340-870.15

OR 1,296,439

DRAFTSMAN

E. A. SPERRY.

MULTIPLE TURRET TARGET INDICATOR.

APPLICATION FILED AUG. 31, 1914.

1,296,439.

Patented Mar. 4, 1919.

3 SHEETS—SHEET 1.

Fig. 1

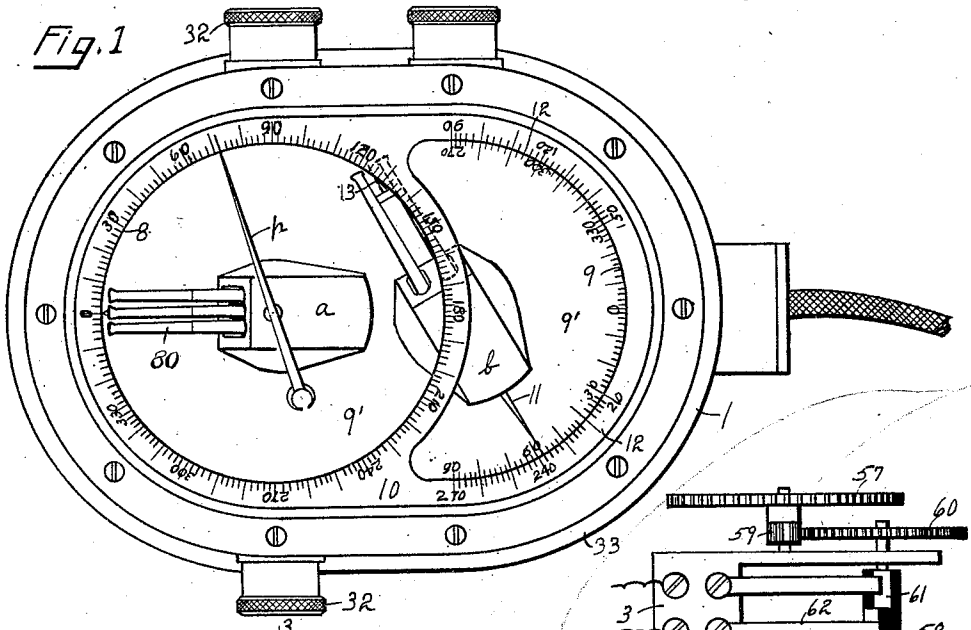


Fig. 2.

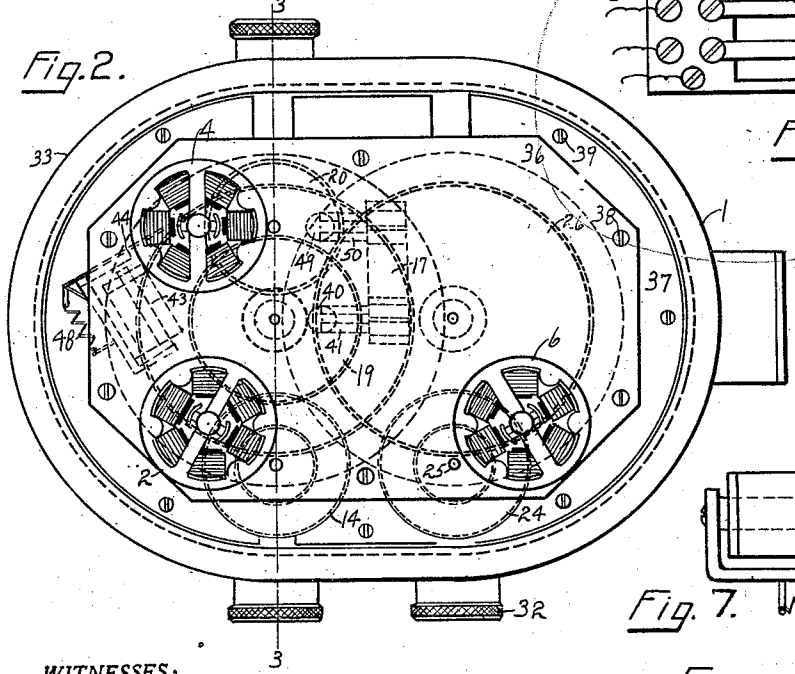
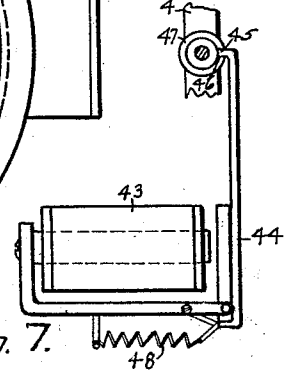


Fig. 6.

