

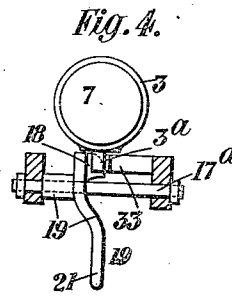
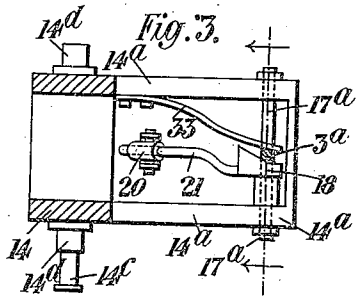
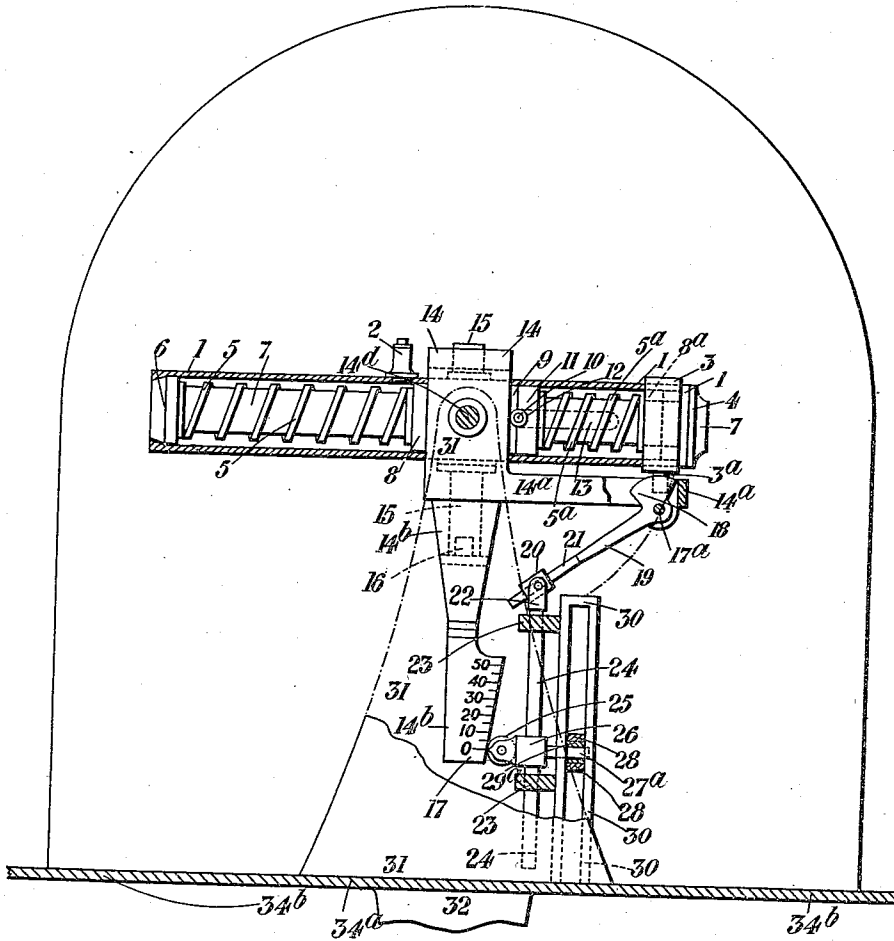
No. 801,746.

PATENTED OCT. 10, 1905.

L. K. SCOTT.
RANGE FINDING GUN.
APPLICATION FILED AUG. 29, 1903.

6 SHEETS—SHEET 1.

Fig. 1.



Witnesses
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J. J. McCarthy.

