

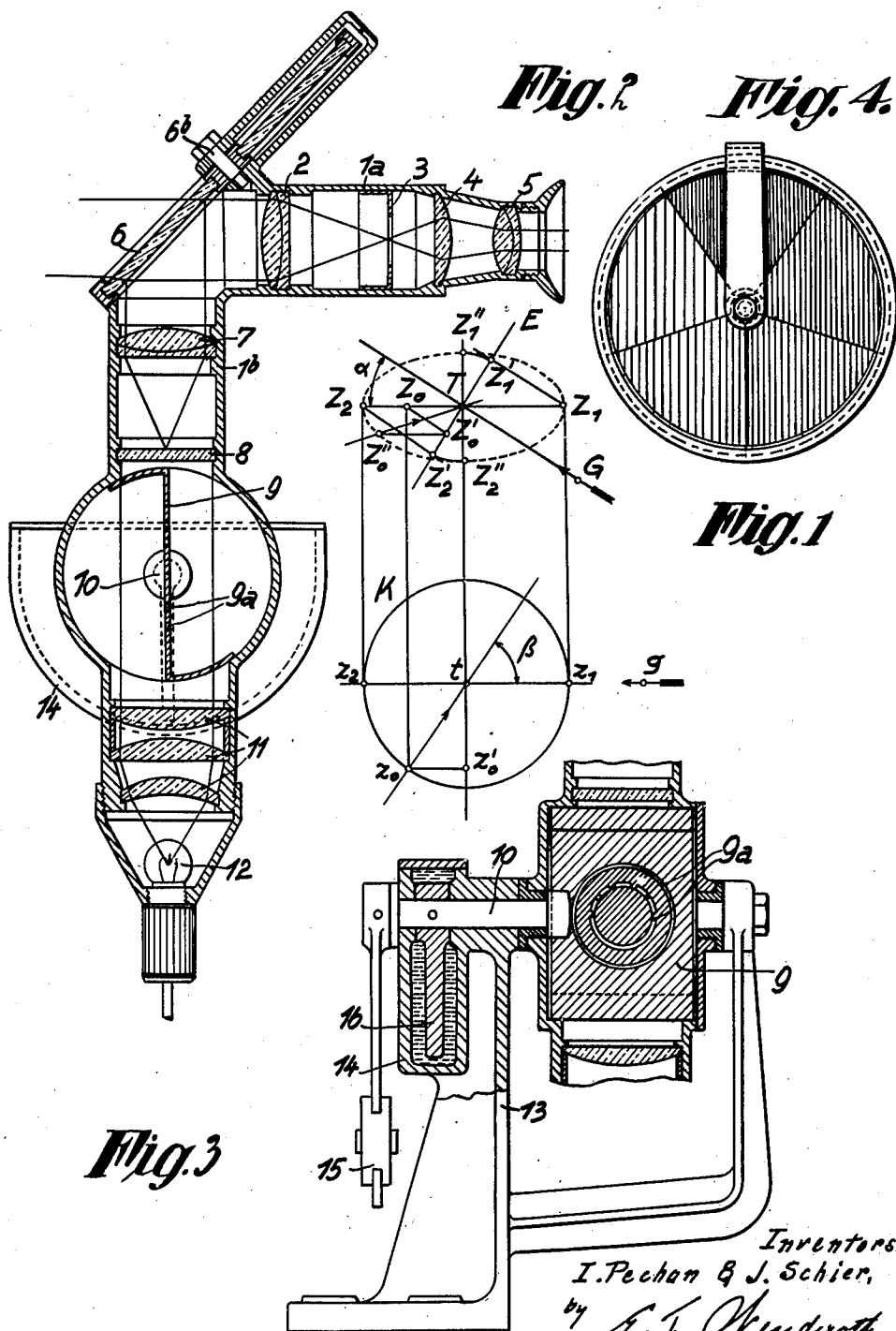
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AIMING TELESCOPE

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UNITED STATES PATENT OFFICE

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AIMING TELESCOPE

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The invention relates to aiming telescopes comprising means for estimating the angle of allowance in front of the target, such for instance as aiming telescopes for anti-aircraft ordnance and machine guns. In view of the fact that in the case of rapidly moving targets the angle of allowance required for hitting the target depends not only on the speed of the target, but also on the angle between the direction of its movement and the sight line, that is to say of its instantaneous position, the means for estimating the required allowance is so constructed that in the casing of the aiming telescope a diaphragm rotatable around a horizontal axis is mounted which is provided with one or more transparent concentric circular rings serving as a scale for the speed of the target, suitable means being provided for inclining this diaphragm at the proper angle to the horizon. A pencil of parallel rays of light is caused to pass through this diaphragm, whereby the said transparent circular ring or rings are projected by the pencil of parallel rays of light in the form of a luminous ellipse or concentric ellipses on a frosted plate owing to the inclination of the diaphragm which depends on the inclination of the line of sight. From this frosted plate the images of the ellipse or ellipses are reflected into the field of vision of the telescope by means of a projection lens and a plane, transparent reflecting plate properly inclined to the optical axis of this lens so that in the field of vision appears the image of one or more concentric luminous ellipses the ratio of axes of which depends on the angle of inclination of the sight line in such a manner, that when the sight line is vertical, the said ellipse or ellipses appear as circles whereas when the sight line is horizontal the said ellipse or ellipses appear as a horizontal straight line of a length equal to the greatest ellipse axis.

