No. 639,407. Patented Dec. 19, 1899.

J. KRONE.

APPARATUS FOR ADJUSTING ELEVATION OF GUNS.

(Application filed Apr. 21, 1899.)

(No Model.) 2 Sheets—Sheet 1.

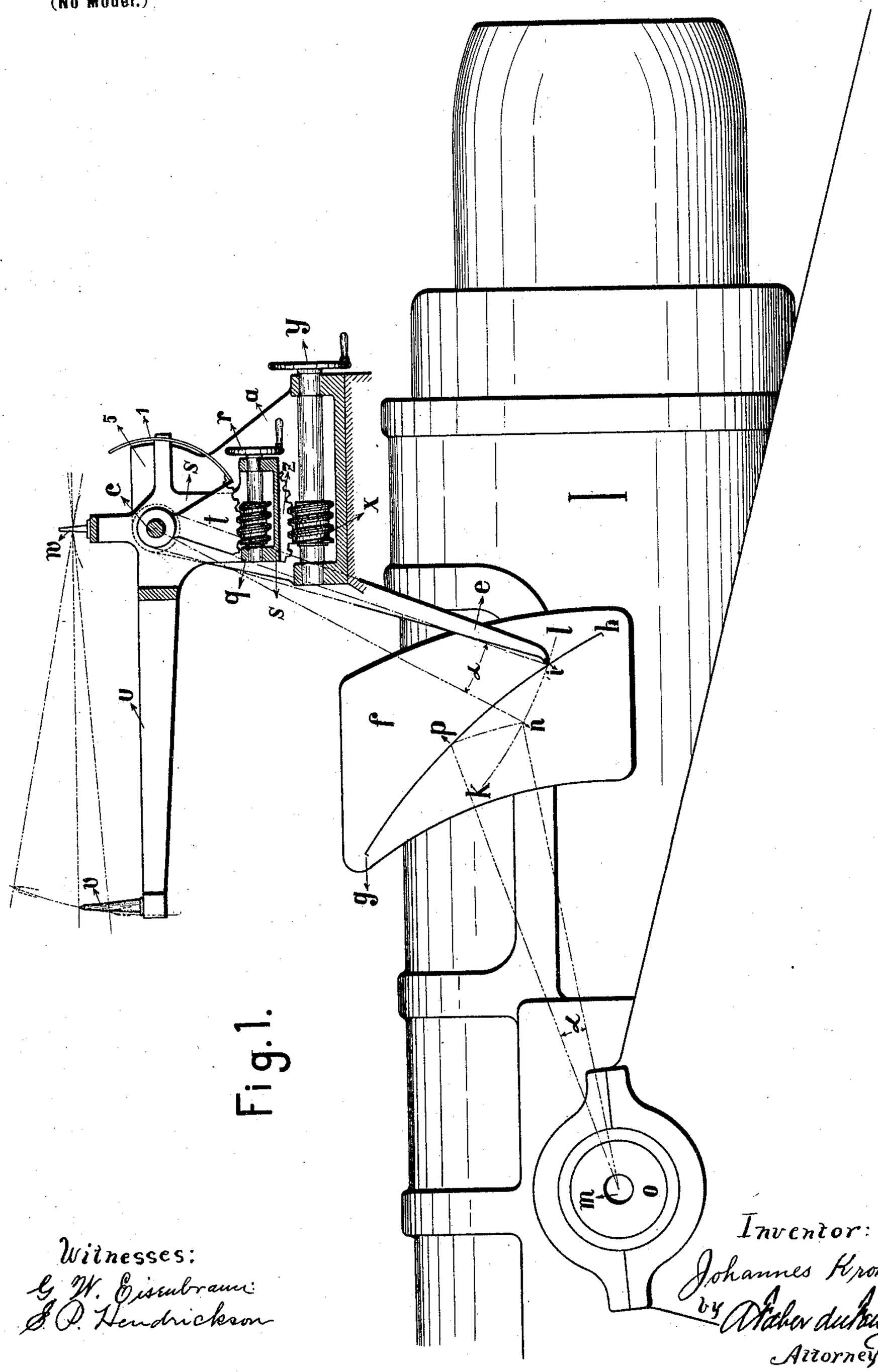

Fig. 1.

Witnesses:
G. W. Eisenbrandt
E. D. Hendrickson

Inventor:
Johannes Krone
by Faber du Bois
Attorney.

No. 639,407. Patented Dec. 19, 1899.

J. KRONE.

APPARATUS FOR ADJUSTING ELEVATION OF GUNS.

(Application filed Apr. 21, 1899.)

(No Model.) 2 Sheets—Sheet 2.

