F. W. WOOD.

GUN FIRE CONTROL SIGNALING APPARATUS.

APPLICATION FILED OCT. 24, 1914.

1,183,155.

Patented May 16, 1916.

2 SHEETS—SHEET 1.

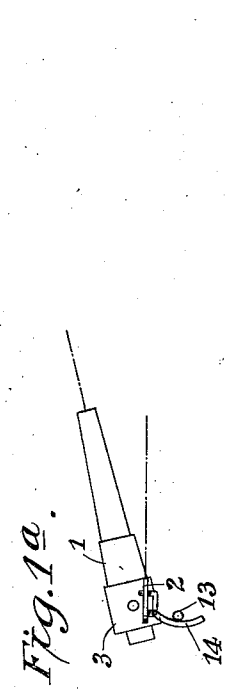


Fig. 1a.

Fig. 1

Witnesses:

Wm. H. Hawkins

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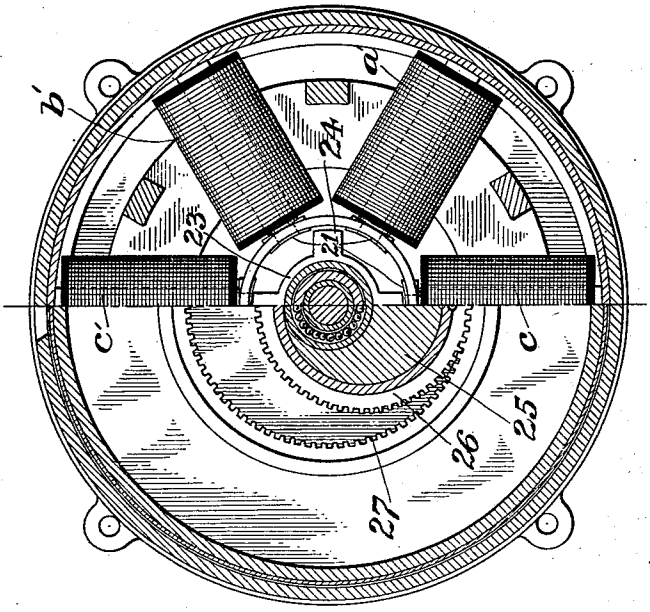
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2 SHEETS—SHEET 2.

Fig. 2.



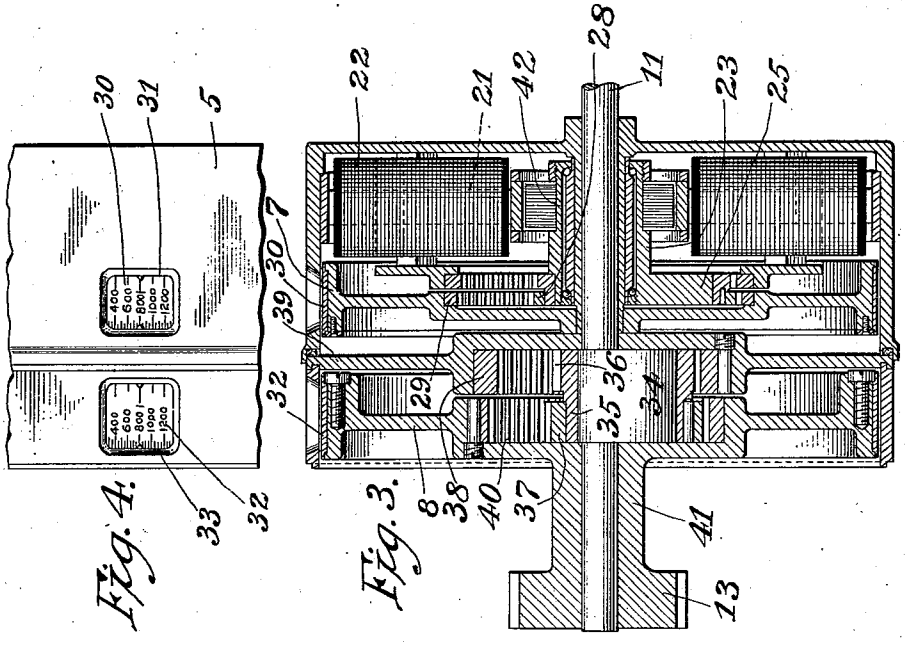


Fig. 4.

