March 10, 1925. 1,529,172

A. T. DAWSON ET AL

MEANS FOR USE IN THE LAYING OF ORDNANCE

Filed Oct. 31, 1919 2 Sheets-Sheet 1

Fig. 1.

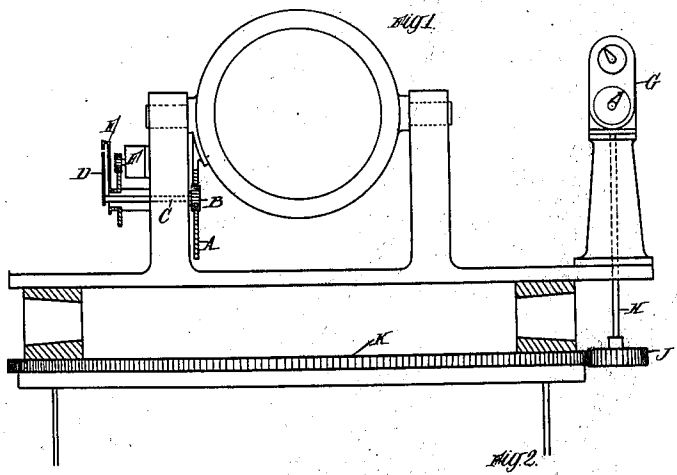


Fig. 3.

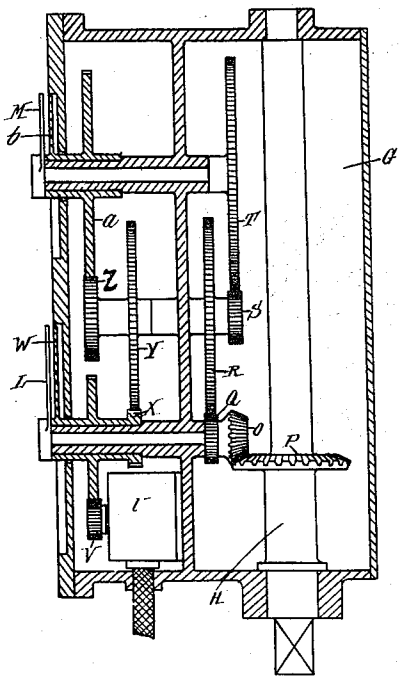
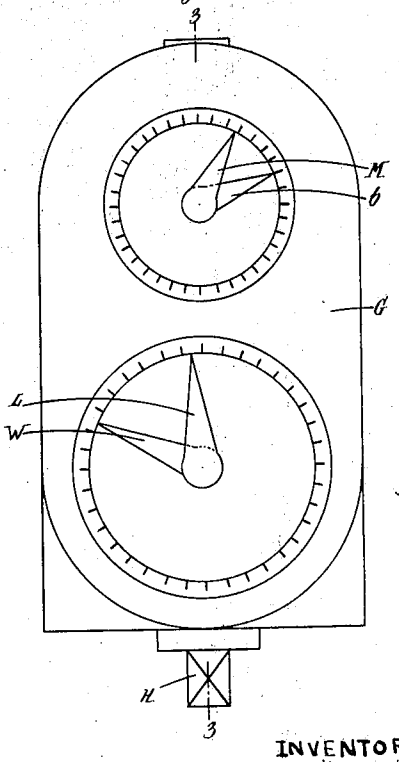


Fig. 2.



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Fig. 4.

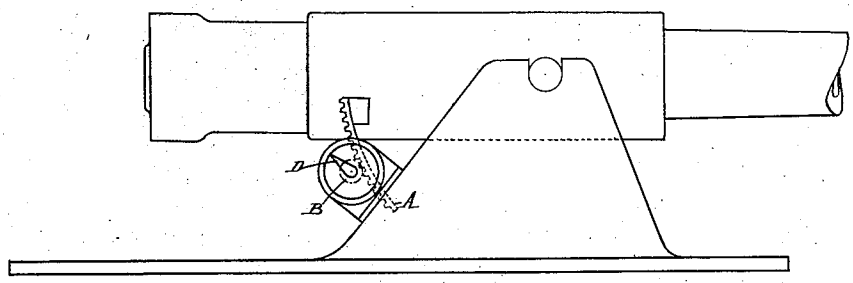


Fig. 3.

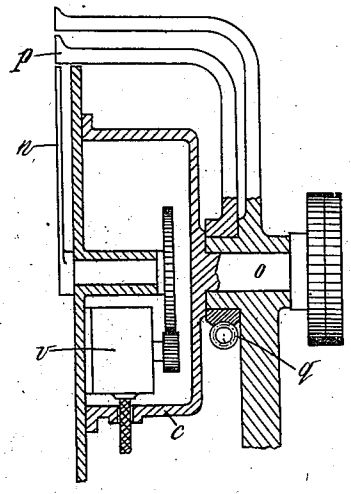


Fig. 7.

