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INDICATING INSTRUMENT FOR USE IN CONNECTION WITH FUSE SETTING OPERATIONS.

APPLICATION FILED JUNE 9, 1919.

1,364,039. Patented Dec. 28, 1920.

2 SHEETS—SHEET 1.

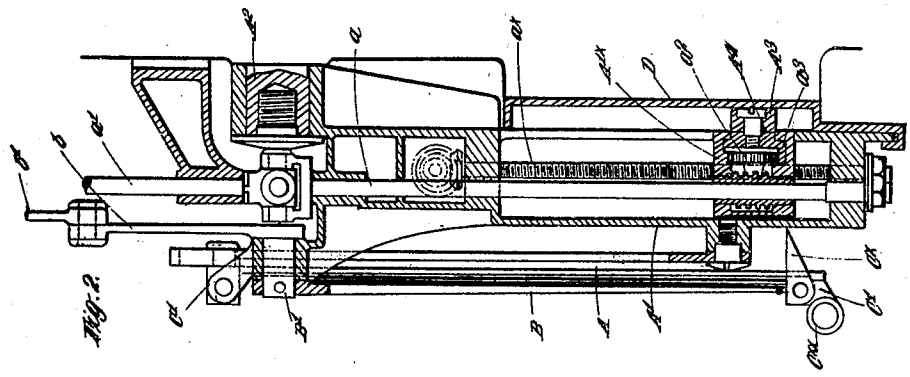


Fig. 2.

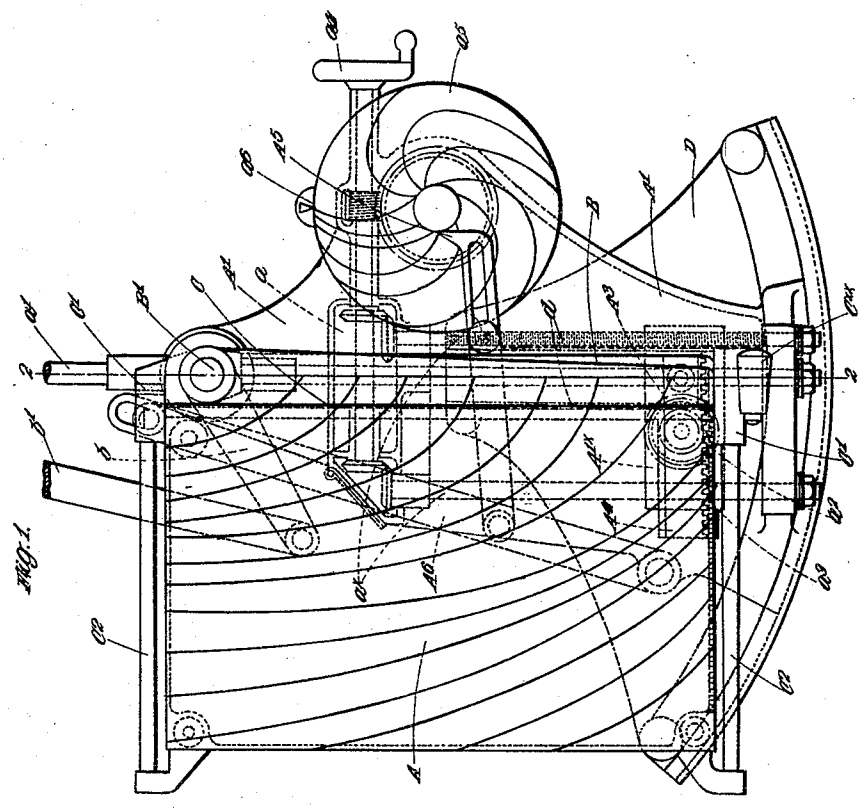


Fig. 1.

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Fig. 3.

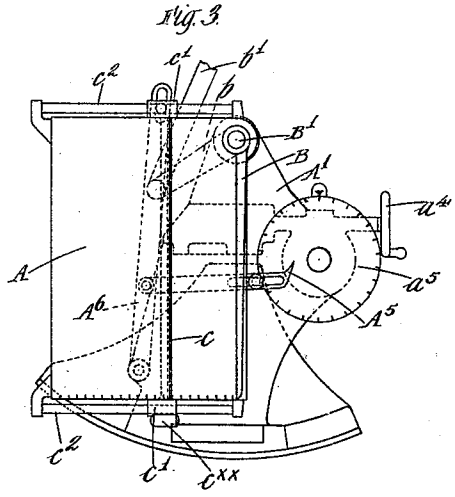


Fig. 4.