Fig. 3.

Witnesses:

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UNITED STATES PATENT OFFICE.

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GUN-FIRE-CONTROL SIGNALING APPARATUS.

1,183,155. Specification of Letters Patent. Patented May 16, 1916.

Application filed October 24, 1914. Serial No. 868,456.

To all whom it may concern:

Be it known that I, FRANK W. WOOD, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented new and useful Improvements in Gun-Fire-Control Signaling Apparatus, of which the following is a specification.

This invention relates to gun-fire control apparatus such as employed in directing the fire of heavy guns. Such control apparatus usually includes a sighting device such as a telescope near the gun to be used in giving the gun the proper inclination to give the trajectory which will enable the shell to strike the target. The same apparatus may be used for giving the gun the proper deflection angle in a horizontal plane to allow for the change of relative position of a moving target, or to allow for side winds.

The apparatus usually includes a range indicator which is controlled from a distant point such as a control station, in such a way that it indicates to the sight setter what elevation the gun should have.

The apparatus also usually includes an indicating member which indicates to the sight setter when he has given the sight bar or telescope the proper elevation.

One of the objects of the present invention is to provide an arrangement whereby these two indications of which the sight setter must be cognizant, will be arranged so as to insure efficiency, and tend to prevent errors.

A further object of the invention is to provide an arrangement whereby an indicating signal member which indicates the range or elevation to the sight setter, can be readily controlled from a distant point such as a control station and which may, if desired, be advanced at a uniform rate so as to enable the indicator to substantially "follow" a target, the position or range of which is constantly changing; and a further object of the invention is to provide an arrangement for enabling the gun sight to be quickly adjusted to assist in bringing the gun to the proper adjustment.

A further object of the invention is to provide means at the control station for accelerating or retarding the rate of advance of the signal at the gun at the will of the operator at the control station.

Further objects of the invention will appear more clearly hereinafter.

The invention consists in the general combination of parts and features described hereinafter, all of which contribute to produce an efficient gun-fire control apparatus.

The preferred embodiment of my invention will be particularly described in the following specification, while the broad scope of my invention will be pointed out in the appended claims.

In the drawings:—Figure 1 is a diagrammatic view showing an embodiment of my apparatus, certain parts being broken away;—Fig. 1ª is a diagrammatic side elevation upon a smaller scale for illustrating the manner in which such a control apparatus directs the fire of a gun. Fig. 2 is a cross section taken through an indicating instrument which is embodied in this apparatus. Fig. 3 is a vertical section through the instrument taken about on the line 3—3 of Fig. 2. Fig. 4 is a plan showing a portion of the case of the instrument and illustrating the opposed arrangement of the indicating members.

Before proceeding to a detail description of this embodiment of the invention, it will facilitate the disclosure thereof to state that the apparatus preferably includes a sighting device such as a telescope which is mounted on, or adjacent to the gun.

In the normal position of the telescope and gun, their axes are parallel. The operation of bringing the gun to proper elevation or adjusted angular position consists substantially in transmitting to the sight setter a signal from the control station indicating the range or inclination angle.

Suppose that the signal to the sight setter indicates a ten degree elevation of the gun, the sight setter then elevates the rear end of the sight bar or telescope to ten degrees by rotating the telescope on its pivot so that the eye piece of the telescope has a ten degree elevation from normal. The gun spotter then elevates the gun on its trunnions, until he can see the target through the telescope. The gun will then have the proper elevation to hit the target. This mode of operation is illustrated in Fig. 1ª which shows the gun elevated.

Referring more particularly to the parts, in the present embodiment of the invention,

1 indicates the gun on which there is attached a sighting device of any kind; this is attached in the form of a telescope 2, said telescope being adjustable by a pivot 3^a on the gun sleeve 3; the axes of the telescope and of the gun in the normal position are parallel. An observer who computes the ranges or angles for controlling the gun fire is supposed to be on look-out and sends information which he has to an operator at the control station 4, and this operator transmits a signal to each gun which is under his control, to direct the sight setter controlling the gun. While there may be as many guns as desired controlled from the control station, in the present embodiment, I have indicated one gun and I shall now describe the apparatus which I prefer to use at the gun and at the control station.

In referring to Fig. 1, it should be understood that the parts of my apparatus are illustrated upon a greatly enlarged scale with respect to the scale on which the gun itself is represented, and certain parts of the apparatus are out of proportion to each other simply for the sake of illustrating the preferred relation of the parts.