Fig. 7.



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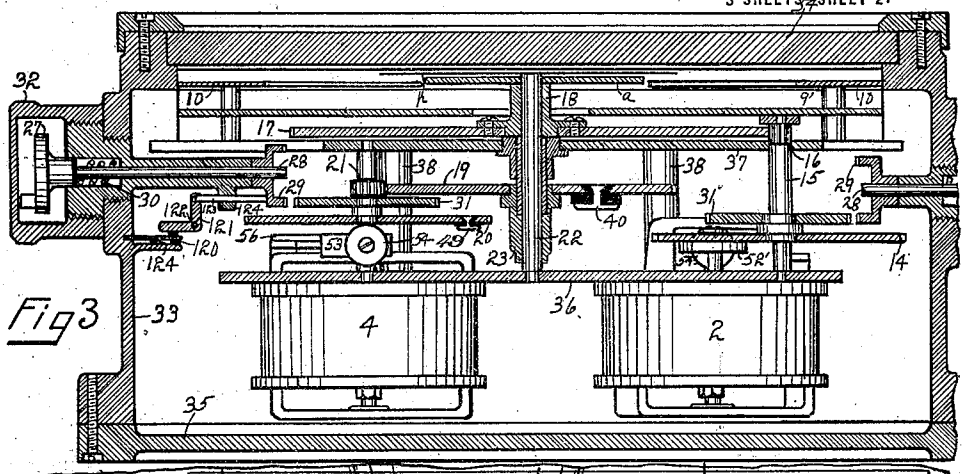


Fig 3

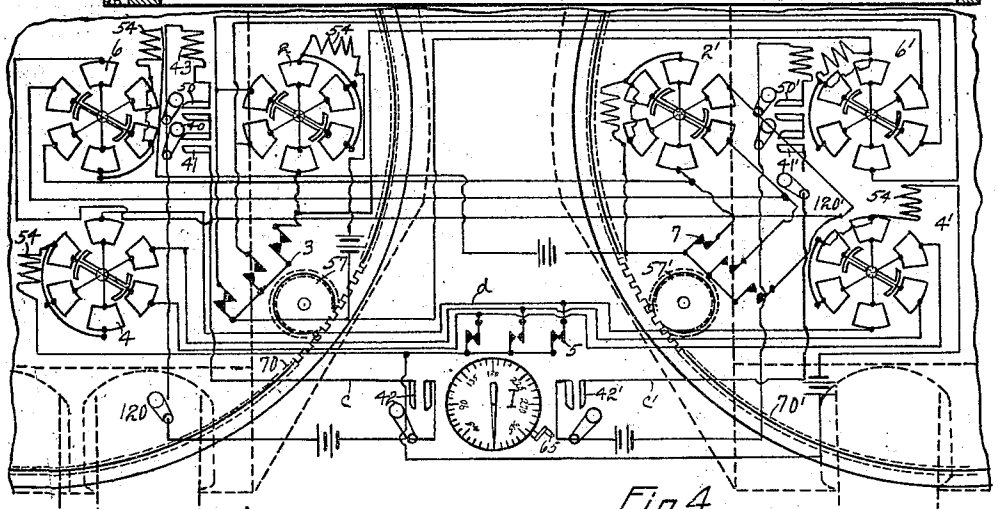


Fig 4

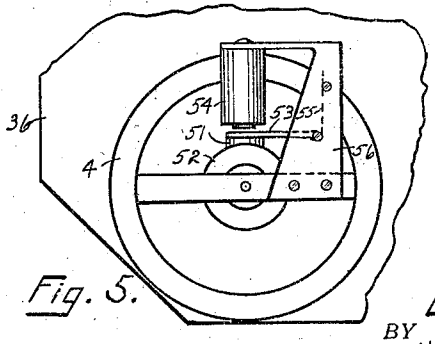


Fig. 5.