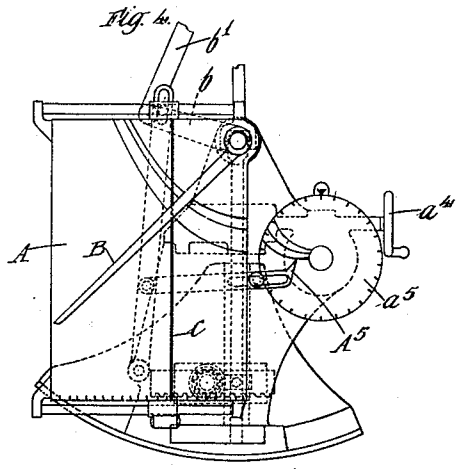


Fig. 5.

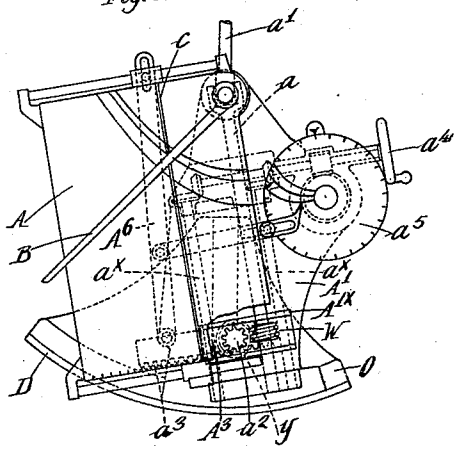
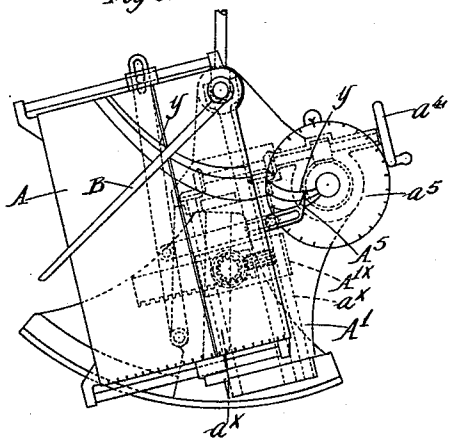


Fig. 6.



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UNITED STATES PATENT OFFICE.

ARTHUR TREVOR DAWSON AND GEORGE THOMAS BUCKHAM, OF WESTMINSTER, LONDON, ENGLAND, ASSIGNORS TO VICKERS LIMITED, OF WESTMINSTER, LONDON, ENGLAND.

INDICATING INSTRUMENT FOR USE IN CONNECTION WITH FUSE-SETTING OPERATIONS.

1,364,039. Specification of Letters Patent. Patented Dec. 28, 1920.

Application filed June 9, 1919. Serial No. 302,957.

To all whom it may concern:

Be it known that we, Sir ARTHUR TREVOR DAWSON, knight, and Sir GEORGE THOMAS BUCKHAM, knight, both subjects of the King of Great Britain, residing at Vickers House, Broadway, Westminster, in the county of London, England, have invented certain new and useful Improvements in Indicating Instruments for Use in Connection with Fuse-Setting Operations, of which the following is a specification.

This invention relates to an indicating instrument for use in connection with fuse setting operations. Anti-aircraft gunsights are usually provided with what is known as vertical deflection gear the purpose of which is to superimpose on the angle of tangent elevation a positive or negative angle corresponding to the angle in a vertical plane through which the target moves in relation to the gun during the time of flight of the projectile from the gun to the target; this superimposed angle (herein termed the vertical deflection angle) may, when small, be considered as a function of the angular speed of the target in a vertical plane containing the axis of the gun, multiplied by the time of flight of the projectile. In setting the shell fuses, methods have been devised which take into consideration the lengh of time occupied in the actual flight of the projectile, together with the target speed. This would be correct if the fuse were adjusted with the projectile in the gun at the instant of firing, or if during the interval of time between the setting of the fuse and the firing of the gun, the target advancing toward or receding from the gun position were to remain stationary and were then, at the instant the gun is fired, to resume its movement. But as the target is moving toward or away from the gun during this interval of time, the fuse setting, in order to obtain a correct burst, will have to be altered by an amount dependent upon the length of this interval of time.

