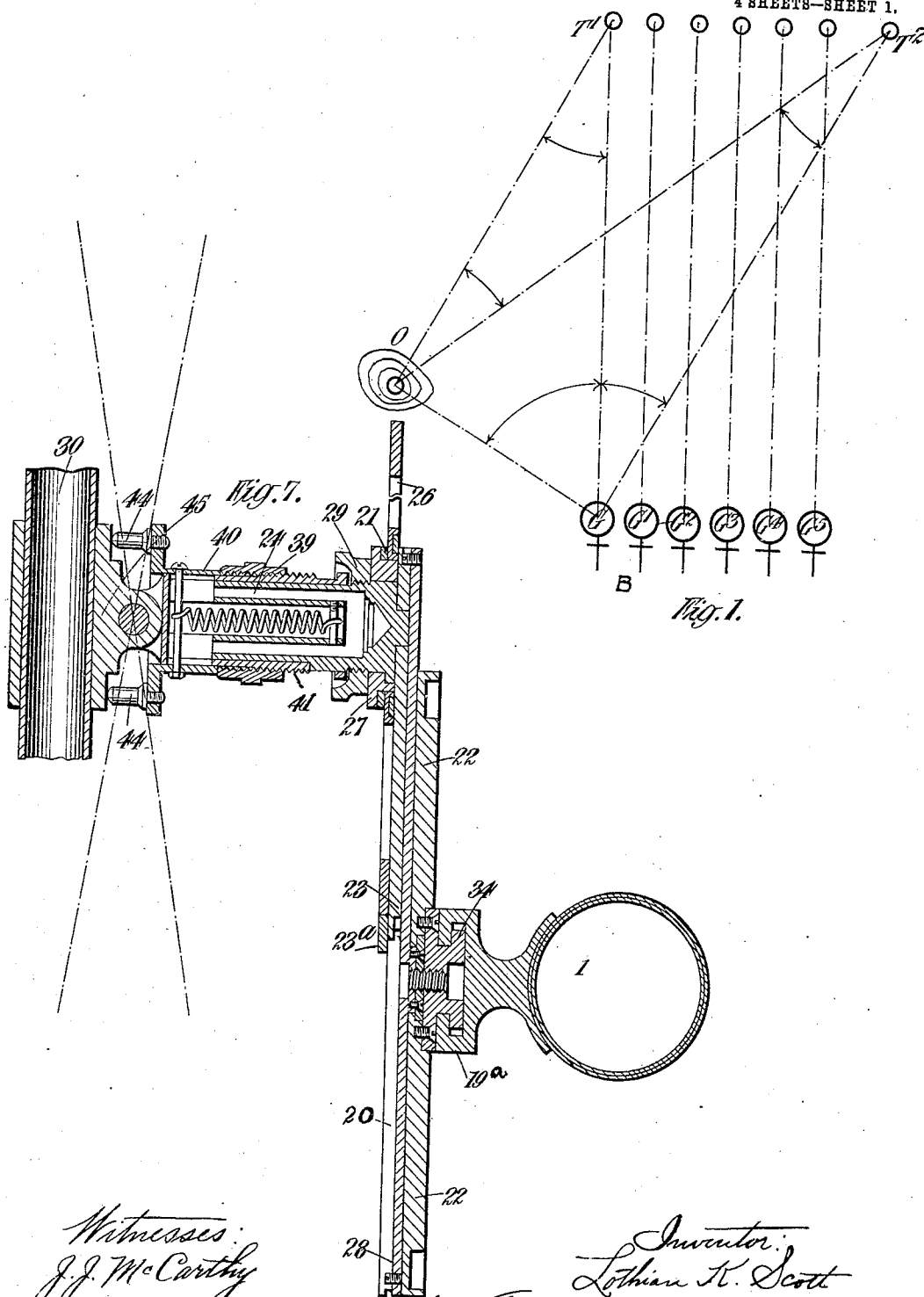


L. K. SCOTT.
 APPARATUS FOR LAYING GUNS FROM BEHIND COVER ON TARGETS.
 APPLICATION FILED MAY 16, 1908.

934,223.

Patented Sept. 14, 1909.