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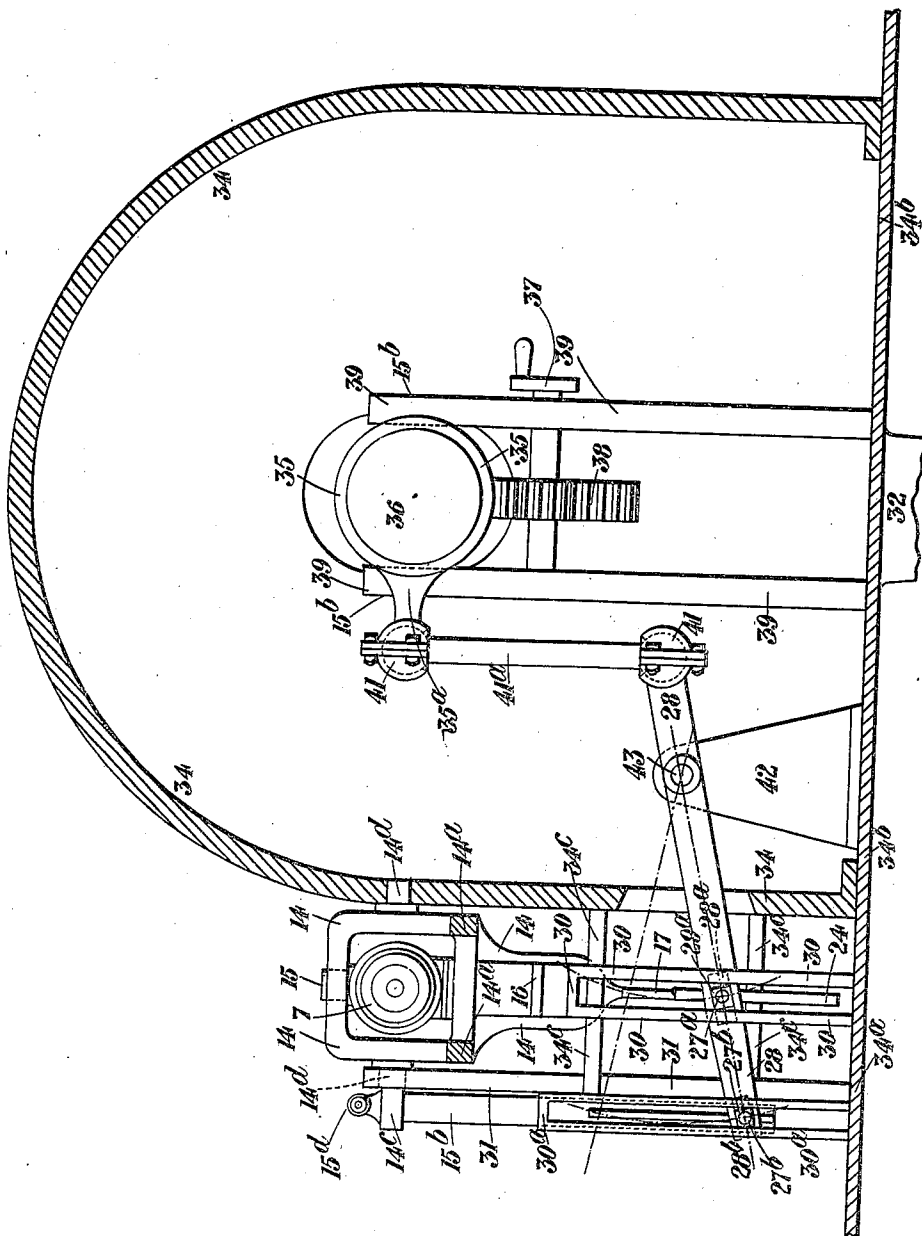
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6 SHEETS—SHEET 2.

Fig. 2.



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5 SHEETS—SHEET 4.

Fig. 7.