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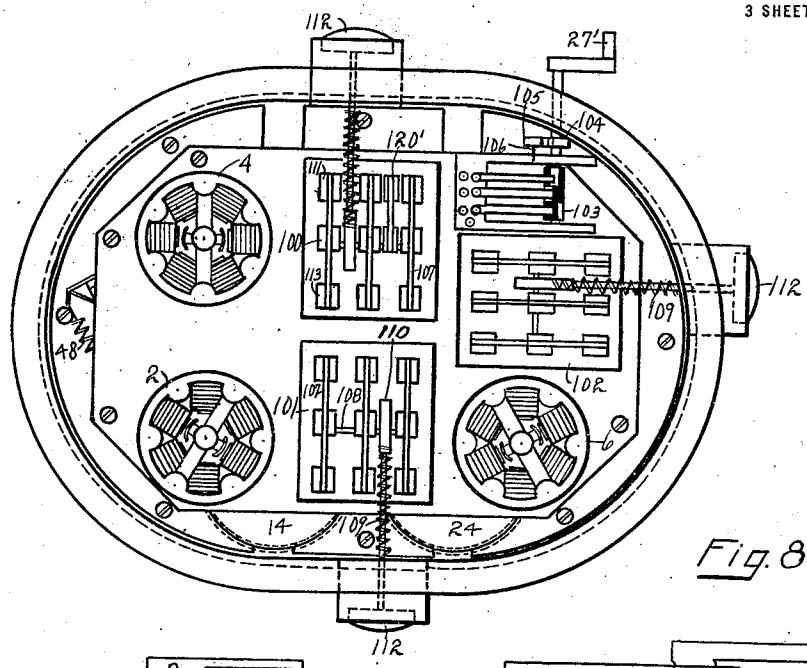


Fig. 8

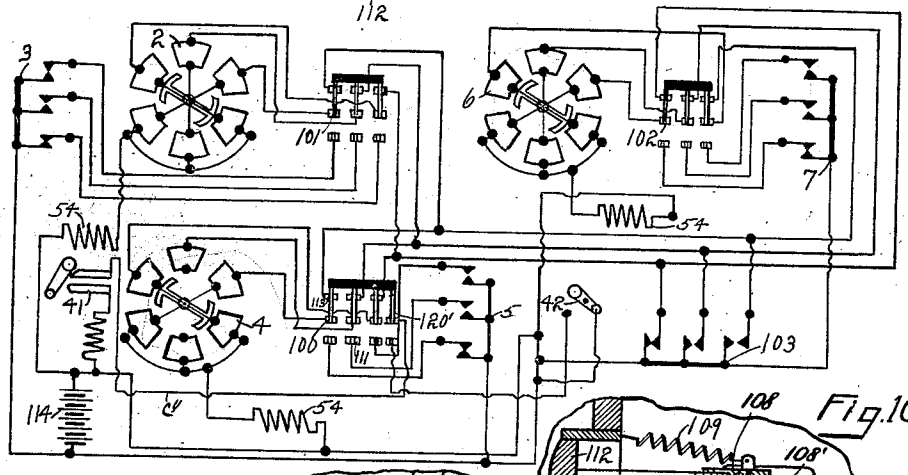


Fig. 9.

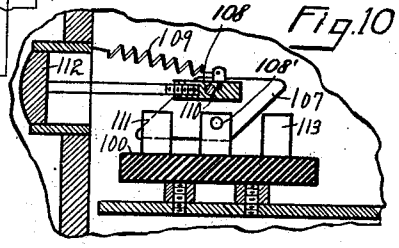


Fig. 10

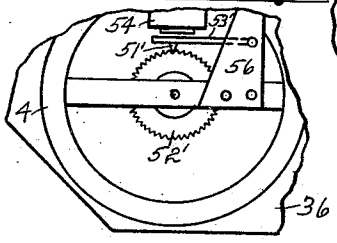


Fig. 11.

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MULTIPLE-TURRET TARGET-INDICATOR.

1,296,439. Specification of Letters Patent. Patented Mar. 4, 1919.

Application filed August 31, 1914. Serial No. 859,329.

To all whom it may concern:

Be it known that I, ELMER A. SPERRY, citizen of the United States, residing at Brooklyn, N. Y., have invented a new and useful Improvement in Multiple-Turret Target-Indicators, of which the following is a specification.

This invention relates to indicating means adapted to be placed within a turret of a war vessel and to show the direction in which the turret should be pointed, the actual position of the turret at each instant, and preferably in addition the position of other turrets on the ship. My invention is capable, also, of many other uses, as will be apparent to those skilled in the art.

Heretofore great difficulty has been experienced in the proper aiming and firing of the big guns in the turrets, due principally to the following causes:—difficulty in locating the proper target from the turret and interference with the guns in an adjacent turret. According to the present system, the "spotter" telephones down to the turret operator the approximate position of the target at which he is to aim, such as "target on the starboard bow", etc. The turret is then swung slowly around until the target is sighted through the telescope. But this has proved a slow and unreliable procedure as the operator may have to search for the target quite a while before he picks it up and since, as frequently happens, the wrong target is picked up, especially where there are two targets close to each other. Again, when adjacent turrets are firing at different targets, there is constant danger of the guns in one turret shooting the muzzles off the guns in the adjacent turret.