4 SHEETS—SHEET 1.



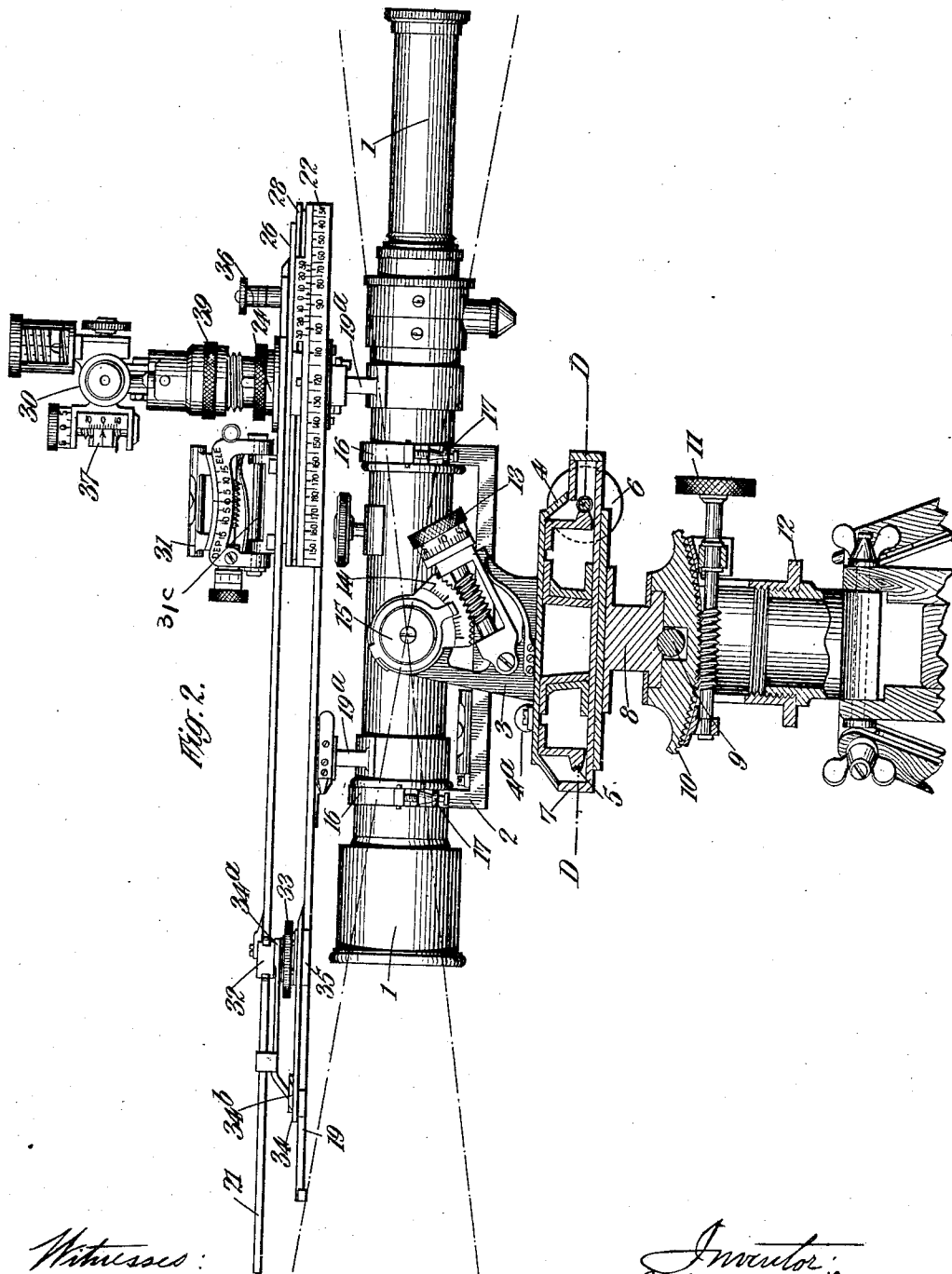
Witnesses:
 J. J. McCarthy
 B. C. Rust

Inventor:
 Lothian K. Scott
 by Peter Herman Watson, Esq.
 Attorney

L. K. SCOTT.
 APPARATUS FOR LAYING GUNS FROM BEHIND COVER ON TARGETS.
 APPLICATION FILED MAY 16, 1908.

934,223.

Patented Sept. 14, 1909.
 4 SHEETS—SHEET 2.



Witnesses:
 J. J. McCarthy
 B. C. Rust

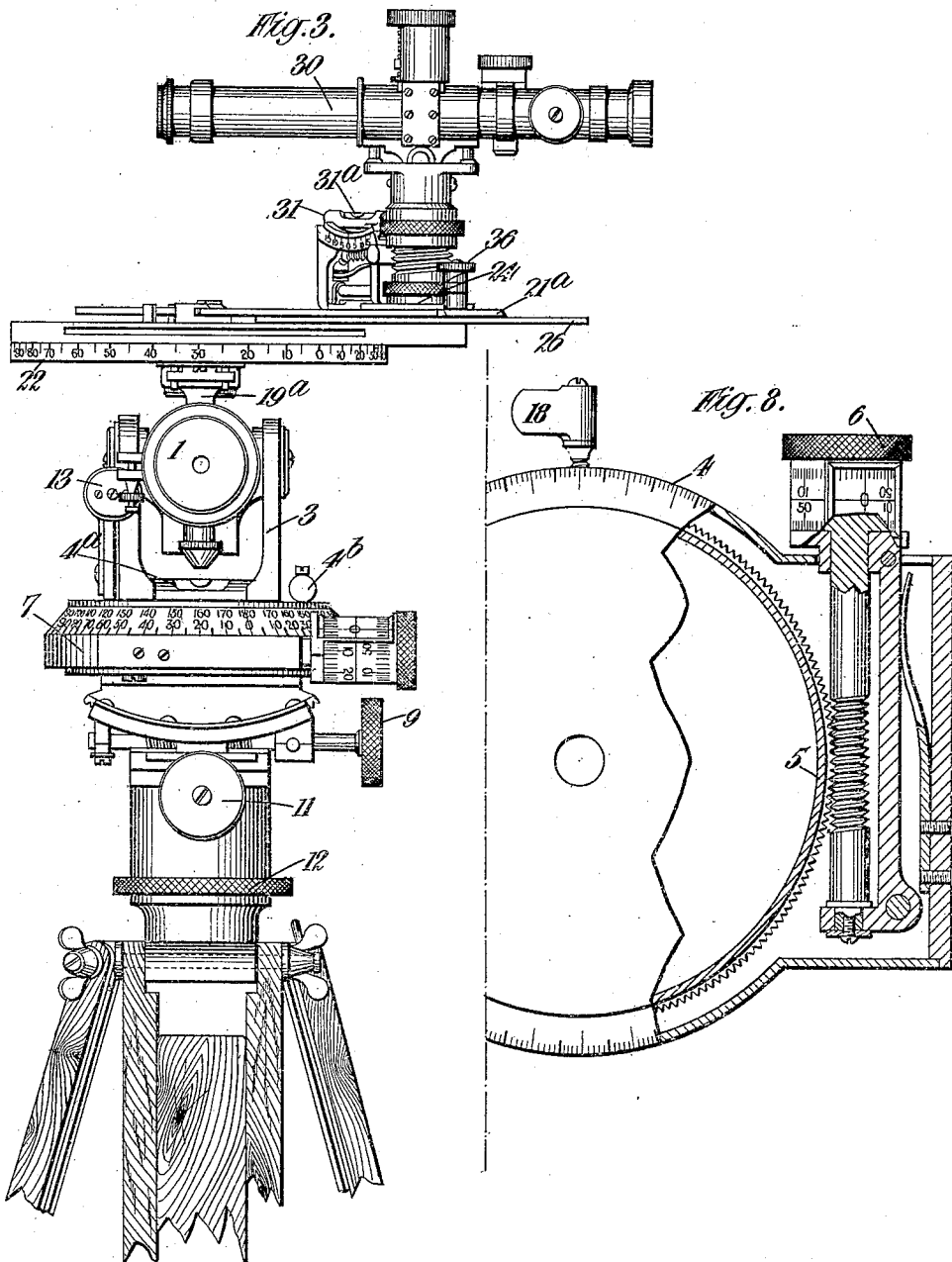
Inventor:
 Lillian K. Scott
 by Foster Truman Watson & Co.
 Attorneys.