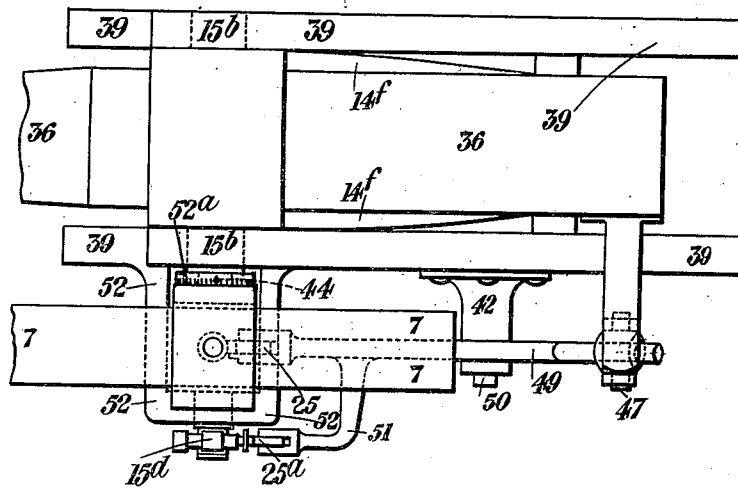
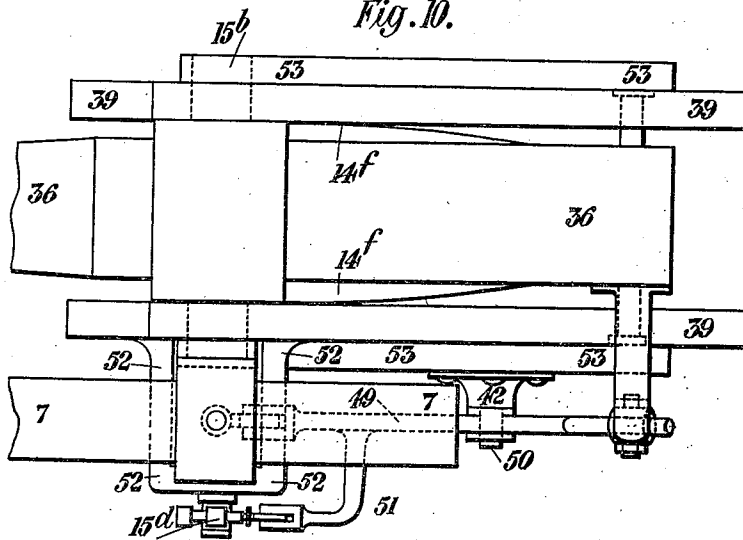


Fig. 10.



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5 SHEETS—SHEET 5.

Fig. 9.

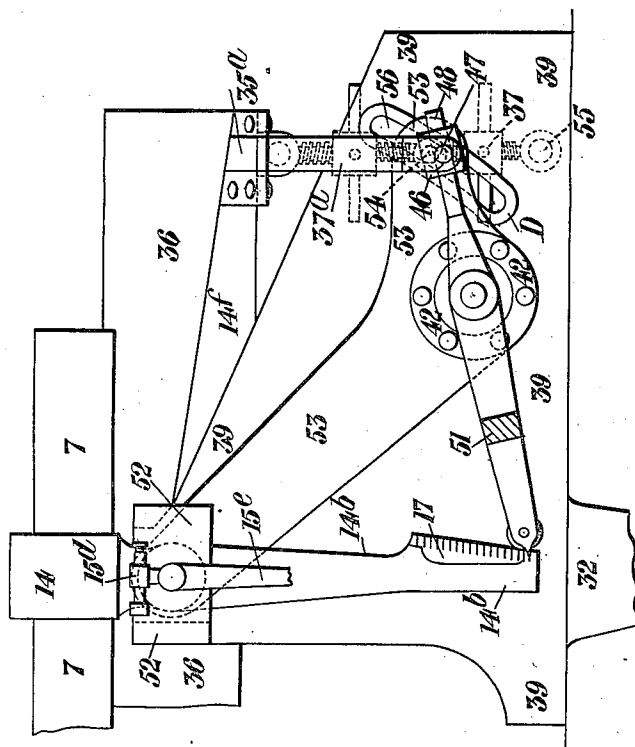
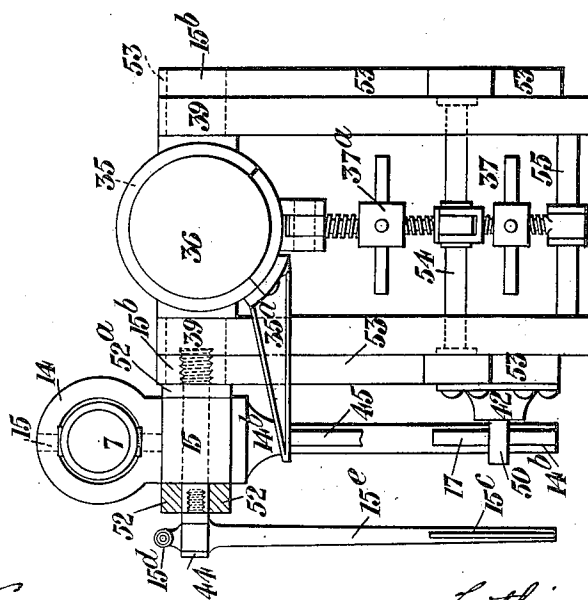