The object of my invention is to provide an indicator which will embody in one instrument a means whereby a turret may be trained quickly on the right target and whereby all danger of interference with an adjacent turret is obviated.

Another object of the invention is to improve the construction of indicators of this general nature whereby a repeating indicator may be set from the master or controlling indicator when it has fallen out of step therewith, and whereby the reliability of operation of said repeating system is improved.

In the drawings forming a part of this specification, one embodiment of my invention is shown.

Figure 1 is a top plan view of an indicator for use in a turret.

Fig. 2 is a bottom plan view of the same with the back plate removed.

Fig. 3 is a section on line 3—3 of Fig. 2.

Fig. 4 is a diagrammatic illustration and wiring diagram of my complete system as installed in two turrets.

Fig. 5 is a detailed view of a brake or stop mechanism for the repeater motor.

Fig. 6 is a detail of a turret transmitter.

Fig. 7 is a detail of the magnetic lock used in the synchronizing system.

Fig. 8 is a view of a modification corresponding to Fig. 2.

Fig. 9 is a wiring diagram therefor.

Fig. 10 is a side elevation of one of the double throw switches shown in Fig. 8.

Fig. 11 shows a modified form of a brake or stop mechanism for the repeater motors.

Indicator 1 is equipped with a plurality of repeater motors, preferably of the step-by-step type, one motor 2 being actuated by a transmitter 3 on its containing turret A, another motor 4 from a transmitter 5 on any type of target bearing indicator or instrument I, while the remaining motors are actuated by transmitters in adjacent turrets. While I have shown only one such turret B, motor 6, and transmitter 7, it is obvious that my system may be made to include any number of turrets and motors. In each adjacent turret a similar indicator is mounted, comprising motor 2′, actuated preferably from said transmitter 7, motor 4′, similar to motor 4, and motor 6′, actuated preferably from said transmitter 3, the same transmitter being used to control the motor within its own turret, and other motors in each of the other turrets. Since each indicator is similar in construction, a detailed description of indicator 1 will only be given.

Suitable position indicators are arranged to be actuated from the motors, comprising a turret position indicator or pointer *a* for the containing turret A, actuated from motor 2, a target position indicator or pointer *p*, actuated from motor 4, and a position indicator *b* for adjacent turret B, actuated from motor 6. Circular graduations 8 and 12, engraved on a fixed plate 10,

coöperate with turret indicator pointer *a* and pointer *p* and turret indicator pointer *b*, respectively.

The indicators are so arranged that the pointers *a* and *b* which are shown as a miniature representation of the turrets will actually cross each other's path within the entire danger zone. Each indicator pointer may be in the form of an irregularly shaped disk of the general outline of the turret and guns with markings 80 thereon representing the guns and turret. Hence the centers of rotation of the indicator pointers *a* and *b* are at least as close together in proportion, or if desired somewhat closer, than the distance between the turrets A and B, the idea being to indicate graphically and clearly the positions of danger by the intersections of the dials. In order to place the dials so that their paths of movement intersect, graduations 9, on a cover plate 10, are also provided, extending from the zero position around only 90° in each direction, on which scale the pointer 11 reads, while the remainder of the scale, or a portion thereof 12, is laid out adjacent the first portion on plate 10 and is read in connection with pointer 13. It should be noted that the graduations on the last named portion of the scale between 150° and 210° are omitted. This is purposely done to indicate the zone in which the guns of turret *b* would strike a fixed portion of the ship. The target bearing indicator or pointer *p* is preferably concentrically mounted with respect to the indicator *a* of the containing turret, whereby the turret officer is provided with a ready and simple means for indicating when the turret is trained on the target. Other means for accomplishing a similar result will be obvious to those skilled in the art.

The whole of the indicating mechanism is shown as inclosed in a casing 33, provided with a glass cover 34 and a back plate 35. The motors and the transmission mechanism are supported by a pair of plates 36, 37, which are secured in spaced relation to each other by posts 38, plate 37 being removably secured to the casing 33 by set screws 39.