L. K. SCOTT.
 APPARATUS FOR LAYING GUNS FROM BEHIND COVER ON TARGETS.
 APPLICATION FILED MAY 16, 1908.

934,223.

Patented Sept. 14, 1909.

4 SHEETS—SHEET 3.



Witnesses:
J. J. McCarthy
B. C. Rust

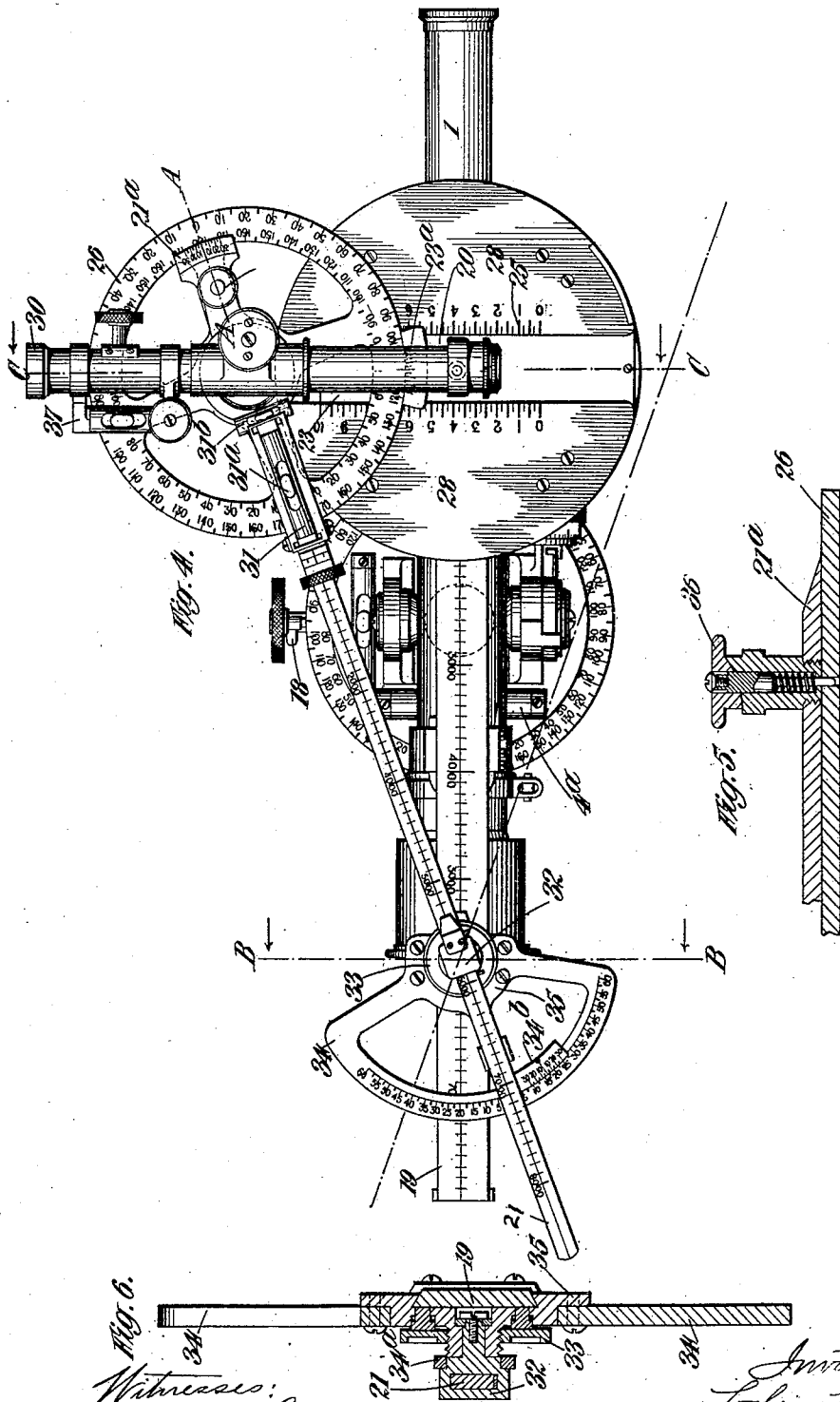
Inventor:
Lothian K. Scott
 by *Foster Freeman Watson & Co.*
Attorneys.