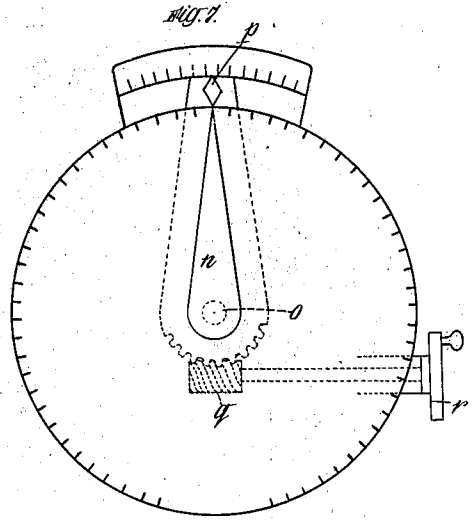


Fig. 6.

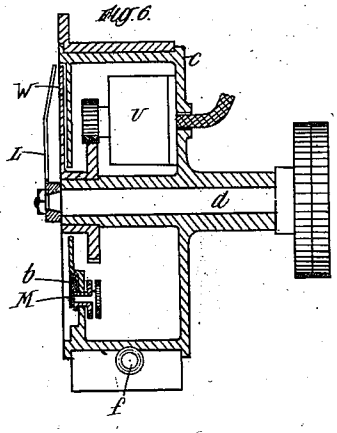
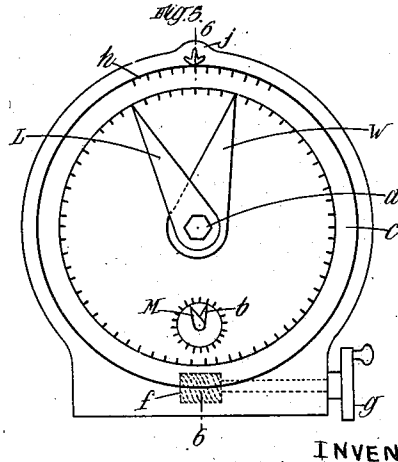


Fig. 5.



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Patented Mar. 10, 1925.

1,529,172

UNITED STATES PATENT OFFICE.

ARTHUR TREVOR DAWSON, GEORGE EDWIN WATT, AND ARTHUR LEONARD PERHAM, OF WESTMINSTER, LONDON, ENGLAND, ASSIGNORS TO VICKERS LIMITED, OF WESTMINSTER, LONDON, ENGLAND.

MEANS FOR USE IN THE LAYING OF ORDNANCE.

Application filed October 31, 1919. Serial No. 334,735.

To all whom it may concern:

Be it known that we, ARTHUR TREVOR DAWSON, GEORGE EDWIN WATT, and ARTHUR LEONARD PERHAM, all 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 or Relating to Means for Use in the Laying of Ordnance, of which the following is a specification.

This invention relates to means for use in the laying of ordnance in elevation or training in accordance with information or indications transmitted from apparatus at a controlling or sighting station situated at a distance from the gun or guns. The object of our invention is to provide means whereby the gun or guns may be quickly, conveniently and accurately laid in conformity with the transmitted indications.

In its simplest form our invention consists in the combination of an indicating pointer actuated from the controlling or sighting station and acting as the receiving member of an order telegraph, with a second or "follower" pointer connected by multiplying gearing to the gun so that angular movements of the latter in elevation or in training as the case may be are reproduced proportionately by the pointer but with a greater angular movement.

The two pointers are arranged so that they rotate about the same axis and the follower pointer is brought into angular coincidence with the indicating pointer by an operator who observes the two pointers (which are distinctively marked) and manipulates the elevating or training gear of the gun. The pointers and the gun elevating or training gear are for this purpose arranged in close proximity to one another. The operator by thus maintaining the pointers in coincidence by elevating or training the gun causes the gun to be laid in conformity with the indications sent from the controlling or sighting station. When a number of guns are controlled in accordance with our invention from a single controlling or sighting station, the difficulty of the work of the gun layers is greatly reduced, their duty being merely that of bringing the pointers into coincidence by elevating or training the guns which is a much simpler operation than that of sighting a telescope upon a distant target especially with an unsteady gun platform such as a ship.