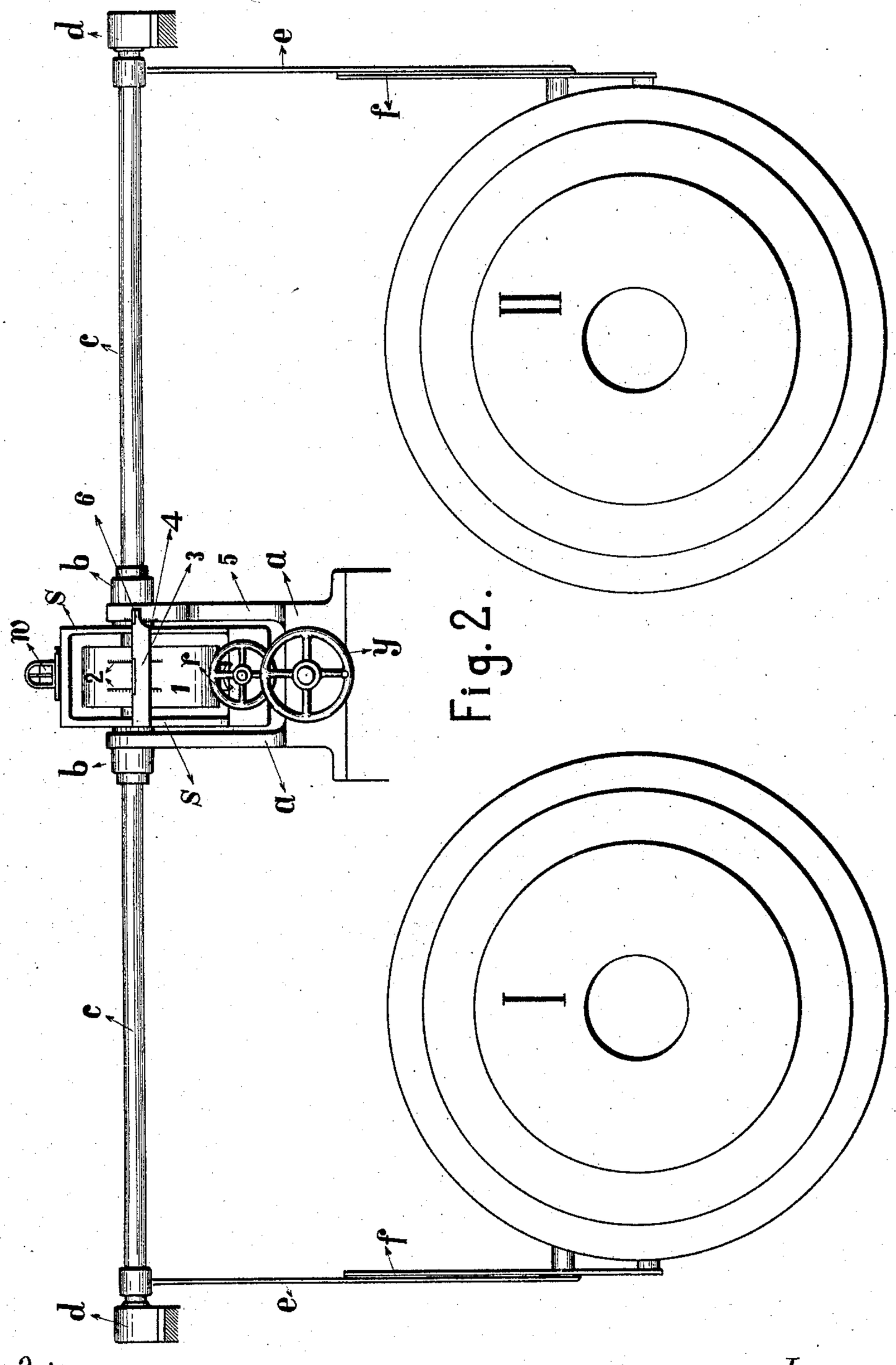

Fig. 2.

Witnesses:
G. W. Eisenbrandt
E. P. Hendrickson

Inventor:
Johannes Krone
by Baker duBois & Co
Attorneys.

UNITED STATES PATENT OFFICE.

JOHANNES KRONE, OF ESSEN, GERMANY, ASSIGNOR TO FRIED. KRUPP, OF SAME PLACE.

APPARATUS FOR ADJUSTING ELEVATION OF GUNS.

SPECIFICATION forming part of Letters Patent No. 639,407, dated December 19, 1899.

Application filed April 21, 1899. Serial No. 713,878. (No model.)

To all whom it may concern:

Be it known that I, JOHANNES KRONE, a citizen of the German Empire, residing at Essen, Germany, have invented certain new and useful Improvements in Apparatuses for Adjusting the Elevation of Guns, of which the following is a specification.