The annexed drawing illustrates by way of example an embodiment of the present invention.

Fig. 1 illustrates the theoretical basis of the invention; Fig. 2 is a vertical section of an aiming telescope according to the invention, Fig. 3 is a sectional front elevation of part

of the apparatus showing the mounting of the diaphragm. Fig. 4 is a plan view of a plate shown in section in Fig. 2.

When the target moves horizontally with a uniform speed the geometrical locus of targets having in common one hitting point is a horizontal circle, the radius r of which is equal to the distance $v \cdot t$ through which the target moves with the speed v in the time t which is the duration of flight of the projectile t being equal to

$$\frac{e}{c}$$

wherein e is the distance of the hitting point from the gun or ordnance and c is the average speed of the projectile. In Fig. 1 K is in plan view this circle having the radius

$$r = \frac{v}{c} e,$$

while in elevation it appears as a straight line $Z_1 T Z_2$. When viewed from the gun g at the angle α of inclination of the straight line connecting the hitting point T with the centre of the objective, this circle appears as an ellipse, the greater axis of which is equal to the diameter of the circle and the smaller axis $Z''_1 Z''_2$ of which results from the projection $Z'_1 Z'_2$ of the two end points $Z_1 Z_2$ of the rectilinear projection of the circle on a plane E perpendicular to the sight line G T, $Z''_1 T Z''_2$ being equal to $Z'_1 T Z'_2$. If now the target moves at the angle β to the horizontal projection of the straight line connecting the hitting point with the centre of the objective, that is to say in plan view along the line $z_0 t$, the projection of the corresponding point z_0 on the plane perpendicular to the line GT gives in elevation the point Z'_0 which is below the horizontal line passing through the hitting point T and at the distance $Z'_0 T$ from this horizontal line and thus gives the point Z''_0 of the ellipse so that the path of the target appears as the oblique radius $Z''_0 T$ of the ellipse. If now the gun is so trained that at the moment of firing the target appears in the periphery of ellipse and the path of the target passes

through the center of the ellipse then the projectile will hit the target.

The aiming telescope, based on the fact that the oblique projections of circles appear as ellipses the greatest radii of which correspond to the values

$$\frac{v}{c}e$$

occurring in practice, comprises a rectangularly bent telescope casing consisting of a telescope part 1_a and a projection part 1_b. In the former is mounted the telescope objective 2 with the diaphragm 3 for the field of vision and the eye piece consisting of the collective lens 4 and the eye lens 5. A transparent and reflecting plane plate 6 is arranged at an angle of 45° to the optical axis of the objective and below this plate is mounted in the projection part 1_b a projection objective 7. A frosted plate 8 is located in the lower focal plane of the projection objective. On this frosted plate are projected the transparent lines of the diaphragm 9 located below the said plate by rays of light coming from below. The diaphragm 9 is mounted in a drum shaped enlargement of the projection part 1_b of the telescope casing which part 1_b is rotatable around a horizontal shaft 10 rigidly secured to the diaphragm. The diaphragm 9 is made of thin sheet metal or of a film such as are used for photographic purposes and is bent Z-shaped for shielding off lateral rays. On this diaphragm one or more, as shown in Fig. 3, thin transparent circular rings 9_a are provided which are projected onto the frosted plate 8, in general, as ellipses the ratio of the axes of which varies with the inclination of the, as shown, vertical stationary plane diaphragm to the line of sight. Below the diaphragm is provided the illuminating set of lenses 11 throwing a pencil of parallel rays of light from the source of light 12 onto the diaphragm and through its transparent circular rings. The source of light 12 is preferably made as small as possible. The horizontal shaft 10 on which the aiming telescope is rotatably mounted may be fixedly or rotatably journaled in the bifurcated post 13 according as to whether the aiming telescope or the gun carrying the same is positioned on a stationary or on an oscillating base as in the case of guns on board of ships. In the latter case the diaphragm is kept stationary by a weight or pendulum 15 and the oscillations of this weight are damped by an oil brake. This oil brake comprises an arm 16 fast on the shaft 10 and acting with suitable play as a brake blade in an oil filled semi-cylindrical trough 14 closed on all sides and fast on the post 13.