The apparatus preferably includes at each gun, an indicator case 5 which may be of drum-shape as shown, and in this case I prefer to provide electrically controlled means 6 for advancing an indicating member 7 which is the signal member controlled by the operator at the control station 4. Any suitable arrangement desired may be employed for advancing this indicating member 7. I prefer however, to employ the mechanism to be described more fully hereinafter.

Adjacent to the indicating member 7 there is a second indicating member 8 arranged within the same case, and the readings on the scales 9 on these two indicating members 7 and 8 appear at a fixed point, that is in openings or windows 10 in the upper side of the case. Preferably passing through the axis of the indicator case 5, I provide an inner-shaft 11 which may be rotated at will by a hand wheel 12, the inner end of the shaft carrying a pinion 13 meshing with the segment 14 which is attached pivotally to the rear end of frame 15 of the telescope. When the hand wheel 12 is rotated, it will rotate the indicating member 8 and will also swing the telescope 2 on its pivot 3 and change its angular position with relation to the gun 1. And the indicating member 8 will indicate the adjusted position of the telscope.

In order to reduce the angular movement of the indicating member 7 by the electrically controlled mechanism 6, the shaft 16 which is driven by the electrically controlled mechanism 6 operates through reducing mechanism to drive the toothed hub 18 of the indicating member, and a similar reducing mechanism 19 is employed for driving the toothed hub 20 on the indicating member 8.

Referring now particularly to Figs. 2 to 4, I shall describe some of these parts more in detail and show them in their true relation and proportions. The electrically controlled mechanism 6 is preferably a step by step indicator comprising a plurality of poles 21 which are the cores of electromagnets 22. There may be six of these poles or magnets and the axes of the coils are arranged radially about the axis of the instrument, and the diametrically opposite coils are connected in pairs in series, in other words the coils a—a', Fig. 1, are connected, the coils b—b' are connected, and the coils c—c' are connected. In the space surrounded by the poles, there is provided an armature or rotor 23 which preferably has four arms 24. From this arrangement, if the coils a—a' become energized by a passing current, the arm of the rotor 23 which is between the two coils a' and b' will be attracted to the core of the coil a' and this will give the rotor a rotation through a twelfth of a revolution. If the current next passes in the coils b—b', the rotor will be given another twelfth of a revolution. In this way, by energizing different pairs of coils in succession, the rotor may be rotated continuously.

The rotation of the rotor 23 is imparted with a reduced effect to the signal or indicating member 7 through the mechanism 17, Fig. 1, which preferably includes an eccentric 25 which is rigid with the rotor. This eccentric 25 is loosely mounted in an eccentric strap or sleeve 26 which is in the form of a gear wheel, and as the eccentric 25 moves around, the teeth of this gear or eccentric strap 26 roll on the teeth of a fixed epicyclic gear 27. The gear 26 has another set of teeth formed on a ring 28 of a slightly different diameter than the gear 26 but rigid therewith, and the teeth of this ring 28 mesh with the epicyclic gear 29 which is rigidly secured to the hub 18 of the signal or indicating member 7. This arrangement will result in producing a reduced advancing movement of the indicating member 7 so that a graduated scale 30 upon it will pass under a sight opening or window 31 in the case 5.

A similar reducing mechanism may be employed for rotating the indicating member 8 to advance its graduated scale 32 under its corresponding window 33 in the case 5. For this purpose, the inner shaft 11 which is operated by hand is provided with an eccentric 34, said eccentric rotating freely in the eccentric strap 35, a part of which is formed into a pinion 36 and another part of which has attached thereto a pinion in the

form of a ring 37, the teeth of the pinion 36 meshing with the teeth of an epicyclic gear 38 fixed to a plate 39 within the instrument, and when the eccentric 34 turns around, the pinion 37 engages the teeth of an epicyclic gear 40 on the hub 20 of the indicating member 8. The indicating member 8 has a neck 41 extending therefrom, and the extremity of this neck is formed into the aforesaid pinion 13; the scale 32 is arranged so that it will indicate at the window, the angle between the axes of the telescope and the gun, when the gun is sighted, that is when the target is visible through the telescope.

In order to reduce the friction at the rotor 23, I prefer to provide the same with a ball bearing 42.