L. K. SCOTT.
 APPARATUS FOR LAYING GUNS FROM BEHIND COVER ON TARGETS.
 APPLICATION FILED MAY 16, 1908.

934,223.

Patented Sept. 14, 1909.

4 SHEETS—SHEET 4.



Witnesses:
J. J. McCarthy
B. C. Rust

Inventor:
Lillian K. Scott
 by *Foster Freeman Watson & Co.*
Attorneys

UNITED STATES PATENT OFFICE.

LOTHIAN KERR SCOTT, OF FARNBOROUGH, ENGLAND.

APPARATUS FOR LAYING GUNS FROM BEHIND COVER ON TARGETS.

934,223.

Specification of Letters Patent. Patented Sept. 14, 1909.

Application filed May 16, 1908. Serial No. 433,290.

To all whom it may concern:

Be it known that I, **LOTHIAN KERR SCOTT**, C. B., 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 the Apparatus Required for Laying Guns from Behind Cover on Targets Which are Not Visible from the Sights of These Guns, of which the following is a specification.

With the imperfect apparatus now in use all sorts of mental calculations are required to enable a gun to be "layed" with anything like accuracy on an invisible target. These calculations (a) require time and special technical and mathematical knowledge and training to make them, (b) delay the opening of rapid and accurate fire from the battery which is of paramount importance, (c) create a waste of most precious ammunition in trial shots, and finally (d) if made during the heat of action, would most probably prove incorrect and useless.

In my improved apparatus, I dispense with all mentally calculated corrections, and I substitute therefor corrections measured automatically by the mechanical adjustment of my "observing instrument" hereinafter described, the working of which is so simple, that anyone of ordinary intelligence can use it, and while acting as observer to the battery, and at a distance from it, can supply, without any previous mathematical or technical knowledge, to the battery commander all the technical data required for enabling him to direct the fire of his battery on to any target within range of his guns which is only seen by the "observer" and not seen by the layers of his guns.

The following are the definitions of the following technical terms used in this specification. 1. The "angle of sight" is the vertical angle given to the axis of the gun when the axis of the gun is directed on a target above or below the horizon. 2. The "battery angle" $O G T^1$ is the angle which has to be given to the sight of one gun of the battery to enable the axis of that gun to be directed on the target T^1 which is laid on and only seen by the telescope of the observing instrument at a distance from the battery. 3. The "battery concentration angle" is the angle which has to be given to the battery commander to enable him to concentrate

or to distribute the fire of his guns on to the target.

In order that my invention may be clearly understood, I will now proceed to describe the same, with reference, by way of example to the accompanying drawings.

Figure 1 shows a diagram in plan of the theoretical principles which have to be worked out mechanically by my observing instrument for regulating the fire of batteries behind cover and out of the enemy's view. Fig. 2 is a side elevation, partly in section, of one form of my observing instrument, constructed according to my invention and set to form and to measure to scale the triangle $O G T^1$ Fig. 1 on the ground. Fig. 3 is the front view of the same. Fig. 4 is a plan of the same showing the mechanical measurement to scale of the triangle $O G T^1$ Fig. 1 on the ground. Fig. 5 is an enlarged section along the line A—A. Fig. 6 is an enlarged section along the line B B. Fig. 7 is an enlarged section along the line C C. Fig. 8 is a fragmentary sectional plan along the line D D of the rotary regulating device.

Like characters of reference indicate similar parts throughout the drawings.

Referring to the diagram Fig. 1, B is a battery of six guns lettered G to G⁵ behind a hill and out of the view of the enemy. O is an observer, with my observing instrument on a tripod at a distance from the battery, who can see both the target and the flank gun G of the battery. T^1 is the target which can be seen by O but which cannot be seen by B.

Referring to Fig. 2 1 is a telescope resting in a carriage 2 pivoted to supports 3 forming part of the upper circular plate 4 which has an internal circular rack 5 the teeth of which are geared to the screw 6 which works in the metal of the lower circular plate 7 which has one leveling arc 8, the teeth of which engage the worm of the screw 9, and another cross-leveling arc 10, the teeth of which engage the worm of the screw 11. Leveling screw 9 works in the metal of the leveling arc 10 and leveling screw 11 works in the metal of the base of the instrument 12 which is screwed to the head of the tripod 13. The screws 9 and 11 are for leveling the upper and lower circular plates 4 and 7 by two levels on the upper plate at right angles to each other.

The screw 6 turns the upper circle 4 and clamps it. For giving the circle 4 a quick movement the worm of 6 can be disengaged from the teeth of the circular rack 5 of the upper plate 4. The screw 6 has a micrometer head for reading the degrees graduated on the edge of the upper plate 4 to minutes.

The degrees are figured from 0° to 180° for giving right and left deflection and these figures are supplemented with the supplement of the angle, thus (0° , 180°) (10° , 170°) (20° , 160°) &c. This is done to avoid calculations when laying out the lines of fire of the guns of a battery parallel to each other as will be described hereafter. The graduations on circle 4 are also used for dividing and recording the divisions of the "field of observation" into sections or targets on which the fire of the battery under cover is to be directed.