The operation of the aiming telescope above described will now be readily understood: By properly operating the training mechanism of the gun the apparatus is so po-

sitioned that the image of the target appears on the luminous ellipse the greatest radius of which corresponds best to the value

$$r = \frac{v}{c}e$$

and that this image moves towards the centre of the said ellipse.

For securing that the luminous ellipses are always clearly visible notwithstanding the varying luminosity of the heaven forming the background of the target, the transparent reflecting plate 6 is composed of a plurality of sectors differing in transparency and reflecting capacity, as indicated in Fig. 4 by hatching different density. This compound plate 6 is mounted on a journal pin 6_b rotatable in a pocket on the telescope casing. By turning this compound plate by means of the journal pin 6_b the one or the other of the said sectors may be brought into operative position in front of the objective 2 of the telescope. Any known suitable means may be provided for holding the compound plate in the position to which it has been adjusted.

What we claim is:

1. An aiming telescope comprising a telescope casing with two parts the axes of such parts being perpendicular to each other, an objective and an eye piece associated to the said objective located in one of the said parts, a horizontal shaft on which the said telescope is rotatably mounted, a source of light, an illuminating set of lenses, an opaque diaphragm provided with at least one concentric circular transparent ring and a frosted plate the four last named elements being mounted the one behind the other in the other part of the telescope casing, the said illuminating set of lenses being adapted to project a pencil of rays of light through the said transparent circular rings of the said diaphragm onto the said frosted plate the said rays of light being parallel to the said other part of the telescope casing, means for permanently holding the said diaphragm in a substantially vertical plane and means for reflecting the rays of light coming from the said frosted plate into the first named part of the telescope casing.

2. An aiming telescope comprising a telescope casing with two parts the axes of such parts being perpendicular to each other, an objective and an eye piece associated to the said objective located in one of the said parts, a horizontal shaft on which the said telescope is rotatably mounted, a source of light, an illuminating set of lenses, an opaque diaphragm provided with at least one concentric circular transparent ring and a frosted plate the four last named elements being mounted the one behind the other in the other part of the telescope casing the said illuminating set of lenses being adapted to project a pencil of rays of light through the said transparent circular rings of the said diaphragm onto the

said frosted plate, the said rays of light being parallel to the said other parts of the telescope casing, means for permanently holding the said diaphragm in a substantially vertical plane and means for reflecting the rays of light coming from the said frosted plate into the first named part of the telescope casing, the last named means comprising a projection objective in the focal plane on one side of which is located the said frosted plate and an inclined plane reflecting surface on the other side of the said projecting lens.

3. An aiming telescope comprising a telescope casing with two parts the axes of such parts being perpendicular to each other, an objective and an eye piece associated to the said objective located in one of the said parts, a horizontal shaft on which the said telescope is rotatably mounted a source of light, an illuminating set of lenses, an opaque diaphragm provided with at least one concentric circular transparent ring and a frosted plate the four last named elements being mounted the one behind the other in the other part of the telescope casing, the said illuminating set of lenses being adapted to project a pencil of rays of light through the said transparent circular rings of the said diaphragm onto the said frosted plate, the said rays of light being parallel to the said other part of the telescope casing, means for permanently holding the said diaphragm in a substantially vertical plane and means for reflecting the rays of light coming from the said frosted plate into the first named part of the telescope casing, the last named means comprising a projection objective in the focal plane on one side of which is located the said frosted plate and an inclined transparent reflecting plane plate comprising a plurality of sectors differing in transparency and reflecting capacity, a partly open opaque case for the said plate secured to the said telescope casing and means for turning the said plate in the said casing, whereby any one of the said sectors may be brought into operative position, and means for locking the said plate in any adjusted position.

4. An aiming telescope comprising a telescope casing with two parts the axes of such parts being perpendicular to each other, an objective and an eye piece associated to the said objective located in one of the said parts, a horizontal shaft on which the said telescope is rotatably mounted, a source of light, an illuminating set of lenses an opaque diaphragm provided with at least one concentric, circular transparent ring and a frosted plate, the four last named elements being mounted the one behind the other in the other part of the telescope casing, the said illuminating set of lenses being adapted to project a pencil of rays of light through the said transparent circular rings of the said diaphragm onto the said frosted plate the

said rays of light being parallel to the said other part of the telescope casing, means for permanently holding the said diaphragm in a substantially vertical plane and means for reflecting the rays of light coming from the said frosted plate into the first named part of the telescope casing, and means mounted on the said diaphragm for shielding off lateral light.

In testimony whereof we affix our signatures.

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