According to the present invention the improved indicating instrument (which may be termed a "fuse predictor") is so constructed and arranged as to give a reading which will indicate the correct fuse setting dependent upon the estimated interval of time occupied in fuse setting and loading. For this purpose the said instrument may comprise a chart of fuse curves, a pointer or the like movable in relation to the chart in accordance with the angle of sight of the target, and a wire or other member movable in relation to the chart in accordance with the height of the target. The point of intersection of the pointer with the wire at any moment will thus indicate the position of the target at that moment, and the point of intersection of the pointer and the wire in relation to the fuse curves will give the correct fuse number if the target is stationary. The said chart and wire can also be moved relatively to the pointer in accordance with the vertical deflection angle so that the point of intersection of the pointer with the wire will thus represent the position of the target after the time of flight of the projectile; and the said chart and wire can furthermore be moved relatively to the pointer in accordance with the aforesaid estimated interval of time, thereby increasing or decreasing the vertical deflection adjustment by the required amount, this amount being represented by the vertical deflection angle divided by the time of flight in seconds and multiplied by the interval of time, measured in seconds, occupied in setting the fuse and loading the projectile into the gun. The point of intersection of the pointer with the wire thus at this time indicates the position of the target after the time of flight of the projectile and also after the aforesaid interval of time occupied in setting the fuse and loading the projectile into the gun. The fuse number indicated on the fuse curves by the said pointer and wire will then give the correct fuse setting necessary at any moment to cause the projectile to burst at the position the target will occupy when the said projectile crosses the path of the target.

In order that the said invention may be clearly understood and readily carried into effect we will describe the same more fully with reference to the accompanying drawings, in which:—

Figure 1 is an elevation of an instrument constructed in accordance with the invention.

Fig. 2 is a section taken approximately on the line 2, 2 of Fig. 1, and

Figs. 3, 4, 5 and 6 are views showing more or less diagrammatically and on a smaller

scale than Fig. 1 different positions hereinafter referred to occupied by the parts of the instrument during its operation.

A is the chart of fuse curves, B the pointer moved in accordance with the angle of sight of the target and C the wire moved in accordance with the height of the target, this wire being herein referred to as the height wire.

In the example shown, the chart is engraved or mounted on a plate A carried by a bracket A′ which is pivoted on a pin A^2 projecting from the gun carriage for example. The pointer B is in the form of a blade pivotally mounted on the bracket A′ by a pin B′ which is arranged co-axially with the pin A^2. The axis of the said pins is intended to represent on the chart the position of the gun and the fuse curves of this chart show the distance from the gun at which each fuse setting will cause the projectile to burst. The height wire C stretches between two connected supports C′, C′ slidably mounted on rods C^2, C^2 carried by the plate A; the lower support has a pointer $C^\times$ movable over height graduations on the bracket A′ and also has a handle portion $C^{\times\times}$ for moving the wire.

The pointer B is connected by a link motion (including an arm *b* and a link *b′*) or other suitable means to the sight, so that as the sight is pointed upon the target, the blade is moved automatically through an angle equal to the angle of sight. The bracket A′ carries a squared spindle *a* connected by a spindle *a′* to the vertical deflection spindle of the sight; the spindle *a* drives by a sliding worm gear, a pinion a^2 meshing with a rack a^3 on a crosshead A^4 slidably mounted in a frame $A'^\times$ on the bracket A′, thereby displacing the crosshead relatively to the bracket A′ by an amount equivalent to the tangent of the vertical deflection angle. The crosshead carries a pivoted block A^3 which engages with a straight vertical slot *d* formed in a bracket D attached to the gun carriage, so that when the spindle *a* is actuated, the bracket A′ carrying the plate A is displaced about its pivot pin A^2 through the vertical deflection angle. The point of intersection of the blade B and the height wire C will now represent the position occupied by the target after an interval of time equal to the time of flight of the projectile. The distance of the pivoted block A^3 from the axis of the pins A^2, B′ is adjusted by a gear comprising two screw-threaded shafts $a^\times$, $a^\times$ engaging with nuts or with screw-threaded holes in the frame $A'^\times$ carrying the sliding cross-head A^4. This gear is actuated by a handwheel a^4 carried by the bracket A′, the movement of this handwheel being recorded upon a dial a^5. Moving the cross head nearer to the said axis increases the angular adjustment of the bracket A′ by an angle equal to the vertical deflection angle divided by the time of flight in seconds and multiplied by *x* where *x* is the aforesaid time taken in fuse setting and loading; the said dial a^5 is graduated with fuse curves arranged to enable the correct movement to be given to the cross-head and a fixed pointer a^6 is provided by which the dial may if desired be set to the time of flight when this is known exactly, the rim or edge of the dial being graduated to represent different times of flight. A number of interchangeable dials graduated with suitable curves to allow for various values of *x*, may be provided and the curves are read against a pointer A^5 which moves across the face of the dial in accordance with the height adjustment, this pointer being operated from the height indicator (*i. e.* the aforesaid height wire C) by a pivoted arm A^6 operated by the upper support C′ or from an instrument receiving height indications. The necessity for the said movement of the pointer A^5 and the provision of the curves on the dial a^5 arises from the fact that although the time *x* is a constant for each gun, it is not used in the instrument as such but as a ratio to the time of flight; and as the latter varies in accordance with the height for a given angle of sight the moving pointer A^5 and the curves on the dial a^5 are provided to allow for a firing value of *x* divided by the time of flight in accordance with the height. After the above mentioned settings have been effected the blade B will consequently indicate upon the height wire C the position of the target after the time of flight of the projectile, and also after the time which elapsed in setting the fuse and loading the gun, so that the fuse number read off at the point of intersection of the blade and the wire will, as aforesaid, give the correct fuse setting required at the moment.