The carriage 2, which is pivoted in the supports 3 by trunnions 15, is movable in a vertical plane and is clamped by the worm of the screw 13 engaging the teeth of the arm 14 encircling one trunnion. The arm may be graduated in degrees and read to minutes by the micrometer head of screw 13. This vertical movement and clamping arrangement is to enable the pointer, at zero deflection in the telescope, to be aimed on the target and to be kept there, till the battery changes its original position.

The upper circular plate 4 is clampable by screw 6 to the lower plate 7, and the two plates set at zero can be turned on to any target and clamped there by screw 18 Figs. 4 and 8, which is a necessary feature for the subsequent working of my "observing instrument" for directing the fire of the battery. The connection between the members 7 and 8 is of an old form, this connection being of the well-known frictional form permitting movement of the member 7 around 8 as an axis when the members 4 and 7 are locked together, but when the latch 18 is thrown to unlocking position 4 and 7 are allowed to move relatively and indicate the angle through which the telescope 1 is moved.

The telescope 1 rests in semi-circular bearings in its carriage 2, and is secured in its bearings by two hinged caps which, by means of screws 17, are made to act as clamps to the telescope when rotated in its bearings. This rotatory motion and clamping arrangement plays an important part and are both necessary, as will be explained hereafter, for the solution of my problem. Attached to the top of the telescope 1 are two grooved pieces 19^a with locking spring 19^b for carrying my mechanical triangle which I will now describe.

Referring to the triangle $O T^1 G$ in diagram Fig. 1 I construct a mechanical triangle consisting of similarly graduated

scales made of any material, and arranged in such a way that I may be able to construct triangles to scale similar to those formed on the ground by the 3 lines $O T^1$, $O G$, and $G T^1$, where O is the observer, T^1 is the target and G the gun of a battery out of view of the enemy, and $O T^1$ is the range from the observer O to the target T^1 , $O G$ is the range from observer O to gun G , $G T^1$ is the range from gun G to target T^1 which is not seen from G .

I take, as an example, the maximum range of $O T^1$ to be 7000 yards, of $O G$ to be 2000 yards, and of $G T^1$ to be 7000 yards, but for convenience of working my mechanical triangle I will make the 3 bars corresponding to the 3 lines $O T^1$, $O G$ and $G T^1$ respectively 8000, 2000 and 8000 yards to scale. Referring to Figs. 2, 3 and 4 I therefore graduate into, say, twentieths of an inch (each $\frac{1}{20}$ being equal to 25 yds. on the ground,) a bar 19 corresponding to $O T^1$, a slide bar 23, a defined point of which may be set a distance from the center of the disk 28, corresponding to $O G$, and a bar 21 corresponding to $G T^1$, and I connect these three bars together to form my mechanical triangle. At the zero end of the graduated bar 19 I have a circular plate 22 which is attached to, or forms part of, it—the center of the circular plate 22 is placed in the central longitudinal line of the bar 19 at the zero range of the scale. A circular plate 28 containing a T-shaped groove 20 cut in it corresponding to the above mentioned bar 23 is also pivoted at the zero of its scale to the center of circular plate 22 by a vertical pivot. In this groove 20 the slider 23, with a vertical pivot 24, fixed to 23 and graduated with arrow heads, slides along the graduated scale 25 on the bar or circle 28. Around this pivot 24 is loosely pivoted a graduated circle 26, and over the circle 26 is loosely pivoted around the pivot 24 the zero end of the bar 21 with its zero range corresponding with the center of the pivot 24, and over the bar 21 is mounted a fixed washer 27 which by means of the clamping screw 29 above it clamps the slider 23 at any required range on the graduations 25 of the groove 20 of the plate 28. Above the clamping screw 29 on the same pivot 24 is placed a telescope (or rule with fore and back sight) with its axis fixed parallel to the center line of the graduated groove 20 and parallel to the plane of circular plate 28. The support for the telescope 30 is so constructed that it will be normally held with its axis parallel with the bar 23. This is accomplished by the cross pin playing in the slot on the member 24, as shown in Fig. 7, and by making the lug connecting the support 24 with the slide 23 square. With its longitudinal axis parallel to the longitudinal center line of the bar 21 I fit a clinometer level 31, which must be

revoluble, around an axis parallel to its longer axis or pin 31^c, into a vertical plane, in order to be able to measure the true inclination of the line G T¹ called the "angle of sight" in a vertical plane. The bar 21 passes through a swivel which works on a slider 35 which is slid along the bar 19 and clamped in any position by the clamping screw 33. The end of the bar 21 is free to move through the swivel at all times during the formation of my mechanical triangle. To the slider 35 is added an arc with vernier for the purpose of being able to read the apex angle of the triangle formed by the three graduated bars 19, 21, and 20 corresponding to the triangle G T¹ O on the ground shown in diagram Fig. 1 and also the "battery concentration angles" for different targets.

The bar 21 is extended backward at its zero end to 21^a for the purpose of enabling it to be clamped when desired to the radial spoke of the graduated circle 26 by spring catch 36, and also for providing a place for the vernier required to read the inner graduations of the circle 26 which when the spring catch 36 is unlocked from the extension 21^a of the bar 21, and the vernier allowed to travel along the inner edge of the circle 26 give mechanically and automatically without calculations the "angles of switch" required for "switching" the axes of the guns of the battery on to different targets.