Fig. 8.



Witnesses
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UNITED STATES PATENT OFFICE.

LOTHIAN KERR SCOTT, OF FARNBOROUGH, ENGLAND.

RANGE-FINDING GUN.

No. 801,746.

Specification of Letters Patent.

Patented Oct. 10, 1905.

Application filed August 29, 1903. Serial No. 171,296.

To all whom it may concern:

Be it known that I, LOTHIAN KERR SCOTT, C. B., late lieutenant-colonel Royal Engineers, a subject of the King of Great Britain, residing at Forest Lodge, Farnborough, in the county of Hants, England, have invented certain new and useful Improvements in Range-Finding Guns, of which the following is a specification.

My invention consists in the mechanical combination of a plurality of ballistically-dissimilar guns in such manner that when either gun is laid on the target the two guns if fired simultaneously or independently will range alike, or, in other words, their shots will have a common point of impact. One of these guns, which may be called the "range-finding gun," is preferably smaller than a gun, which may be called the "main" or "great" gun, with which the range-finding gun is combined, as before described. Means for adapting the range-finding gun to coast or naval guns may be varied in numerous details and is shown in the accompanying drawings in different modifications, which are described in the following specification.

It is thought that the following description will be rendered clearer if the meanings of some of the terms therein are first explained.

In the following description the "angle of assimilation" refers to the angular difference between the angles of elevation of two guns when ranging alike.

By the phrase "assimilating said guns" is meant assimilating the shooting of said guns—that is, assimilating said guns as regards the ranging and direction of their shots, whether the guns which fire them be laid with the same angles of elevation for the range and with the same angles of deflection for the direction or not.

The "angle of elevation" is the angle which the line of sight makes with the axis of the gun.

The "range-finder range" is the theoretical range found by a range-finder.

The "gun-range" is the actual range given by the sight when the shot strikes the target, which for various and obvious reasons will not always correspond with the range-finder range.

Two guns are said to be "ballistically dissimilar" when they do not shoot alike when laid with the same angles of elevation and deflection.

A gun is considered as being "laid on a target" when the line of sight of the sighting apparatus passes through the point aimed at, whether the line of sight be on the target or off it. For instance, if the wind is blowing across the range from the right the shot would be deflected to the left and the line of sight which commands the axis of the gun would have to be either directed to the right of the target, in order to counteract the force of the wind, or the line of sight would have to be mechanically deflected to the left of the axis of the gun and then laid on the target, which would have the same effect as laying a line of sight which is parallel to the axis of the gun to a point to the right of the target.

By the term "elevation" it is intended to express displacement of the breech in a vertical plane, whether such displacement is in an upward or in a downward direction, except where it is used in conjunction with the word "depression," when it is limited to its narrower sense, in which it signifies an upward displacement of the breech.