Taking up now the specific construction of the indicator, including the transmission system between the motors and the dials, motor 2 is provided with a pinion (not shown) which drives a gear 14 secured to shaft 15. Also secured to shaft 15 is a pinion 16 which drives the large gear 17 secured to sleeve 18, carrying directly the turret pointer *a*. Similarly, motor 4 drives the large gear 19 through reduction gears 20 and 21. Said gear 19 is secured to central shaft 22 by means of hub 23. The shaft extends freely through sleeve 18 and carries adjacent its upper end pointer *p*. In like manner motor 6 controls indicator *b* through reduction gears 24 and 25 and large gear 26 on the hub of which is secured the dial.

In order to set the pointers in the proper position with respect to the turrets, when the indicator is being set up or in order to correct it in case it should fall out of step, local synchronizers in the form of setting handles 27 are provided for the indicators. Each handle is mounted on a shaft 28 carrying adjacent its other end a crown gear 29. A spring 30 normally holds gear 29 out of mesh with a gear 31, mounted on the same shaft as the reduction gearing of each group, but by pushing in on the proper handle 27, a crown gear 29 can be brought into mesh with one of said gears 31, and the dial rotated by hand. Screw caps 32 may be provided to cover said handles 27, preventing accidental operation thereof.

As a further means for setting the pointer *p* properly, an electric stop is provided which operates to lock the pointer when it has reached a predetermined position, thereby providing a long distance synchronizer which sets directly from the target bearing indicator I. This means comprises a button 40 mounted on gear 19, which wipes over a pair of fingers 41 fixed on the frame. When the button is in the position shown in Fig. 2, a circuit is completed through the fingers. In the same circuit *c* with the fingers 41 is a hand operated switch 42 on or associated with the target bearing indicator, so that the circuit will only be closed when both switches are closed. This circuit *c* is arranged to operate a solenoid 43, the armature 44 of which carries a pin 45 adapted to engage in a notch 46 in a collar 47 on the shaft of the motor 4, when the solenoid is energized. A spring 48 holds the pin 45 normally out of said notch. In order, then to lock the indicator, not only must the gear 19 carrying button 40 be in a predetermined position and the switch 42 on the indicator be closed, but also the motor shaft must have assumed such a position that the notch 46 is under the pin 45. This enables the pointer *p* to be adjusted with a great degree of accuracy, since the motor is connected so that one of its steps equals only a very small arc of movement on the pointer, while the pin and notch insure the locking of the motor at exactly the correct position.

A further aid to the same end is to equip the gear 20 also with a button 49 (Fig. 2) which wipes over stationary fingers 50 in the same circuit with the other two switches and solenoids 43. In such a case all three buttons must be in the circuit closing position simultaneously, and at the same time that notch 46 is under locking pin 45 before pointer *p* will be locked. The buttons 40 and 49 and the notch 46 are so placed as to lock the pointer *p* in a predetermined known position, such as the zero position. After the pointer is locked the operator of indicator I

continues to rotate it until it also reads on the same position as the pointer p, or in other words, the operator brings the indicator I also to the zero position. As soon as this position is attained said circuit c is broken by the operator at button 42 leaving circuit d through motor 4 and transmitter 5 closed so that the pointer will follow the movements of the indicator I. It will be understood that the other motors may be equipped with such a lock if desired.

In addition to the button 42 another switch 120 may be put in the circuit c, the purpose of which is to break said circuit when the setting handle 27 is used. From what has already been said, it will be apparent that the handle 27 may be used to synchronize a dial to any position of the master instrument, so that it is desirable to have a positive means for preventing the lock 45 from acting when synchronizing in this manner. Switch 120 is readily connected to the setting device by means of a bell crank lever 121 pivoted on a fixed rod 122 and secured adjacent one end to a rod 123, which slides freely in a bearing 124 and bears against the outer face of crown gear 29. The spring 30 which holds the gear 29 disengaged presses the lower end of bell crank lever into engagement with the switch 120, holding it closed, but when the crown gear is moved forward into engagement with gear 31 the spring 124 is allowed to open the switch. By this means all interference between the two setting systems is avoided.

I prefer to equip each of the repeater motors with a novel form of stop or lock which is adapted to prevent the motors from rotating when they are not in use. I find such a stop especially serviceable on motors connected so that the rotation of one will have a tendency to rotate another, such as where they drive concentrically arranged sleeves, like shaft 22 and sleeve 18, which have a sliding contact with each other. The stop is also useful in setting a dial by handle 27, since it prevents the dial from coasting past the desired position, upon release of the handle.

