provided with a pin  $f$  engaging the arm  $g$  of an angular lever  $gh$ , and further by means of a pin  $i$  of the said arm  $g$  engaging a guiding slot or recess  $k$  of the curved piece 10. The guiding slot or recess  $k$  is provided at the upper end of the curved member 10 (Figures 2 and 3), its length being determined by the greatest range of adjustment of the curved member 10 according to the greatest distance of the target.

The curved member 10 is embraced by a sliding piece 1 which moves with the gun if the latter is elevated or depressed. This sliding piece is engaged by a pin  $m$  connected with a sleeve  $n$  surrounding an arm 5. The latter is pivoted on a pin  $t$  connected or made in one piece with a member  $r$  which is rigidly connected by means of an arm  $s$  with the holder  $a$ . By moving the slide piece 1 in consequence of the elevation of the gun barrel the link triangle 5, 8, 9 is adjusted in the manner described in the above said U. S. patent so as to correct the range angle.

The arm  $h$  of the angle lever  $gh$  is pivotally connected with the pivot 11 of the

curved member 10 (Figure 2). The arm  $h$  however can be released from the said pivot as will be hereafter described.

The pivot of the angular lever  $gh$  is formed by a pin  $o$  engaging a groove  $p$  of the member  $r$  (Figure 3). The member  $r$  carries a drum  $c$  within which in a well known manner a distance scale is connected with the screw spindle  $d$  so as to be readable from the outside of the drum through an opening.

$u$  is the ocular of a sighting telescope carried by the bracket  $b$  in an unchangeable position, as in the present construction only the prism  $v$  will be adjusted for sighting.

The said prism situated nearly in the axis of the pin  $t$  is adjusted by the link triangle 5, 8, 9 by means of a gear 7 in such a manner that it rotates only with half the circular velocity of the barrel. The link triangle 5, 8, 9 is moved by the elevation of the gun directly, if the pin  $t$  is a trunnion of the gun barrel, or as in the shown embodiment by means of a link parallelogram if the pin  $t$  is situated outside the trunnion. The reduction of the circular velocity is caused by the transmission of the movement from the arm 5 to the prism  $v$  through the links 5, 8 and 9.

If it is desired to fire at elevated targets, the curved member 10 is connected with its pivot 11 in the same manner as in the U. S. Patent 1143428 and as shown in Figures 4 and 5. In this case the angular lever  $gh$  is released from the pivot 11 as is shown by Figure 5.

If it is however desired to fire at targets situated in the horizontal plane of the muzzle of the gun the curved member 10 is released from the holder  $a$ , as shown by Figure 7, from which it will be seen that the curved member 10 remains connected with the angular lever  $gh$  when released from the holder  $a$ .

The operation of the device for firing at different targets will be better understood by reference to Figures 8-10.

Figure 8 shows the principal parts of the device diagrammatically in their normal position, that is to say, in the position which the parts have if the gun barrel is in a horizontal position. In this case the curved member 10 is concentric to the axis of the pin  $t$  this axis forming the axis of rotation of the line of sight.

If it is now desired to fire at elevated targets the arm  $h$  of the angular lever  $gh$  is released from the holder  $a$  and the curved piece 10 is adjusted in the same manner as in the U. S. Patent 1143428 by swinging it round its pivot 11. This is shown by Figure 9 in which the dotted line shows the original normal position of the curved member 10 whilst the new position of this member is shown by a full line. If now the gun barrel

is elevated the pin  $i$  comes into the position shown in Figure 9 by dot and dash lines, whereby also the link triangle 5, 8, 9 is adjusted for the correction of the range angle.

The mode of operation in firing at targets situated in the horizontal plane of the muzzle of the gun is explained by Figure 10. In this figure the dotted curved line shows the same position of the curved member 10 as is shown in Figure 9 by a full line, that is to say, it is assumed in Figure 10 that the target is in the same distance as in Figure 9. By the elevation of the gun barrel corresponding to that distance the pin  $i$  comes into the position shown by dot and dash lines in Figure 10.

If now the ship rolls and the sighting-device is constantly directed to the target, the pin  $i$  would move on the curved member 10 between two positions indicated by the small circles  $i^1$  and  $i^2$ , as the curved member 10 is assumed to be connected with the holder  $a$ . The said movement of the pin  $i$  on the curved member 10 would however result in a constant alteration of the angle of range by the constant alteration of the position of the curved member 10. As however the target is not elevated but in the horizontal plane of the gun muzzle the said constant alteration of the angle of range is not correct and would be prevented if the curved member 10 were concentric with the axis  $t$  of rotation. Such a concentric position of the curved member 10 is shown in Figure 10 by a dot and dash line.

Now it is possible with the device constructed according to the present invention to bring the curved member 10 in such a position, that it is nearly concentric to the axis  $t$  in that part of its length in which the pin  $i$  moves in consequence of the rolling of the ship. This adjustment of the curved member 10 can be made because it is possible to release the pivoted end of the curved member 10 from the holder  $a$  and to connect it with the end 12 of the arm  $h$  of the angular lever  $gh$ . The curved member 10 is then in the position shown in Figure 10 by a full line and it will be seen that in this position the curved member between the points  $i^1$  and  $i^2$  is much more concentric to the axis  $t$  than if it had conserved the position shown by a dotted line.

The conditions assumed in Figure 10 are the most unfavorable occurring in practice, that is to say, the curved member 10 is adjusted for a distance of 10000 m. and the points  $i^1$  and  $i^2$  correspond to a rolling of the ship of  $10^\circ$  in each direction. Therefore it will be seen, that for smaller distances of firing and for a smaller angle of rolling the curved member 10 can be brought into a position in which it is nearly concentric with the axis  $t$  in that part of its

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length in which the pin  $i$  moves to and fro by directing the line of sight constantly to the target during the ship rolls.

5 I claim is:—

1. In combination with a pivotally mounted gun-barrel and a sighting-device, means forming a sliding connection between the gun-barrel and the sighting-device, a curved member pivoted at one end and to which  
10 said sliding connection is slidably connected, a support for the pivoted end of said member, means for moving said member on its pivot, the pivoted end of said member being  
15 releasably held in its support.

2. In combination with a pivotally mounted gun-barrel and a sighting-device, means forming a sliding connection between the

gun-barrel and the sighting-device, a curved member pivoted at one end and to which  
20 said sliding connection is slidably connected, a support for the pivoted end of said member, means for moving said member on its pivot, the pivoted end of said member being  
25 releasably held in its support, an angular lever, a guide within which the pivot of said lever is adjustable and means for connecting the released curved member with the said angular lever.

In testimony whereof, I have signed this  
30 specification in the presence of two subscribing witnesses.

OSKAR GRAUHEDING. [L. s.]

Witnesses:

ALBERT NUFER,  
META WARD.