One object of my invention is to find the gun-range for the great gun by the range-finding gun.

It is a further object of the invention to apply the gun-range automatically to the axis of the great gun simultaneously with the finding of the range by the range-finding gun.

It is a further object of the invention to reduce the expense of ammunition for target practice, and thereby render a much larger quantity of ammunition available for that purpose.

It is a further object of the invention to prolong the life of the great gun. In peace-time the great gun need never be fired except to test its accuracy and working, so that its life (which is only about two hundred rounds) will not be necessarily spent in target practice. In war-time the great gun need only be fired when the range of the target has been accurately found for it by the range-finding gun.

As the laying of the range-finding gun may be done by means of the elevating and traversing gear of the great gun, (which may be common to both guns,) the gunners when firing the range-finding gun will invariably have the very important and necessary advantage of practicing in the use and in the manipulation of the machinery of the great gun.

Referring to the drawings, Figure 1 is a side

view, partly in section and partly in elevation, of the ranging-gun adapted for coast-gun use resting on a standard fixed to the turn-table of a turret, but outside of the turret. The recoil arrangement for the gun is shown and also the cam-curves for automatically assimilating in range and direction the shooting of the ranging-gun with that of the heavy gun. Fig. 2 is an end view of the same, showing the ranging-gun, the automatic sight graduated for the range of the big gun outside the turret and connected by levers to the big gun. Fig. 3 is a plan of the cam-curve arrangement for deflecting the gun horizontally. Fig. 4 is an end view of the same. Fig. 5 is an end view of the big gun and of the ranging-gun and of the automatic sight, working in combination on the produced trunnion of the big gun and adapted for coast-gun use. Fig. 6 is a side view of the same, showing the graduated and assimilating cam-curve of the ranging-gun, the roller, the lever carrying the roller and its connection with the big gun, and the standard fixed to the cheek of the gun-carriage. Fig. 7 is a plan of Fig. 6, showing the big coast-gun with the ranging-gun and the autosight strung on the produced trunnion of the big gun, the lever with two rollers for actuating, by means of their respective cam-curves, the ranging-gun and the autosight when the elevating-gear of the big gun is operated. Fig. 8 is an end view of the elevation of the combination of a big gun, a range-finding gun, an automatic sight, and duplex elevating-gear adapted for use with naval guns. Fig. 9 is a side view of the same. Fig. 10 is a plan of the same.

Referring to Fig. 2, 34 is a turret pivoted at 32. 36 is a gun inside 34, resting in its carriage 39 and supplied with one elevating-gear 37. 35 is a collar fixed to the gun 36 and having a projection 35^a, which is connected with the short end of the lever 28 by an arm 41^a with ball-and-socket joints.

The lever 28 is pivoted to a standard 42, which is a fixture to the turn-table 34^b of the turret 34.

The lever 28 is connected by the square nuts sliding in grooves cut in the lever 28 or in any other suitable manner to the pivots 27^a and 27^b of two rollers acting, respectively, on the cam-curve 17 of the ranging-gun 7 and on the cam-curve 27 of the autosight 15^d. The roller of the cam-curve 17 is fitted to a rod 24, which by the action of the elevating-gear 37 moves up and down in the projections 23 of the frame 30, which is a fixture to 34^b, produced to 34^a. The roller of the cam-curve of the autosight is in this case a similar fitting to the above.

When the gun 36 is depressed by the elevating-gear 37, the lever 28 will be raised and carry simultaneously along with it the roller 25 of the cam-curve of the ranging-gun and

the roller of the cam-curve of the autosight along their respective cam-curves, and thus automatically impart a movement to both the ranging-gun and autosight according to the curvature given to these cam-curves for assimilating the shooting of the ranging-gun with that of the heavy gun 36.

Referring to Figs. 1 and 2, 25 is a roller actuated, as explained, by the lever 28, which is actuated by the elevating-gear of the gun 37 or its equivalent.