It is understood that the particular construction of this instrument as regards the manner of advancing the indicating members, is immaterial and if desired, any suitable receiving instrument can be used for translating a signal to the indicating member 7. In the present instance, in order to control the energizing of the different coils in the manner suggested above, I prefer to employ a circuit closing device which may be rotated, and as it rotates it will touch certain contacts which will have the effect of throwing the electric current into the proper conductors to give the rotor its advancing movement. In the present instance, 43 indicates such a circuit closing device which has the simple form of a controller drum adjacent to the surface of which a plurality of brushes or contacts 44, 45, 46, and 47 are provided.

At the control station and near the operators position so as to be visible by him, I prefer to provide an indicator 48 which is advanced in the same way by the circuit closer 43 as the indicating member or signal 7. In other words, this instrument 48 has three pairs of oppositely disposed coils namely a—a', b—b' and c—c' corresponding in position with the correspondingly indicated coils of the other instrument which is at the gun, and the coils are preferably wired in parallel with the corresponding coils at the other instrument. In other words, a conductor 48 connects the coils a and A, and the conductor 49 connects the coils b' and B', and the conductor 50 connects the coils c' and C'. The coils b, c and a' are all connected to the conductor 52 which connects to a conductor 51 which connects with the coils B, C and A'.

The drum 53 is rotated when desired, by means of its hand wheel 54; the contact 47 is always in contact with the surface of the drum and is connected with the return conductor 56 which is attached at 57 to a return main 58. When the drum 53 is turned, contact is first made by it with the contact or brush 46 which energizes the coils a, a' and A, A', next the coils b, b' and B, B' will be energized and so on around so that the indicating member 7 will be advanced and in synchrony with it will be advanced the indicating needle 59 of the instrument 48. Evidently this drum 53 may be rotated forward and back, and when it is rotated, the indicating members 7 and 59 will have a corresponding and a synchronous movement. In this way the operator can signal the proper range or gun elevation to the sight setter, and at the same time his own indicator 48 will indicate the character of the signal that is transmitted to the gun.

Where the gun is to be fired at a moving target such as a moving ship, it is desirable to provide an arrangement whereby the instruments are driven automatically to substantially indicate the increasing range so that a constant signal is being transmitted to the gun which is approximately correct, I provide hand controlled means which can be operated at the will of the man at the control station, for correcting this approximate signal so that it will be accurate. For this purpose, I prefer to provide a motor which is preferably an electric motor 61, said motor having a driving connection 62 with a variable speed device 63. Any suitable mechanism may be used for this purpose, preferably a continuously rotating disk 64 which operates to drive a wheel 65 which is feathered to a shaft 66 extending diametrically across above the disk 64. The shaft 66 drives the drum 53 through a clutch 67 including a movable clutch member 68 controlled by a lever 69. When the lever 69 is moved toward the right, the clutch is opened and the drum 53 can then only be rotated by hand.

It will be evident that with the wheel 65 set at a certain position, the motor 61 will drive the drum 53 at a uniform rate of rotation and hence the indicating members will be advanced at a uniform rate. In order to enable this rate of advance of the indicating members to be accelerated or retarded, I prefer to mount the wheel 65 in a movable bracket 70 which moves as a nut on the adjusting screw 71, said adjusting screw having a handle 72 which may be rotated by hand as desired. Above the screw 71 a scale 73 is provided for indicating the rate of movement of the indicating members. With this arrangement, evidently if the target is moving away from the gun, the indicating member 7 at the gun can be operated so that the reading of this scale indicates a higher and higher elevation to be given to the gun. This elevation or angle will be approximately correct but can be corrected or adjusted from the control station to agree with the last information had from the observer's position. This correction is of course, made

simply by rotating the hand 72 in one direction or the other.

In order to provide means for automatically closing the circuit through the electric motor 61 when the clutch 67 is closed, I prefer to provide the lever 69 with an arm 75 which will close a double switch 76 when the lever is rotated toward the left.

A test device is provided for insuring that the indicating member 59 and the indicating member 7 will be in synchrony; for this purpose I prefer to provide a signal such as an electric light 77 to which a conductor 78 runs from a contact plate 79, and when the member 7 advances to a certain point indicated by the scale, the contact 79 will be connected with an extension 80 of the conductor 51 by means of a contact 81 carried on the indicating member 7. The conductor 51 is connected with the minus side of the line and the plus side of the line has a conductor 82 which is a main line leading in between a plurality of lights 77′ similar to the light or signal 77.