If I choose I fit the clinometer level 31 as 37 loosely round the telescope 30 so as to be able to turn the level round it as an axis into a vertical plane for measuring the "angle of sight" along the bar 19 in a vertical plane when the telescope 30 is turned longitudinally over the bar 21.

My mechanical triangle when used is attached to telescope 1 by two tongues of metal 43 (Fig. 7) which are attached to the underneath part of the O T¹ bar 19, at convenient distances for balance, and which slip into two corresponding grooved pieces 19^a 19^b fixed to the telescope 1. The center line of the O T¹ bar 19 must be horizontally and vertically parallel to the axis of the telescope 1, and must remain so during the manipulation of my mechanical triangle.

Referring to Fig. 7 which is an enlarged section through the longitudinal axis of telescope 30 and O G bar 20, the telescope 30 is hinged to a socket 41 which fits exactly the pivot 24 and is stopped from going down too far on 24 and from turning around the socket by a key which exactly fits the keyway in the socket 41. A screw thread is cut on the exterior of the socket on which a screw collar 39 travels up and down. On the socket and above 39 is a tubular piece 40 supplied with two horns 44 which are screwed hard against the underneath part of the hinge piece 45 of the telescope 30 when it is required to fix the telescope rigidly parallel

to the O G bar 20 or circular plate 28 of the mechanical triangle. The telescope 30 may be placed parallel with 21 by raising 41 above the key and then swinging it on 24. The spring shown is fixed to 40 and to 24 in order to bring 40 back, when 39 is unscrewed for giving a depression movement to 30.

Referring to Fig. 6, (which is a section through the swivel 32 in the direction of the chain dotted line) 34^a is the loosely pivoted portion of the arm of the vernier 34^b for reading the battery "concentration angles" to minutes and is loosely attached by a clip to 21 to move therewith.

Having now described my "observing instrument" for the laying of guns from behind cover at unseen targets from the sights, I wish it to be understood that I can if I choose modify the mechanical arrangement of my "observing instrument" so as to use only one telescope for laying on the target T¹ and on the gun G and for forming the mechanical triangle O G T¹ to scale but this method is not so convenient for use or so certain and quick in its action.

The following is how I use my observing instrument practically in the field—referring to the diagram in Fig. 1 where O is the observer, G a gun of the battery and T¹ is the target on the extreme left of the observer's field of view or of the battery field of fire within range of the guns of the battery, and T² a target on the extreme right of the "observer's field of view" or of the "battery field of fire."

1. Set up my observing instrument Fig. 2 on its tripod at O.

2. By screws 9 and 11 level the circular plates 7 and 4 as indicated by the cross levels 4^a and 4^b.

3. Set 7 and 4 to zero on the graduated circle and direct the pointer of telescope 1 on the target, horizontally, by the horizontal movement of the two plates 7 and 4 together, and clamp them in that position by clamp 18 Figs. 4 and 8, and if necessary depress or elevate telescope 1 on target.

My "observing instrument" is then in readiness for regulating the fire of the battery.

4. Battery range finders find the ranges of O to T¹ and of O to G to be respectively, say, 6000 and 1400 yards.

5. Set the slider 35 on the O T¹ bar 19 to 6000 yds. and clamp it there by clamp 33.

6. Set the slider 23 in the graduated groove 20 of the circular plate 28 to 1400 yds. and clamp it there by clamp 24.

7. Having set telescope 30 by screw collar 39 parallel to the circular plate 28, turn the telescope 30 in the direction of the gun, and elevate or depress it on to the gun by revolving telescope 1 in its bearings, and clamp it when telescope 30 is on the gun by clamps 17.

8. Now by the act of laying the telescope

30 on the gun G while telescope 1 remains aimed on the target T^1 , the following data for laying the gun G on the unseen target T^1 will be found automatically by the mechanical adjustment and completion of my mechanical triangle O G T viz: 1. The battery angle O G T^1 . 2. The angle of sight of G to T^1 . 3. The range of G to T^1 . 4. The apex angle O T^1 G of the triangle O G T^1 . 5. The battery concentration angle. The battery angle O G T^1 is read off the outer graduations of the graduated circle 26 by the vernier 23^a. The "angle of sight" of G to T^1 is read off the clinometer 31 which has its longitudinal bubble 31^a and cross bubble 31^b leveled by hand. The range of G to T^1 is read off the G T^1 bar 21. The apex angle O T^1 G is read off the arc 34 by the vernier 34^b—and enables the "battery concentration angle" to be found in the following manner—let the apex angle O T^1 G equal 15°—set the slider 23 (which was originally clamped at 1400 yds.) temporarily to 1500 yds. the distance between O and G⁵ and read off the arc 34 by vernier 34^b the apex angle which we will suppose to be 15°. 40^{mins}. Subtract 15° from 15°. 40^{mins}, and there remains 40^{mins} as the "concentration angle" which has to be given to the axis of the gun G⁵ to enable it to concentrate its fire on the target T^1 fired at by the gun G—and 40^{mins} divided by 5 for the 5 spaces between the guns will give 8^{mins} as the angle which has to be given to the axis of any one gun for concentrating its fire on the target fired at by the gun on either side of it or vice versa for making the guns G to G⁵ fire parallel to each other—thus the "concentration angle" for G¹, G², G³, G⁴ and G⁵ to concentrate on target T^1 would be respectively, 8, 16, 24, 32 and 40 minutes,—and vice versa to distribute from this concentration, the fire of each gun parallel to the fire of G, 8, 16, 24, 32 and 40 mins. right deflection must be given to G¹, G², G³, G⁴ and G⁵.