17 is a cam-curve fitted to the depending arm 14^b of the crate 14, carrying the ranging-gun 7. The crate 14 has its trunnions 14^d resting horizontally in a frame or standard 31, fixed to a turn-table 34^b, produced to 34^a.

A jacket or tube 1, incasing the ranging-gun 7, with suitable recoil arrangements (to be described hereinafter) and having vertical trunnions 15, is pivoted vertically in the crate 14. The jacket or tube 1 is pivoted vertically in its crate to enable it to be deflected horizontally for the purpose of assimilating in direction the shooting of the ranging-gun 7 to that of the big gun 36.

The crate 14 is suspended with its trunnions 14^d horizontal to the standard 31 in order that the shooting of the ranging-gun 7 may be assimilated in range to that of the gun 36 by being oscillated by the action of the roller along the cam-curve in a vertical plane parallel to the vertical plane passing through the axis of gun 36.

To prevent the shock of discharge from injuring the cam-curve mechanism, the ranging-gun 7 is provided with suitable recoil arrangements, which may be as follows:

Referring to Fig. 1, the gun 7 is adapted to slide longitudinally in a sleeve or jacket 1. The gun is provided with two small trunnions 10, fitted with rollers 12. These rollers on the recoil of the gun from being fired run in guides cut for their reception in the sides of the jacket 1. The recoil of the gun is taken by two separate springs 5 and 5^a, wrapped round the outside of the barrel of the gun. These two springs offer resistance to the recoil simultaneously along the axis of the gun, and they respectively bear at one end against a collar 6, fixed to the gun, and against a loose collar 11 round the gun, and at the other end, respectively, against a loose collar 8 round the gun, but of the same diameter as the internal diameter of the jacket 1, and similar collar 8^a, (shown dotted,) which is, however, a fixture to the metal of the jacket to prevent the spring from coming out of the jacket 1 at the breech end.

To get the gun into the jacket 1, with the springs 5 and 5^a and the collars 8, 11, and 8^a in place, the collar 8^a is slipped first over the gun, then the breech-end spiral spring 5^a, and then the collar 11. The collar 8 and the other spring 5 are placed inside and in front of the

vertical trunnions 15 of the jacket 1. The gun is slipped through collar 8 and spring 5, and finally the collar 6 is screwed onto the muzzle of the gun to close one end of the jacket, and another collar 8^a is fitted and fixed to the metal inside the breech end of the jacket for the purpose of keeping the spring mechanism within the jacket.

When the gun is fired, the recoil arrangement acts in the following manner: The fixed collar 6 and the loose collar 11, which moves with the gun, compress the two springs 5 and 5^a, and the valve 2 in front of the trunnions 15, opening outward, lets the air escape quickly out of the jacket. To break the shock when the gun springs back to the firing position, the valve 2, supplied with small holes, closes and admits the air gradually into the jacket 7.

The shooting of the ranging-gun 7 is assimilated in range to the shooting of the heavy gun 36 by the movement of the roller 25 along the cam-curve 17. The roller 25 is moved along the cam-curve 17 by operating the gear 37, and the curvature of the cam is such that the gun 7 will automatically receive the proper angles of elevation to make its shot when fired range the same as that from the big gun 36.

The shooting of the ranging-gun 7 is assimilated automatically to the shooting of the gun 36 in direction by the rotary movement of the cam-curve 18 against the pin 3^a of the collar 3, fixed to the jacket 1, which gives a horizontal deflection to the gun 7. This deflection can be given automatically by connecting the lever 21, carrying the cam-curve 18, with the rod carrying the roller 25, worked by the elevating-gear 37 through the lever 28. The cam-curve 18, fixed to one end of the lever 21, is pivoted to the bar 17^a, Fig. 3, of the extension 14^a of the crate 14 and at the other end passes through a swivel 20, connected with the rod 24, carrying the roller 25. The pin 3^a of the gun 7 is kept in contact with the cam-curve by the flat or other suitable spring 33, attached to 14^a, or by a spiral spring encircling the bar 17^a.