Assuming that the signal or light 77 is supposed to become active when the indicating member 7 indicates some arbitrary number such as 10,000 yards, when this signal is active, the indicating number or needle 59 will also note 10,000 yards.

The signals 77′ are connected by conductors 83 with the indicators of the guns controlled from the same control station. Referring again to the control drum 53, it is needless to go into details as to its construction, it is of any common form preferably of the type in which the bearing surface is formed with gaps 53^a which determine which of the brushes will be maintained in contact with the drum.

Current is constantly supplied to the apparatus when the double switch 84 is closed, and whether the motor is being driven or not; the switch 76 is simply a motor switch. When the switch 84 is closed the positive line 85 and the negative line 86 are connected respectively with the conductors 82 and 51, if desired through suitable fuse connections indicated at the point 87.

I shall now describe the general mode of operation of the apparatus.

An observer at the look-out station transmits his information or calculation to the control station where the operator is located and in the vicinity of the controller 53. If the apparatus is being controlled entirely by hand, the clutch 57 is opened and also the switch 76; the operator in the control station simply rotates the wheel 54 and brings his indicating member 59 to the point corresponding to the range or angle to be given to the gun; this same signal is transmitted to the sight setter through the medium of the electrically controlled indicating member or signal number 7. The sight setter then turns the wheel 12 so as to elevate the rear end of the telescope. The amount of elevation is indicated by the indicating member 8; when the reading on this indicating member 8 is brought into correspondence with the indicating member 7, the rotation of the wheel 12 is stopped; the gun spotter then swings the gun on its trunnions 88 until the telescope 2 is on the target. The gun will then have the proper elevation to strike the target.

In case the target is moving, for instance away from the gun, the range will be increasing and usually such increase will be at a constant rate. In such a case, the operator will employ the mechanical means for assisting in maintaining the gun near its proper elevation. In order to do this, he closes the clutch 67 which starts the motor 61, and by adjusting the wheel 65 to the proper point, he can cause the controller 53 to be rotated at the proper speed to advance the indicating number 7 at substantially the proper rate, such that it will compensate for the changing range and give approximately the proper range. From time to time however, the operator at the control station will be given the result of a range observation or calculation by means of which he can correct the indicators to make them more exact. This correction is made effective by rotating the handle 72 forward or back.

A typical circuit through the instrument and by means of which the electrically controlled indicating members thereof are advanced is as follows. The line 85, switch 84, conductors 82 and 56 to the contact 47, through the drum 53 to contact 46 and by the conductor 48 toward the right through coils A, A′, to the conductor 52 and then through switch 84 to the line wire 86; from brush 46, toward the left on conductor 48 through coils a, a', and back to switch 84 through conductor 51. This circuit is typical whether the motor is operating or not. When the clutch 67 is closed, the electric motor 61 is simply brought into circuit formed through conductors 76′.

Although I have described the apparatus as applied to the controlling of the gun as affected by the range of the target, it is obvious that the same apparatus may be used for controlling the gun with respect to deflection angles.

It is understood that the embodiment of the invention described herein is only one of the many embodiments or forms the invention may take, and I do not wish to be limited in the practice of my invention, nor in my claims, to the particular embodiment set forth.

What I claim is:—

1. In a gun-fire control apparatus, in

combination, a rotor near the gun position, electro-magnetic means and circuits therefor, hand operated means at a central station for controlling the circuits through said electro-magnetic means to effect a step by step rotation of said rotor, an indicating member having a scale and driven at an increased rotary speed from said rotor, another indicating member also having a scale corresponding to said first named scale, and hand operated means for actuating said last named indicating member to bring the corresponding numbers of the scale thereof into alinement with the numbers of the other scale.

2. In a gun-fire control apparatus, in combination, a rotor near the gun position, electro-magnetic means and circuits therefor, motor actuated means at a central station for controlling the circuits through said electro-magnetic means to effect a step-by-step rotation of said rotor, an indicating member having a scale and driven at an increased rotary speed with respect to and from said rotor, another indicating member also having a scale corresponding to said first named scale, and hand operated means for actuating said last named indicating member to bring the corresponding numbers of the scale thereof into alinement with the numbers of the other scale.