Having by the above data laid out the lines of fire of the different guns of the battery as desired, it only remains now to provide the "switch angle" for enabling the guns of the battery to "switch" its fire on to any other target within range seen by the observer at O, and the following is the method of obtaining it without calculation. The observer at O unclamps the graduated plate 4 from the lower plate 7, and turns the telescope 1 on to the new target T^2 , sets the slider 35 of the O T^1 bar 19 to the range of the target T^2 found by the battery range finder, unclamps in Fig. 5 the G T^1 bar 21 produced backward from the circle 26 by raising the spring catch 36, and turns the telescope 30 back to gun G, from which it has been moved by the switching of tele-

scope 1 on to target T^2 . This operation gives automatically (1) the "angle of switch" for the gun which is read off the interior graduated circle of 26 by the vernier 21^a, (2) the "angle of sight" from G to T^2 , (3) the range of gun G to target T^2 read off scale 21, (4) the apex angle, O T^2 G, (5) and the battery "concentration or dispersion" angle found as already explained above. This method differs from the previous method inasmuch as the range from O to G is constant and therefore has not to be re-found by the range finder. By turning telescope 1 on to the crest of the hill in front of the gun I can on the same principle find the "angle of sight" from the gun G to the crest of the hill which, to allow the axis to clear the crest, must not be greater than the least angle of elevation which has to be given to the gun G in order to hit the target. This angle I call the clearance angle. My mechanical triangle which gives me the range of gun to target evidently indicates at the same time whether my gun is within range of the target, and by setting the bar 19 to the maximum range of the gun it enables me by means of the telescope 30 which has moved with it to indicate to the gun G the position to which it has to be advanced in order to be within range of the target.

What I claim is—

1. In an observing instrument, a plurality of sighting devices constructed to be moved to point one in the direction of one object and the other in the direction of another object, scale means operatively connected with said sighting devices constructed to be set in proportion to the distances of said two objects from the point of observation, indicating mechanism set in operative position by said positioning of said scale means and sighting devices, constructed to indicate automatically and visually the angle at one of the objects made by the lines connecting that object with the point of observation, and the other object.

2. In an observing instrument, a plurality of sighting devices constructed to be moved to point one in the direction of one object and the other in the direction of another object, scale means operatively connected with said sighting devices constructed to be set in proportion to the distances of said two objects from the point of observation, indicating mechanism set in operative position by said positioning of said scale means and sighting devices, constructed to indicate automatically and visually the distance between said objects.

3. In an observing instrument, a plurality of sighting devices constructed to be moved to point one in the direction of one object and the other in the direction of another object, scale means operatively con-

ected with said sighting devices constructed to be set in proportion to the distances of said two objects from the point of observation, indicating mechanism set in operative position by said positioning of said scale means and sighting devices, constructed to indicate mechanically and visually the angle of depression or the elevation of one of said objects with respect to the other.

4. In an observing instrument, a plurality of sighting devices constructed to be moved to point one in the direction of one object and the other in the direction of another object, scale means operatively connected with said sighting devices constructed to be set in proportion to the distances of said two objects from the point of observation indicating mechanism set in operative position by said positioning of said scale means and sighting devices, constructed to indicate automatically and visually and simultaneously the angle at one of the objects made by the lines connecting that object with the point of observation, and the other object and the distance between them.

5. In an observing instrument, a plurality of sighting devices constructed to be moved to point one in the direction of one object and the other in the direction of another object, scale means operatively connected with said sighting devices constructed to be set in proportion to the distances of said two objects from the point of observation, indicating mechanism set in operative position by said positioning of said scale means and sighting devices, constructed to indicate automatically and visually and simultaneously the angle at one of the objects made by the lines connecting that object with the point of observation, and the other object and the distance between them and means for indicating the angle of depression or elevation of one of said objects with respect to the other.

6. In an observing instrument, scales constructed to be set in proportion to the distances of two objects from the point of observation, sighting means operatively connected to the scales whereby they may be pointed in the direction of said objects, and mechanism set in operative position by means of the positioning of the scales constructed to indicate mechanically and visually the angle of depression or elevation of one object with respect to the other.

7. In an observing instrument, scales constructed to be set in proportion to the distances of two objects from the point of observation, sighting means operatively connected to the scales whereby they may be pointed in the direction of said objects, and mechanism set in operative position by means of the positioning of the scales constructed to indicate mechanically and vis-

ually the angle of depression or elevation of one object with respect to the other and the distance between them.

8. In an observing instrument, a plurality of sighting devices, means to operate said sighting devices to point one in the direction of one object and the other in the direction of another object, a plurality of graduated scales, one connected to one of the sighting devices and another connected to the other sighting device, means to set said scales to indicate the distance between the objects and the point of observation, and a third scale connected to the sighting devices to be operated by the movement thereof to automatically and visually indicate the distance between the objects.

9. In an observing instrument, a plurality of scales forming a mechanical triangle, operative means to move two of said scales in the directions of two objects, and means operated by said operating means to automatically position the scale forming the third side of the mechanical triangle so that it will visually indicate the distance between the objects and the direction of the line connecting them.

10. In an observing instrument, a plurality of scales forming a mechanical triangle operative means to move two of said scales in the directions of two objects, and means operated by said operative means to automatically position the scale forming the third side of the mechanical triangle so that it will visually indicate the distance between the objects, a clinometer connected to said third scale, and a scale on said clinometer to indicate the direction in a vertical plane of the line connecting the two objects.