Fig. 5 shows another way of mechanically combining the ranging-gun 7 with the heavy gun 36 for the purpose of assimilating their shooting for coast-guns.

Referring to Fig. 5, the trunnion 15^b of the gun 36 or its crate is extended to 44. The crate 14, carrying the ranging-gun 7 and the sight 15^d, is suspended on 44 in such a way that they may be free to oscillate, and the extension 44 of the trunnion 15^b is supported by the bracket 52, fixed to the cheek 39 of the carriage of the big gun 36. The automatic sight 15^d and the gun 7 are set in motion by two separate rollers working on the same lever 49, which is pivoted at 50 to the stand-

ard 42, which is fixed to the cheek of the carriage 39. The lever 49 is connected with the gun 36 by the arm 45, which is a fixture to the gun.

It will be seen by the drawings that if the gun be depressed the lever 49 will be set in motion, and the two rollers in contact with the cam-curves 17 of the crate 14 and 15^c of the autosight 15^d will travel along these curves, and if their curvatures are correct the desired movement will be imparted to the gun 7 and sight 15^d for assimilating the ranging of the two guns 7 and 36 and for making the corresponding lines of sight intersect the points of impact of their shots.

Fig. 9 shows a method for assimilating the shooting of a ranging-gun 7 with a naval gun 36. It only differs from the method for coast-guns in that a duplex elevating-gear must be provided and that the standard 42, carrying the lever pivoted to the cheek of the carriage, must be fixed to the movable arm 53 of the duplex elevating-gear, as 37 and 37^a, (shown in Fig. 8,) instead of to the cheek of the carriage 39, Fig. 6, where 53 represents two loose arms pivoted round the produced trunnions 39 of 36 and connected together by the bolt 54, which carries the elevating-gear 37^a.

The ranging-gun 7 having been mechanically combined with the big gun 36 in the manner shown in Figs. 1, 2, 5, and 6 for coast-guns and in Figs. 8 and 9 for naval guns, the elevation and deflection curves for assimilating its shooting with that of the big gun 36 are shaped in the following manner:

For coast-guns on an elevation above the sea.—First, depress by the elevating-gear 37, common to both guns, the gun 36 for its shot to strike the water-line or any other point of the target—say at a range of five hundred yards; second, the gun 7, which by its preponderance ought to have its cam-curve 17 in contact with the roller 25, should now have sufficient elevation for its shot to hit the same point of the target as that from gun 36; third, if it has not file away the metal of the cam-curve until the axis of 7 has been correctly adjusted in elevation in order to give the same range as 36 and mark this position of the roller 25 on the curve 17 as zero elevation; fourth, if the direction is not correct file away the metal of cam-curve 18, Fig. 1, until gun 7 has been sufficiently deflected horizontally to make its shot strike the same point of the target as that of 36 and mark this deflection on the cam-curve 18 pressing against the pin 3^a as the zero deflection of the scale; fifth, treat the curve of the autosight 15^d in a similar manner by filing to make its line of sight intersect the point of impact common to both guns and mark this point on the curve as the zero elevation of the line of sight 15^d; sixth, proceed in a similar man-

ner for each one-hundred-yards range up to five thousand yards until the curve 17 of the ranging-gun and the curve of the autosight 15^d have both been cut and graduated, so that the shooting of gun 7 will have been assimilated to the shooting of gun 36 in range and direction.