3. In a gun-fire control apparatus, in combination, a rotor near the gun position, electro-magnetic means and circuits therefor, a motor and hand operated means at a central station for controlling the circuits through said electro-magnetic means, a clutch for connecting the motor at will and enabling either the said hand operated means or the motor to be used to effect the closing of the circuits through said electro-magnetic means to effect a step-by-step rotation of said rotor, an indicating member having a scale with a plurality of numbered divisions and driven at an increased rotary speed from said rotor, another indicating member also having a scale with a plurality of numbered divisions corresponding to said first named scale, and hand operated means for actuating said last named indicating members to bring the corresponding numbers of the scale thereof into alinement at a fixed point with the numbers of the other scale.

4. In a gun-fire control apparatus, in combination, a rotor near the gun position, electro-magnetic means and circuits therefor, motor actuated means at a central station for controlling the circuits through said electro-magnetic means to effect a step-by-step rotation of said rotor, an indicating member having a scale and driven at an increased rotary speed with respect to and from said rotor, another indicating member also having a scale corresponding to said first named scale, hand operated means for actuating said last named indicating member to bring the corresponding numbers of the scale thereof into alinement with the numbers of the other scale, and means for changing at will the speed of closing the circuits.

5. In a gun-fire control apparatus, in combination, a rotor near the gun position, electro-magnetic means and circuits therefor, motor actuated means at a central station for controlling the circuits through said electro-magnetic means to effect a step-by-step rotation of said rotor, an indicating member having a scale and driven at an increased rotary speed with respect to and from said rotor, another indicating member also having a scale corresponding to said first named scale, hand operated means for actuating said last named indicating member to bring the corresponding numbers of the scale thereof into alinement with the numbers of the other scale, the circuit-controlling means including a drum driven from the motor, and means for varying the speed of driving said drum by the motor to change the rate of closing the circuits through said electro-magnetic means.

6. In a gun-fire control apparatus, in combination, an indicating member for indicating to the sight setter the angular adjustment to be given the gun to hit a distant relatively moving target, a second indicating member arranged to show the angular adjustment of the sighted gun, means for continuously advancing said first indicating member at a substantially uniform rate to compensate for the change of range, and a hand controlled device for advancing said second indicating member to bring the reading thereof into correspondence with said first indicating member while said first indicating member is in motion.

7. In a gun-fire control apparatus, in combination, an indicating member having a scale for indicating to the sight setter the angular adjustment to be given the gun to hit a distant moving target, a second indicating member for indicating the angular adjustment of the sight, and having a scale similar to the first scale, alongside said first indicating member so that both said indicating members can be read simultaneously, means for advancing said first indicating member at a substantially uniform rate to compensate for the change of range, and a hand actuated device for advancing said second indicating member to bring the reading thereof into correspondence with said first indicating member while said first indicating member is in motion.

8. In a gun-fire control apparatus, in combination, an indicating member for indicating to the sight setter the angular adjustment to be given the gun to hit a distant moving target, a second indicating member

for indicating the angular adjustment of the sight bar, motor driven means for advancing said first indicating member at a substantially uniform rate to compensate for the change of range, and hand actuated means for advancing said second indicating member to bring the reading thereof into correspondence with said first named indicating member.

9. In a gun-fire control apparatus for directing fire at a moving target, in combination, an electrically controlled indicating member having a scale for indicating at a fixed point to the sight setter the angular adjustment to be given the gun to hit the moving target, a second indicating member having a scale to show the angular adjustment of the sighted gun, a motor, circuits leading from a control station to said first named indicating member, a circuit closing device driven by said motor for closing said circuits to advance said first named indicating member at a substantially uniform rate to compensate for the change of range, and hand-controlled means for advancing said second indicating member to bring the reading on the scale thereof into correspondence with the reading on the scale of said first indicating member while said first indicating member is moving.

10. In a gun-fire control apparatus for directing fire at a moving target, in combination, an electrically controlled indicating member having a scale for indicating to the sight setter the angular adjustment to be given the gun to hit the moving target, a second indicating member having a scale to show the angular adjustment of the gun, both said scales constructed to be read at a fixed point, a motor, circuits leading from a control station to said first named indicating member, a circuit closing device driven by said motor for closing said circuits to advance said first named indicating member at a substantially uniform rate to compensate for the change of range, and hand-actuated means for advancing said second indicating member to bring the reading on the scale thereof into correspondence with the reading on the scale of said first indicating member while the same is in motion, and a hand-controlled device at the control station for varying the rate of driving of said circuit closing device.