Specifically, the stop consists of a spring pressed friction block 51, which bears on a collar 52 on the shaft of the motor and is secured to the pivoted armature 53 of electro-magnet 54. A spring 55 holds the brake set normally, but by placing the magnet 54 in the motor circuit, means are provided to hold the stop or brake in an inoperative position during the time that the motor is energized. Magnet 54 is shown as supported from a plate 56 secured to the motor frame. The brake is designed so that while it will prevent accidental rotation of the motors, it will not interfere with turning them from handles 27, but rather assists the accuracy of hand setting as pointed out above.

As this invention in its broad aspect is independent of the specific type of step-by-step motors and transmitters used, and as this type of motor is well known, a detailed description of their action and construction will be omitted. In the wiring diagram the transmitters are shown as three pairs of contact points adapted to be brought in contact in succession by the movement of the controlling means. A convenient means of accomplishing this result is shown in Fig. 6, which illustrates one of the turret transmitters 3. This transmitter is designed to be secured so that the gear 57 will mesh with an internal gear 70 on the turret A. Gear 57 rotates the commutator 58 through multiplying gears 59 and 60. The commutator is made in three sections and each section is provided with two diametrically opposite 90° conducting strips 61 grounded to the frame and spaced by insulating blocks. The strips on each section are arranged 30° ahead, so that six different steps are provided for the six pole motors, one step directly under each pole when one brush 62 only is on a conducting strip, and one step between each pair of poles when two brushes are on conducting strips.

The target bearing indicator I may assume any form. It is shown as a dial with a transmitter 5 attached and operated manually by handle 65. It may be made a part of target bearing telescope and located in the fighting top or it may be located at the sub-central station on the battle ship, where the operator may not only receive the true bearings of the target but may, if desired, apply the proper corrections for drift, etc., in setting the indicator, so that the guns will always be pointed in exactly the same direction as indicated by the pointer.

It should be noted that this system has the further advantage that the turret may be set in the proper position in azimuth without sighting from the turret. This makes an important advance in the art, since very often a target is visible from the fighting top when it is obscured by smoke or fog from the turret.

In Figs. 8 to 11 a modification is shown which related more particularly to the local setting or synchronizing means. In place of a setting handle 27 for each dial, I use a single setting handle 27′ and set the dials electrically from it, using switches 100, 101 or 102 to throw the selected motor into circuit with a transmitter 103 operated by the handle. The shaft of handle 27′ is preferably provided with a notched collar 104 against which a roller 105 is held by the spring 106 which supports it. The notch and roller are positioned so that when they are in engagement, the motor armature being actuated from the transmitter will be under a certain pole, thus increasing the

accuracy of the setting or synchronizing operation, through an expediency similar to that described in connection with contact fingers 41 and 42. The transmitter 103 is shown as of the same type as heretofore described. The switches 100, 101 and 102 are shown as of the double throw type. Each switch comprises a plurality of blades 107 on pins 108′ and connected by a rod 108. A spring 109 connects a block 110 secured to said rod to the casing, pulling blades 107 into engagement with the fingers 111, which are connected to one of the master transmitters as shown in Fig. 9. A push button 112 is connected to each switch through block 110. By pushing in on the button, the blades are thrown between fingers 113, connecting a motor with the synchronizing transmitter 103. Rotation of this transmitter through handle 27′ will then set the corresponding dial. A switch 120′ may also be provided which corresponds in function to switch 120 in the other form of the invention. Like switch 120 it is placed in the circuit c'' of the lock magnet 43. It is preferably made a part of the switch 100, so that when the button 112 connected to said switch is pushed in said circuit is broken. It should also be noted in connection with Fig. 9 that it shows the electrical connections where one source of power 114 is used for all the circuits. It is obvious that a single source of power could also be used in the circuits shown in Fig. 4 if so desired.

Fig. 11 shows an alternative form of stop or brake from that shown in Fig. 5. In this form of stop a more positive form of engagement is secured by providing the armature 53′ with a tooth 51′ to engage serrations on the collar 52′. This form of brake is especially adapted for use in connection with the modification shown in Figs. 8 to 10 since the brake will be disengaged by the electric circuit through the setting transmitter and motor and hence the positive engagement between them will not interfere with the local synchronizing of the indicator. In this form it should be noted that both brake 51 and lock 43 both of which may generally be termed locks are rendered inoperative on operation of the local synchronizing means.