The fuse curves on the chart A are obtained as follows:—The height of target is plotted horizontally against the angle of sight to a suitable scale and this determines a point on one of the curves which has a constant fuse number. The range table for the particular gun gives the fuse number corresponding to the height and the angle of sight. The same fuse number will also determine other heights and angles of sight; consequently a series of points are determined through which a curve can be drawn. The other curves on the chart are determined in a similar manner. The fuse curves on the dial a^5 are also obtained in a similar manner, but with the exception that they have to be plotted in conjunction with the movement of the pointer A^5 which is controlled by the height setting device together with the movement of the crosshead A^3 controlled by the rotation of the dial a^5 through the handwheel a^4.

In using the instrument the height wire

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C is first set to the known height of the target through which operation the upper support C′ displaces the lever A^6 which moves the pointer A^5 across the face of the dial a^5; Fig. 3 shows the position of these parts after the height wire has been adjusted from the position shown by Fig. 1. The pointer B is also moved through an angle equal to the angle of sight by the arm b and the link b', Fig. 4 showing the pointer adjusted to a given angle of sight. The spindle a is also rotated by the vertical deflection gear of the sight and this movement of the spindle causes the bracket A′ carrying the chart plate A to be moved about its pivot pin A^2 through an angle corresponding to the vertical deflection angle as aforesaid; Fig. 5 shows the bracket A′ adjusted to agree with a given angle of vertical deflection. To correct for "lost time" (*i. e.* the time taken to set the fuse, load the gun and fire it) the handle a^4 is turned until the same fuse number is read on the chart A at the intersection of the pointer B and the height wire C as is read at the pointer A^5 against the markings on the dial a^5, the rotation of the said handle operating the screws a^x, a^x to swing the bracket A′ about its axis pin A^2 through a further angle to correct for the aforesaid lost time. Fig. 6 shows this correction as having been effected, the fuse curve y on the chart A corresponding to the fuse curve y on the dial a^5 and this gives the correct predicted fuse setting required at the moment.

What we claim and desire to secure by Letters Patent of the United States is:—

1. An instrument for use in connection with the setting of shell fuses for anti-aircraft guns, comprising in combination a chart of fuse curves, a movable member, means for moving said member in relation to the chart in accordance with the angle of sight of the target, a second movable member, means for moving said second member in relation to the chart in accordance with the height of the target and means for moving the chart and the second mentioned member in relation to the first mentioned member in accordance with the vertical deflection angle and also in accordance with the estimated interval of time occupied in setting the fuse and loading the gun.

2. An instrument for use in connection with the setting of shell fuses for anti-aircraft guns, comprising in combination a pivoted chart of fuse curves, a pointer pivoted to move about the same axis as said pivoted chart and so situated as to swing over the face of the chart, means for angularly moving said pointer over the chart in accordance with the angle of sight of the target, a wire stretched across said chart, means for moving said wire bodily over the chart in accordance with the height of the target and means for swinging the chart and the wire together in relation to the pointer in accordance with the vertical deflection angle and also in accordance with the estimated interval of time occupied in setting the fuse and loading the gun.

3. An instrument for use in connection with the setting of shell fuses for anti-aircraft guns, comprising in combination a pivoted chart of fuse curves, a pointer pivoted to move about the same axis as said pivoted chart and so situated as to swing over the face of the chart, means for angularly moving said pointer over the chart in accordance with the angle of sight of the target, a wire stretched across said chart, means for moving said wire bodily over the chart in accordance with the height of the target, means for swinging the chart and the wire together in relation to the pointer in accordance with the vertical deflection angle and also in accordance with the estimated interval of time occupied in setting the fuse and loading the gun, and a device comprising a pointer adjustable in accordance with the height of the target and a member moved by the last mentioned means and provided with fuse curves, said device determining the amount of movement that should be given to the said last mentioned means.

In testimony whereof we affix our signatures.

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GEORGE THOMAS BUCKHAM.