11. In a gun-fire control apparatus for directing fire at a moving target, in combination, an electrically controlled indicating member having a scale for indicating to the sight setter the angular adjustment to be given the gun to hit the moving target, a second indicating member having a scale to show the angular adjustment of the sighted gun, both said scales constructed to be read at a fixed point, a motor, circuits leading from a control station to said first named indicating member, a circuit closing device driven by said motor for closing said circuits to advance said first named indicating member at a substantially uniform rate to compensate for the change of range, and hand-actuated means for advancing said second indicating member to bring the reading on the scale thereof into correspondence with the reading on the scale of said first indicating member while the same is in motion, a clutch for driving said circuit closing device from said motor, arranged to be opened at will, and means for actuating said circuit closing device by hand.

12. In a gun-fire control apparatus for directing fire at a moving target, in combination, an electrically controlled indicating member having a scale with a plurality of divisions for indicating to the sight setter the angular adjustment of the gun to hit the moving target, a second indicating member having a scale with a plurality of divisions to show the angular adjustment of the sighted gun, a motor, conductors leading from a control station to said first named indicating member, a circuit closing device for controlling the flow of current through said conductors to advance said first named indicating member, a variable speed device for driving said circuit closing device from said motor to advance said first named indicating member at a substantially uniform rate and thereby compensate for a change of range, hand actuated means for adjusting said variable speed device while in operation to change the speed of driving said circuit closing device, and hand-actuated means for advancing said second indicating member to bring the reading on the scale thereof into correspondence with the reading on the scale of said first indicating member while the latter is moving.

13. In a gun-fire control apparatus for directing fire at a moving target, in combination, an electrically controlled indicating member having a scale with a plurality of divisions for indicating to the sight setter the angular adjustment to be given the gun to hit the moving target, a second indicating member arranged adjacent to said first indicating member and having a scale with a plurality of divisions to show the angular adjustment of the sighted gun, a motor, a circuit closing device for controlling said first named indicating member, a hand controlled variable speed device for driving said circuit closing device from said motor, and hand-actuated means for advancing said second indicating member to bring the reading on the scale thereof into correspondence with the reading on the scale of said first indicating member.

14. In a gun-fire control apparatus for directing fire at a moving target, an elec-

trically controlled indicating member having a scale with a plurality of divisions for indicating to the sight setter the angular adjustment to be given the gun to hit the moving target, a second indicating member having a scale with a plurality of divisions arranged to show the angular adjustment of the sighted gun, an electric motor, a circuit closing device for controlling said first named indicating member, a clutch for driving said circuit closing device from said motor, a member for simultaneously closing said clutch and closing a circuit through said motor to drive the motor, means for actuating said circuit closing device by hand, and hand-actuated means for advancing said second indicating member to bring the reading on the scale thereof into correspondence with the reading on the scale of said first indicating member.

15. In a gun-fire control apparatus, in combination, an indicating member having a scale for indicating to the sight setter the angular adjustment to be given to the gun to hit a distant target, a second indicating member having a scale to indicate the position of the sighting telescope, an indicator at the control station, said indicator and said first named indicating member having a purality of poles and electrically controlled means associated therewith for advancing the indicating members with a step-by-step movement in synchrony, means at the gun for advancing said second named indicating member to bring the reading on the scale of said second indicating member into correspondence with the reading on the scale of said first named indicating member, and a signal at the control station for indicating whether said indicator and the first named indicating member are in synchrony.

16. In a gun-fire control apparatus for directing fire at a moving target, in combination, an electrically controlled indicating member having a scale for indicating to the sight setter the angular adjustment to be given the gun to hit the moving target, a second indicating member coöperating therewith to show the angular adjustment of the gun sight, a motor at a control station, a contact drum actuated thereby for electrically controlling the advance of said first named indicating member, a hand actuated variable transmission device for driving said drum from said motor, and having a scale indicating the positions corresponding to the different rates of change of range, and hand operated means for actuating said second named indicating member to bring the same into coincidence with said first named indicating member.

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

FRANK W. WOOD.

Witnesses:
F. D. AMMEN,
L. ELFMAN.