It is convenient to so proportion the multiplying gearing between the gun and the follower pointer that one complete turn of the latter represents an integral number of degrees of gun elevation or training. If this number of degrees should be less than the allowed angular movement of the gun in elevation or training, then the movement of the follower pointer will at times exceed one revolution and it would be possible in this case to unconsciously lay the gun with an error equal to one or more turns of the pointer. To avoid the possibility of such incorrect laying we may provide a further pair of indicating and follower pointers so arranged that one turn represents a number of degrees of angular movement equal to or greater than the maximum movement the gun is capable of performing. For example, when the invention is applied to the training of a gun, the second mentioned pair of pointers would conveniently be arranged to represent 360° of training per revolution, and for the first mentioned pair of pointers 5°, 6° or 10° of training would probably be a suitable value for one revolution of the pointers of this pair. The greater the radius of the pointer and the smaller the degree value of one revolution, the longer is the arc described by the pointer for each degree of angular movement of the gun. It is desirable that this length of arc shall not be too small or the accuracy and facility of the gun laying would be impaired.

To enable corrections in the elevation or training to be applied we may include in our apparatus means for effecting a displacement of one or of each of the pointers relatively to the means by which it is driven or relatively to the other pointer. This relative displacement may effect corrections in the training for the angle of convergence of the gun and the sighting apparatus at the controlling station, corrections in elevation for differences in muzzle velocities of several guns or differences in the height or

for errors in level of any individual gun, or any other correction it may be desired to make.

If it is desired to initially adjust the follower pointer relatively to the gun, this may be effected by displacing the pointer upon the member carrying it, or by displacing any convenient parts of the driving gear; for example a vernier or a frictional type of shaft coupling may be employed for this purpose.

As an alternative to the use of one or more pairs of moving pointers as above described we may, in carrying our invention into effect, employ an instrument in which the receiving apparatus of the order telegraph is carried by a member which is geared mechanically to the gun cradle or turntable so as to rotate proportionately to and through a greater angular distance than the angle of elevation or training of the gun as the case may be, and we may provide a fixed mark or pointer to which the receiver indicating pointer may be set, the apparatus being so disposed that the axis of rotation of the indicating pointer and the axis about which the apparatus itself is rotated are coincident.

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

Figure 1 is a diagrammatic rear elevation of a gun mounting fitted with apparatus constructed according to the invention.

Figures 2 and 3 are respectively a front elevation and a vertical section on the line 3, 3 of Figure 2 shewing diagrammatically a typical construction of indicating instrument with two pairs of pointers for controlling the training.

Figure 4 is a diagrammatic side elevation of a gun mounting fitted with apparatus constructed according to the invention for controlling the elevation.

Figures 5 and 6 are respectively a front elevation and a vertical section on the line 6, 6 of Figure 5 shewing diagrammatically a typical construction of instrument arranged for effecting correction adjustments, and

Figures 7 and 8 are respectively a front elevation and a vertical section shewing the invention applied to another type of instrument.

Referring to Figures 1 and 4, A is a toothed rack segment attached to the cradle in which the gun slides on recoil and B is a pinion which meshes with this rack segment and is carried by a spindle C on which is mounted a follower pointer D for elevation control. Arranged to turn about the same axis as the spindle C is an indicating pointer E (Figure 1) driven by gearing from an electric motor F controlled from the controlling or sighting station. In Figure 1, G shews an indicator for training control, this indicator having one or more indicating pointers as will be hereinafter described, driven from an electric motor controlled from the controlling or sighting station, and one or more follower pointers arranged to be driven by a shaft H and a pinion J from a fixed circular toothed rack K arranged concentrically with the axis about which the gun is trained.

Figures 1 and 4 illustrate the general principle of applying the invention to a gun mounting but it will be obvious that considerable variation is possible in the arrangement of the gearing between the gun cradle or the turntable and the follower pointers. In any form of gearing or shafting particular care must be taken that the backlash between the gun cradle or the turntable and the follower pointers does not exceed the limit of accuracy required in the elevation or training of the gun, and to this end it may be necessary to construct one or more of the toothed wheels on the known principle of dividing the wheel transversely so that the width of the teeth may in effect be increased either manually or by the pressure of a spring acting between the two portions of the divided wheel.

Referring to Figures 2 and 3, L and M are two follower pointers of the indicator G for training control, the first mentioned pointer being driven from the shaft H of Figure 1 by bevel wheels O and P. The second pointer M is driven through smaller angular distances from the pointer L by spur wheels Q, R, S and T. An electric motor U controlled from the controlling or sighting station drives a pointer W arranged contiguous to the pointer L and also, by gearing X, Y, Z and *a* drives a second pointer *b* arranged contiguous to the pointer M. The ratio of the gearing between the pointers is such, as hereinbefore described, that the pointers M and *b* move through much smaller angular distances than the pointers W and L.