The general operation of my system is as follows:—When the ship is going into battle or target practice, each turret indicator is set by handles 27 or handle 27′ at the position in which the turrets are then placed. The pointer p may be set in a similar manner if the position of the target bearing instrument is known or it may be set directly from said instrument by means of the lock 43, as explained above. When the indicator is synchronized, the current is then turned on through the motor coils, so that they will follow every movement of their respective transmitters. As soon as the operator of the indicator I, locates the bearings of the target, if it is used on the target bearing telescope, or is informed of the bearings and range of the target, if it is operated in the sub-central station, he turns it so that it will indicate said bearings, or still better in the latter alternative so that it will indicate the direction in which the gun should be aimed, by applying the above noted corrections. As he turns indicator I, the pointer p in each turret will keep in step. The turret operator then revolves his turret so that indicator pointer a is directly under pointer p, unless he notes that such a position will interfere with the adjacent turrets, by observing the position of pointer p with respect to indicators b. In such a case proper notification could be given either to the operator of the adjacent turrets or the sub-central station. After locating the target and applying the proper elevation to the guns, the operator may either fire the guns immediately or he may take sights on the target himself and apply whatever correction he finds necessary.

In accordance with the provisions of the patent statutes, I have herein described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means. Also, while it is designed to use the various features and elements in the combination and relations described, some of these may be altered and others omitted without interfering with the more general results outlined, and the invention extends to such use.

Having now described my invention, what I claim and desire to secure by Letters Patent is:

1. A turret indicator system comprising a plurality of turrets, an electrical transmitter in each turret actuated by the rotation of the turret, a plurality of position indicators in each turret, each transmitter being connected to a position indicator in each turret.

2. A target turret indicator system comprising a transmitter connected to a turret so as to be actuated thereby, a position indicator in the turret connected therewith, a transmitter on a target bearing instrument, and a target bearing indicator connected therewith and mounted adjacent said position indicator.

3. An indicator for turrets comprising a position indicator adapted to show at each instant the position of its turret and a pointer mounted adjacent thereto and means whereby said pointer is caused to repeat the movements of a distant target bearing instrument.

4. A target bearing indicator system com-

prising a position indicator in the turret connected so as to rotate with the turret, and a target bearing indicator connected therewith and mounted adjacent said position indicator.

5. A multiple turret indicator system comprising a plurality of position indicators in each turret, each indicator being arranged to rotate in step with one of the turrets, and a target bearing indicator in each turret mounted adjacent the position indicator for the inclosing turret, and arranged to rotate in step with a target bearing instrument.

6. A target bearing system for turrets, comprising a master instrument adapted to be set to show the actual position in which the turrets should be placed, a position indicator adapted at each instant to indicate the position of the containing turret, and an indicator adapted to be controlled at a distance from said instrument and to be placed adjacent said position indicator, whereby the guns may be aimed without sighting from the turret.

7. An indicator for turrets comprising a position indicator adapted to show at each instant the position of its turret, and a pointer mounted concentrically therewith and adapted to repeat at a distance the movements of a target bearing instrument.

8. In an indicating system for turrets, a position indicator adapted to show the position of an adjacent turret, and a target indicator mounted adjacent said position indicator and adapted to show the target bearings, whereby the operator of the turret may anticipate an interference between the turrets.

9. A target bearing system for turrets, comprising a master instrument adapted to be set to show the actual position in which the turrets should be placed, a position indicator adapted to show the position of the containing turret, a second indicator adapted at each instant to indicate the position of an adjoining turret, and an indicator adapted to be controlled at a distance from said instrument and to be placed adjacent said position indicator, whereby the guns may be aimed without sighting from the turret.

10. In a repeating system, the combination with an indicator adapted to repeat the movements of a distant master controller, of an electrically controlled lock mounted on said indicator, a plurality of controlling switches for said lock, including a switch controlled from said master controller, and a switch controlled from said indicator, whereby said lock is actuated only when both the controller and indicator switches are closed.

11. In a repeater system, the combination with a repeater motor, an indicating means, and a train of reduction gearing between said motor and indicating means, of an electric lock associated with said system adapted to lock the indicator, and controlling switches for said lock mounted upon a plurality of gears in said gear train, whereby the lock is actuated only when the indicator has reached a predetermined position.

12. In a repeater system the combination with a plurality of concentrically arranged indicators, a repeater motor for each indicator, and a brake on each motor adapted to prevent rotation of the connected indicator when its motor is not energized.

13. In a repeating system, the combination with a repeater motor, an indicating means, and reduction gearing between said motor and indicating means, of a lock for said means comprising a notched collar on a rotary part of said system, of relatively high velocity, a finger movable on a part of the system, and means for causing said finger to engage the notch controlled by the relative position of the indicating means whereby accurate setting is obtained.