11. In an observing instrument, a plurality of scales forming a mechanical triangle, a telescope connected to one of said scales whereby it may be moved in the direction of one object, a telescope connected to another of said scales, whereby it may be moved in the direction of another object, and a third scale pivotally and slidingly connected with the other scales, whereby the third scale will visually indicate the distance between the objects, and a clinometer mounted on said third scale to visually indicate the direction in a vertical plane of the line connecting the two objects.

12. In an observing instrument, a mechanical triangle comprising two graduated scales, pivotally connected at one end, a third scale pivotally connected to one of said scales and pivotally and slidingly connected to the other of said scales, means to set the first mentioned scales in the direction of two objects and to indicate the distance between the objects and the point of observation, and means operated by said means to automatically set the third scale to indicate

the distance between the objects and the direction of the line connecting them.

13. In an observing instrument, a telescope mounted for movement in a horizontal and a vertical plane, a mechanical triangle mounted upon said telescope to move about said telescope as an axis, a second telescope mounted upon one side of said mechanical triangle so as to swing in a horizontal plane, another side of the triangle connected to move with said second telescope, and a graduated segment to indicate the angle between the two sides of the triangle.

14. In an observing instrument, two sighting devices adapted to be pointed in the direction of a plurality of objects, graduated scales pivotally connected together at one end and attached to and movable with said devices, a third graduated scale pivotally and slidably connecting the other ends of the first mentioned scales, and a graduated segment mounted for movement about the pivotal point between the last mentioned scale and one of the other scales, a vernier mounted on the last mentioned scale, and means to connect and disconnect the vernier so as to move with and relative to the segment.

15. In an observing instrument, two sighting devices adapted to be pointed in the direction of a plurality of objects, graduated scales pivotally connected at one end and attached to and movable with the sighting devices, a third graduated scale pivotally and slidably connected with the other ends of the first mentioned scales, a graduated segment mounted for movement about the pivotal point between the last mentioned scale and one of the other scales, a vernier mounted on the last mentioned scale, a spring actuated locking bolt, a head and cam surface on said locking bolt, said locking bolt being adapted to cooperate with a socket in said segment to connect and disconnect said vernier and segment.

16. In an observing instrument, a telescope mounted for movement in horizontal and vertical planes, a plurality of lugs on said telescope provided with T-shaped grooves, a mechanical triangle, one side of said triangle being provided with T-shaped lugs adapted to cooperate with the T-shaped grooves to connect said triangle with the telescope.

17. In an observing instrument, a telescope mounted for movement in horizontal and vertical planes, a plurality of lugs on said telescope provided with T-shaped grooves, a mechanical triangle, one side of said triangle being provided with T-shaped lugs adapted to cooperate with T-shaped grooves to connect said triangle with the telescope, and a spring locking clip to secure said triangle in position.

18. In an observing instrument, a mechanical triangle one of the sides being con-

structed of a graduated bar, a disk provided with a groove and connected to said graduated bar, a slide mounted in said groove, a support mounted upon said slide adapted to carry a sighting device, said slide forming a second side of the triangle, a graduated bar mounted for pivotal movement about said support and for pivotal and sliding movement with respect to the first bar, said third bar forming the third side of the triangle.

19. In an observing instrument, three graduated scales forming a mechanical triangle, a pivotal connection between two of said scales at their zero point and a pivotal and sliding connection between the third scale and each of said first two scales, a graduated segment on each of said first two scales, and cooperating pointers on the third scale.

20. In an observing instrument, in combination, three graduated scales forming a mechanical triangle, a pivotal connection between two of said scales, a slide on each of said two scales, one of said slides having a graduated segment fixed thereto, the third scale being slidably mounted in said slide and pivotally connected at its zero point to the other slide, and a pointer on the third scale cooperating with the segment.

21. In an observing instrument, three graduated scales forming a mechanical triangle, a pivotal connection between two of said scales, a slide on each of said two scales, the third scale being pivotally connected to one of the slides and pivotally and slidably connected to the other slide, a segment connected to the first slide and a segment on the second slide adapted to be connected and disconnected from the third scale.

22. In an observing instrument, a mechanical triangle mounted to swing around a vertical pivot including two scales pivotally connected, a third scale pivotally and slidably connected to said first two scales, a graduated segment mounted on the connection between the third scale and one of said other scales, and a latch to connect and disconnect said third scale with said segment.

23. In an observing instrument, in combination, a telescope mounted to swing on vertical and horizontal axes, scales to indicate the amount of movement, a mechanical triangle mounted to swing about the telescope as an axis including two scales pivotally connected, a third scale pivotally and slidably connected to said first two scales, a graduated segment pivotally mounted on the connection between the third scale and one of said other scales, and a latch to connect and disconnect said third scale with said segment.

24. In an observing instrument, a plurality of scales forming a mechanical triangle, operative means to move two of said scales in the directions of two objects, and

means operated by said operative means to
automatically position the scale forming the
third side of the mechanical triangle so that
it will visually indicate the distance between
5 the objects, a clinometer connected to said
third scale and mounted to swing about an
axis parallel thereto, and a scale on said
clinometer to indicate the direction in a ver-

tical plane of the line connecting the two
objects.

In testimony whereof I affix my signature
in presence of two witnesses.

LOTHIAN KERR SCOTT.

Witnesses:

ELIZABETH MARY LEE,
MARY CLARKE.

10