Figures 5 and 6 shew a modified arrangement in which the second pair of pointers M, *b* are of much smaller radius than the first pair L, W and are located within the circle described by the latter pair. The casing *c* carrying the motor U that drives the pointers W and *b* and also carrying the two pairs of pointers, is arranged so that it can be rotated about the axis of the spindle *d* that drives the pointer L in accordance with the angles of elevation or training of the gun. Convenient means, such as the worm gearing *f* and the handwheel *g* may be provided for effecting rotational adjustment of the casing *c* and a scale *h* and an arrow *j* may be engraved on the casing and

on a fixed part for indicating the amount of adjustment given. Thus by actuating the handwheel g the pointer W is displaced relatively to the pointer L and the desired correction for convergence etc., hereinbefore referred to, is effected. The gearing connecting the pointers L and W with the pointers M and b is not shewn but is similar in character to that shewn in Figure 3. In Figure 6 the pointer L is shewn connected to its spindle d by a nut and cone which enables the pointer to be adjusted relatively to the spindle in cases where it is desired to make an initial adjustment of the pointer in relation to the gun.

In Figures 7 and 8 the casing c, carrying the motor U controlled from the controlling or sighting station, is rigidly mounted on a spindle o geared to the rack segment A of Figure 4 or the rack K of Figure 1 the pointer n operated by the motor thus receiving a rotation in space that is the difference between the number of turns imparted by the motor U and those imparted by the movement of the spindle o. The gun is laid by maintaining the pointer n in line with a normally stationary arrow or zero mark p. For adjustment purposes this arrow may be altered in angular position by means of the worm gearing q and the handwheel r, a scale being provided for indicating the amount of such adjustment. It will be observed that in this construction the second pair of pointers of Figures 2 and 3 and 5 and 6 is dispensed with. Alternatively to the means described for applying corrections we may introduce a differential gear element in the gearing driving the follower pointer and by an adjustment of the abutment member of the differential gear we may effect a corresponding adjustment in the relative position of the follower pointer and the gun.

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

1. Means for use in the laying of ordnance in elevation or training in accordance with information or indications transmitted from a controlling or sighting station situated at a distance from an ordnance element, comprising the combination of a casing, a shaft journaled in the casing, an indicator carried by the shaft, a motor mounted on the casing and connected to the shaft for turning the shaft and the indicator carried thereby, means for turning the casing, the motor shaft and indicator carried thereby about an axis, and a second indicator co-acting with the first indicator, said second indicator being unaffected by the movement of the casing.

2. Means for use in the laying of ordnance in elevation or training in accordance with information or indications transmitted from a controlling or sighting station situated at a distance from an ordnance element, comprising a casing, a shaft mounted in the casing, an indicator carried by the shaft, means for turning the casing, the shaft and the indicator about the axis of the shaft, a second shaft mounted in the casing and unaffected by movement of the casing about the axis of the first shaft, an indicator carried by the second shaft and coacting with the first named indicator, means for actuating one of said shafts from the controlling station and means for actuating the other shaft from the ordnance element.

3. Means for use in the laying of ordnance in elevation or training in accordance with information or indications transmitted from a controlling or sighting station situated at a distance from the gun or guns, comprising in combination an indicating member actuated from the said controlling or sighting station distant from the gun, a second or follower member, means for actuating said second member by the elevating or training of the gun, through a greater angular distance than that of the gun, the gun being correctly elevated or trained when the follower member has been brought into agreement with the indicating member, and means for effecting relative adjustment between said members for giving any desired correction.

4. Means for use in the laying of ordnance in elevation or training in accordance with information or indications transmitted from a controlling or sighting station situated at a distance from an ordnance element, a casing provided with a bearing member, a shaft mounted on the bearing member, an indicator carried by the shaft, a second shaft mounted in the bearing member, an indicator carried by the second shaft, a motor mounted on the casing and connected to one of the shafts for turning it and the indicator carried thereby, means for connecting the other shaft to the ordnance element so that the shaft will be turned when the element is moved and means for turning the casing with the bearing member and the shaft mounted thereon about the axis of said shafts for effecting a displacement of one of the indicators relatively to the other, said other shaft being unaffected by the turning of the casing.

5. Means for use in the laying of ordnance in elevation or training in accordance with information or indications transmitted from a controlling or sighting station situated at a distance from an ordnance element, a casing provided with a bearing member, a shaft mounted on the bearing member, an indicator carried by the shaft, a motor mounted on the casing and connected to the shaft for turning it and the indicator carried thereby, a second shaft mounted in the bearing member, an indicator carried by the second shaft, means for connecting the

second shaft to the ordnance element so that the shaft will be turned when the element is moved, and means for turning the casing with the bearing member, the shaft mounted thereon and the motor about the axis of said shafts for effecting a displacement of one of the indicators relatively to the other, said second shaft being unaffected by the turning of the casing.

In testimony whereof we affix our signatures.

ARTHUR TREVOR DAWSON.
GEORGE EDWIN WATT.
ARTHUR LEONARD PERHAM.