This invention refers to an apparatus for adjusting the elevation of guns whose sighting apparatus is not attached to the barrel itself and which require special means to obtain the proper elevation. The methods hitherto used for this purpose required more or less complicated intermediate mechanism between the sight and the gun, in which mechanism lost motion would be apt to occur. Besides, they necessitated the application of the graduation, &c., to the gun itself, so that errors of observation by the man attending the elevating mechanism were not excluded. The present invention is to remedy those defects, and for this purpose it consists in adjusting an index-hand to the desired elevation of the gun and then turning the gun up or down until some point of an elevation-curve provided on the gun-barrel comes up to the end of the index-hand. The adjustable index-hand may be connected to the sighting mechanism in such a manner that in sighting the difference of level is at once accounted for.

In the annexed drawings the invention is illustrated as applied to two guns placed parallel within a turret to be pointed by one and the same sighting apparatus.

The invention may, however, be readily applied to single guns as well as to more than two guns with a common sighting apparatus.

In the drawings, Figure 1 is a side view of the rear part of two turret-guns as well as of the common sighting apparatus, the latter being partly in section. Fig. 2 is a rear end view of the two gun-barrels and of the sighting apparatus.

Similar letters and numerals refer to similar parts throughout both views.

Between the two guns and near the place for the operator is a standard *a*. *c* is a shaft supported in bearings *b b* of the standard *a* and in other fixed bearings *d d* at its outer ends. To the shaft *c* are attached index-hands *e e*. To each of the gun-barrels, respectively to the cradles, is attached a plate *f*, on which a curve *g h* is marked out. This curve is drawn in the following manner: Assuming the position of the index-hand *e* in Fig. 1 to be the zero position, the point *i* of the plate *f*, to which the end of the index-hand (or some mark near the end of it) points, is at the same time the zero-point of the curve *g h*. Any other point of the curve, such as the point *p*, is obtained by turning the index-hand *e* an angle α, whereby its end is brought to a point *n* on the arc *k l* described by the end of the index-hand. Drawing then a line *m n* from the center of the trunnion *o* to the point *n* describing an arc of a circle with *m* as a center and *m n* as a radius and drawing a line *m p* at an angle α degrees with *m n* then the point *p* is a point of the curve *g h*, and by turning the gun to bring this point *p* down to the end of the pointer when turned an angle α degrees from *i* to *n* the gun will have an elevation of α degrees. A number of points determined in the same way are connected to form a continuous curve *g h*. It must be observed that to the left of the zero-point *i* the arcs described from the center *m* of the trunnion are directed upwardly, while to the right of the zero-point they are directed downwardly.

When the curve *g h* has been properly traced and the index-hand *e* is moved from the position shown in Fig. 1 to any other position—for instance, to a position in which its point is at *n* (α degrees from the zero position) and then the elevation of the gun is changed by means of the elevating-gear, the point of the index-hand describes relatively to the gun an arc of a circle concentric to the trunnion and will finally reach the point *p* of the curve *g h*. If now the elevation is not further changed, the barrel has been elevated an angle of α degrees, as follows from the above-described method of forming the curve. The same applies to any other angle, to the right and left of the zero-point, and if the index-hand has been properly adjusted for distance and difference of level the elevation of the gun must be properly adjusted when the point of the index-hand touches the curve *g h*. The curve *g h* may also be traced by drawing the line *m p* at an angle with *m n*

greater or less than α degrees if only the relation between the two angles be constant for the several points of the curve.

It is not absolutely necessary that the index-hand should be pivoted, since it may, for instance, be arranged to slide in a straight line within a guide, in which case its point also travels in a straight line. This, however, does not change the method of tracing the curve $g\,h$ and the manner of sighting and adjusting the gun to the proper elevation.

Two adjustments are provided for the index-hands e—namely, an adjustment to the elevation due to the distance, as required by the firing-tables, and an adjustment to the angle of depression or elevation of the object to be fired at. For this purpose a box-like casing s, carrying the sighting-beam u with the front sight v and the back sight w, is pivoted on the shaft c between the sides of the standard a and adjustably held by a worm x, mounted in bearings of the standard a, the worm being provided with a handle y and engaging a worm-wheel sector z at the bottom of the casing s. Fixed to the shaft c is another worm-wheel sector t, actuated by a worm q, journaled in the casing s and provided with a hand-wheel r. By this latter worm-gear the relative angular position of the index-hand e and sighting-beam u is adjusted to the elevation due to horizontal distance, while by the first-mentioned worm-gear these two parts are turned together for the purpose of adjustment to the difference of level. From the worm-wheel sector t extends a cylindrically-formed plate 1, concentric to the shaft c. This plate has on its outer face a graduation 2, which when the index-hand e is adjusted by the worm-gear $q\,t$ passes a mark on the upper edge of the cross-piece 3, fixed to the casing s, thereby allowing the gunner to read off the number of degrees to which the index-hands e have been turned in relation to sighting-arm u, while an index-hand 6, extending from the casing s to a cylindric scale on the right side 5 of the standard a, indicates the degree of angular motion of the casing s, (together with worm-gear $q\,t$ and sighting apparatus.)