The above arrangement would answer for naval guns as well if it would suffice to trust to the roll or pitch of the vessel for bringing the line of sight automatically without the intervention of an elevating-gear onto the target; but this is not practical, and consequently to apply the automatic assimilation of the shooting of one gun with another for naval purposes it is necessary to make the arrangement shown in Figs. 8 and 9. The procedure is as follows: First, level the gun 36 by a clinometer; second, by clinometer give the axis of the suspended ranging-gun 7 the elevation to make it range the same as gun 36 when level; third, fix this position of the roller on the cam-curve 17 as the zero elevation, as described above; fourth, give the axis of 7 the deflection to make its shot intersect the point of impact of the shot of 36 and mark this on the curve 18 as zero deflection; fifth, treat the cam-curve of the autosight 15^d in the same manner when the line of sight of the sight is level, and thereby fix the zero elevation on the curve by a mark and secure this mark by the bubble of a level attached; sixth, to complete the curvature of the cam-curves for gun 7 and sight 15^d proceed as already described for coast-guns.

To use the range-finding gun 7 as a range-finder to the gun 36 in real action—

I. *For coast-guns.*—(a) Both guns being loaded, lay the autosight 15^d (set for tide and errors of the day) on the target by elevating-gear 37. (b) As soon as the target has been "bracketed" or struck fire the big gun.

II. *For naval guns.*—(a) Both guns being loaded, turn the elevating-gear 37^a (which works the rollers along the curves of gun 7 and autosight simultaneously) until the rollers 25 and 25^a, Fig. 7, are set to the supposed range, which is graduated on their cam-curves. (b) Lay the autosight 15^d on the target by supplementary elevating-gear 37, Fig. 8, being careful during the operation not to disturb the elevating-screw 37^a, and fire. If the shot does not strike the target, alter the angle of elevation of the guns again by 37^a and lay with 37, and so on, till the range has been found for gun 36.

What I claim, and desire to secure by Letters Patent, is—

1. The combination with a plurality of ballistically-dissimilar guns, of means for assimilating said guns whereby the shots of both will strike the same point, substantially as described.

2. The combination with a plurality of ballistically-dissimilar guns, of means whereby the laying of one of said guns upon a certain point operates automatically to lay another of said guns on said point, substantially as described.

3. The combination with a plurality of ballistically-dissimilar guns, of means whereby the laying of one of said guns upon a certain point operates automatically to lay another of said guns on said point, a sighting device, and means whereby the line of sight of said sighting device is automatically caused to pass through said point, substantially as described.

4. The combination with a plurality of ballistically-dissimilar guns, of elevating means for certain of said guns, and means whereby the elevation of certain of said guns operates automatically to correct the direction of other of said guns, substantially as described.

5. The combination with a plurality of ballistically-dissimilar guns, of elevating mechanism for certain of said guns, and means whereby the elevation of certain of said guns operates automatically to correct the elevation of other of said guns, substantially as described.

6. The combination with a plurality of ballistically-dissimilar guns, of elevating means for certain of said guns, and means whereby the elevation of certain of said guns operates automatically to correct the elevation and direction of other of said guns, substantially as described.

7. The combination with a heavy gun, of a ranging-gun, elevating means for the heavy gun, and means whereby the elevation and depression of the heavy gun operates automatically to correspondingly correct the elevation and direction of the ranging-gun, so that if both guns were fired simultaneously both shots would strike the same point, substantially as described.

8. The combination with a heavy gun, of a ranging-gun, a sighting device, elevating means for the heavy gun, means whereby the elevation and depression of the heavy gun operates automatically to correspondingly correct the elevation and direction of the ranging-gun, so that if both guns were fired simultaneously both shots would strike the same point, and means whereby the elevation and depression of the heavy gun operates automatically to lay said sighting device so that its line of sight passes through said point, substantially as described.

9. The combination with a plurality of ballistically-dissimilar guns, of means for ascertaining the range for one of said guns and means for automatically applying the range found to another of said guns, substantially as described.

10. The combination with a large gun, of a ballistically-dissimilar range-finding gun therefor, means for ascertaining the range for said

range-finding gun and means for automatically applying the range found to said large gun, substantially as described.

11. The combination with a plurality of ballistically-dissimilar guns, of gearing common to said guns and means whereby said gearing operates to lay said guns on a given point, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

LOTHIAN KERR SCOTT.

Witnesses:

THERÈSE GAUBERT,
ISABELLA SMITH.