14. In a repeater system, the combination with a repeater motor, an indicating means, and reduction gearing between said motor and indicating means, of a lock for said means comprising a notched collar on said motor shaft, a movable finger adapted to engage said notch, an electromagnetic means for controlling said finger, and an electric switch in circuit with said means positioned so as to be closed when the indicator reaches a predetermined position.

15. In a repeater system, the combination with a repeater motor, an indicating means, and reduction gearing between said motor and indicating means, of a lock for said means comprising a notched collar on said motor shaft, a movable finger adapted to engage said notch, electromagnetic means for controlling said finger, and a plurality of electric switches connected in series in circuit with said means, said switches being positioned on different gears so as to rotate at different speeds, whereby the indicator will be locked only when the indicator itself, the transmission gears and the motor are in the correct position.

16. In a repeater system the combination, with a master indicator, of a repeater motor and indicator, reduction gearing between said motor and indicator and a setting handle adapted to be brought into operative engagement with said gearing whereby said indicator may be set to correspond with the master indicator.

17. In a repeater system, the combination with a master indicator adapted to be set in predetermined positions, a switch adjacent thereto, and a repeater indicator controlled thereby, of an electrically controlled lock for said indicator in circuit with said switch, a second switch for said lock mounted to rotate with said indicator, whereby said

repeater indicator may be properly set by closing said first switch and rotating said master indicator.

18. In a repeater system, the combination with an indicator adapted to reproduce the movements of a master controller, of an electrically controlled lock adapted to lock the indicator in a predetermined position, whereby it may be set from the master controller a local setting means adapted to set the indicator directly, and a switch in circuit with said lock connected with said means so that said lock will be rendered inoperative when said means are operated.

19. In a repeater system the combination with a repeater and a controller, of a long distance regulating means for setting the repeater from the controller, a local regulating means mounted on said repeater, and means for rendering one of said means inoperative when the other is actuated.

20. In a repeater system the combination with a repeater and a controller, of a long distance regulating means for setting the repeater from the controller, and a local regulator mounted on said repeater.

21. In a repeater system the combination with a controlling instrument, of a repeating indicator adapted to be controlled from said instrument comprising a motor, an indicating dial, reduction gearing between said motor and dial and means whereby said dial may be synchronized from said instrument.

22. In a repeater system the combination with a controlling instrument, of a repeating indicator adapted to be controlled from said instrument comprising a motor and indicating dial, reduction gearing between said motor and dial and means whereby said dial may be synchronized from said instrument comprising a lock on said indicator controlled from said instrument.

23. In a repeating indicator, an indicating means, a stop or lock operatively connected with said means, a local setting device for said means, and means for rendering said stop or lock inoperative when said device is operated.

24. In an indicator, the combination with a plurality of concentrically arranged indicators, a repeater motor for each indicator, an electric operating means for each motor and a positive means for locking an indicator when disconnected from its operating means whereby it will not be thrown out of position by the operation of the other indicator.

25. In a repeater system, the combination with a sending instrument, of a repeating indicator, a motor connected to said indicator adapted to cause it to repeat at a distance the movements of said instrument, and a lock associated with said indicator, adapted to lock it when it has reached a predetermined position.

26. In a repeating system, the combination with a sending instrument and a transmitter connected thereto, of a repeating indicator comprising a repeater motor adapted to be actuated from said transmitter, an indicator controlled by said motor, a normally inoperative lock for said motor and indicator, adapted when excited to lock the indicator in a predetermined position and means located adjacent said sending instrument for operating said lock.

27. In a gun fire control system, a transmitter adapted to transmit the bearing of a target, a turret position transmitter, a receiving instrument operatively connected to both transmitters and means, in said receiving instrument, for indicating when the turret is trained on the target.

28. In a gun fire control system, a target bearing transmitter, a turret position transmitter, a receiving instrument operatively connected to said transmitters and means including a pointer in said receiving instrument for indicating when a turret is trained on a target.

29. A tell-tale indicator comprising a plurality of concentrically arranged rotatable indicators, concentric hubs and driving gears for said indicators, a step-by-step motor for each of said gears, means whereby a motor may be rendered inoperative and a magnetic stop for a motor adapted to prevent the connected indicator from being rotated by rotation of the other indicators, when said motor is inoperative.

In testimony whereof I, ELMER A. SPERRY, have signed my name to this specification in the presence of two subscribing witnesses, this 26th day of August 1914.

ELMER A. SPERRY.

Witnesses:
L. J. DIBBLE,
EVERETT W. MARKES.

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