In operation the gunner, by the hand-wheel r, first adjusts the index-hand e to the proper elevation called for by the firing-tables for the given horizontal distance of the object to be fired at. During this operation the position of the sight-beam remains unchanged. Then turning the hand-wheel y the gunner directs the sight-line to the target or other object to be fired at. In so adjusting the sight the casing s is turned, and with it the index-hand e, so that according to the elevation or depression of the target the angle to which the index-hands have been previously adjusted is increased or decreased. The gun is now turned by the elevating machinery until the end of the index-hand e meets the curve $g\,h$, when the gun is at the proper elevation for the given distance.

Sometimes—for example, aboard—the adjustment of the index-hand to the angle of depression or elevation of the object to be fired at may be dispensed with, the sighting-beam u forming a solid part of the standard a, the sight-line being horizontal, and the worm q journaled in the standard a. The difference of level may then be accounted for by profiting from the rolling of the ship and firing at the moment the target is passing the sight-line.

What I claim as new is—

1. In an apparatus for adjusting the elevation of guns, the combination with an index-plate attached to the gun and having an index-curve traced thereon, of a standard fixed to the gun-support; an index-hand adjustable in said standard according to the required elevation of the gun, whereby after adjustment of the index-hand the gun is adjusted to the proper elevation by turning it on the trunnions until a fixed part of the index-hand meets the index-curve, substantially as described.

2. In an apparatus for adjusting the elevation of guns, the combination with an index-plate attached to the gun and having an index-curve traced thereon, of a standard fixed to the gun-support; an index-hand fixed to a shaft journaled within said standard and extending over the index-plate, and mechanism for turning the index-hand and adjusting it to the proper angle of elevation, substantially as and for the purpose specified.

3. In an apparatus for adjusting the elevation of guns, the combination with an index-plate attached to the gun and having an index-curve traced thereon, of a standard fixed to the gun-support; an index-hand adjustable in said standard in relation to the sight-line to the angle of elevation due to the distance of the target, and also adjustable jointly with the sight-line to the elevation or depression of the target, whereby after adjustment of the index-hand the gun is adjusted to the proper elevation by turning it on the trunnions until a fixed part of the index-hand meets the index-curve, substantially as described.

4. In an apparatus for adjusting the elevation of guns, the combination with an index-plate attached to the gun and having an index-curve traced thereon, of a standard fixed to the gun-support; an index-hand fixed to a shaft journaled within said standard and extending over the index-plate; a casing and sighting-arm attached thereto pivoted to the same shaft and adjustably connected to the index-hand, and mechanism for turning the casing together with the index-hand, substantially as and for the purpose specified.

5. In an apparatus for adjusting the elevation of guns, an index-plate fixed to the gun; an index-curve traced on said plate; a standard fixed to the gun-support, a shaft supported in bearings of said standard; an index-hand fixed to said shaft and extending to swing

across the face of said index-plate; a casing pivoted to the shaft and carrying a sighting-beam with front and back sight; mechanical means for turning the index-hand in relation to the sighting-arm; a scale to read off the angle of turning; and mechanical means for turning the index-hand together with the sighting apparatus; whereby the relative angular position of the sighting-arm and the index-hand is first adjusted to the elevation due to the distance of the target, the sighting-arm and index-hand then jointly turned to direct the sight-line to the object, and the gun finally brought to the proper elevation by turning it on the trunnions until the outer end of the index-hand meets the index-curve, substantially as described.

6. In an apparatus for adjusting the elevation of guns; index-plates *f* fixed to the gun; index-curves *g h* drawn on said index-plates; a standard *a* fixed to the gun-support; a shaft *c* supported in bearings *b b* of the standard, and in outer fixed bearings *d d*; index-hands *e e* fixed to the shaft *c* and extending over the index-plates; a casing *s* pivoted to the shaft *c* between the sides of the standard, and carrying the sighting-beam *u*, front sight *v* and back sight *w*; worm-wheel sector *t* and worm *q*, for turning the shaft, respectively the index-hands *e e* fixed thereon, in relation to the casing *s* for adjustment to the angle of elevation due to distance; scale 1 and cross-piece 2 for reading off said angle; worm *x* mounted in the standard *a*, provided with hand-wheel *y* and engaging worm-wheel sector *z* on the lower side of the casing *s*, whereby the casing, sighting-beam and index-hands are turned together and the index-hands adjusted for difference of level, as the sight-line is turned up or down toward the target, and the guns brought to the proper elevation by turning them on their trunnions until the ends of the index-hands come up to the index-curves, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JOHANNES KRONE.

Witnesses:
WILLIAM ESSENWEIN,
GEO. P. PETTIT.