

F. W. WOOD.
DANGER ZONE SIGNAL FOR TURRETS.
APPLICATION FILED JUNE 8, 1908.

933,218.

Patented Sept. 7, 1909.
5 SHEETS—SHEET 1.

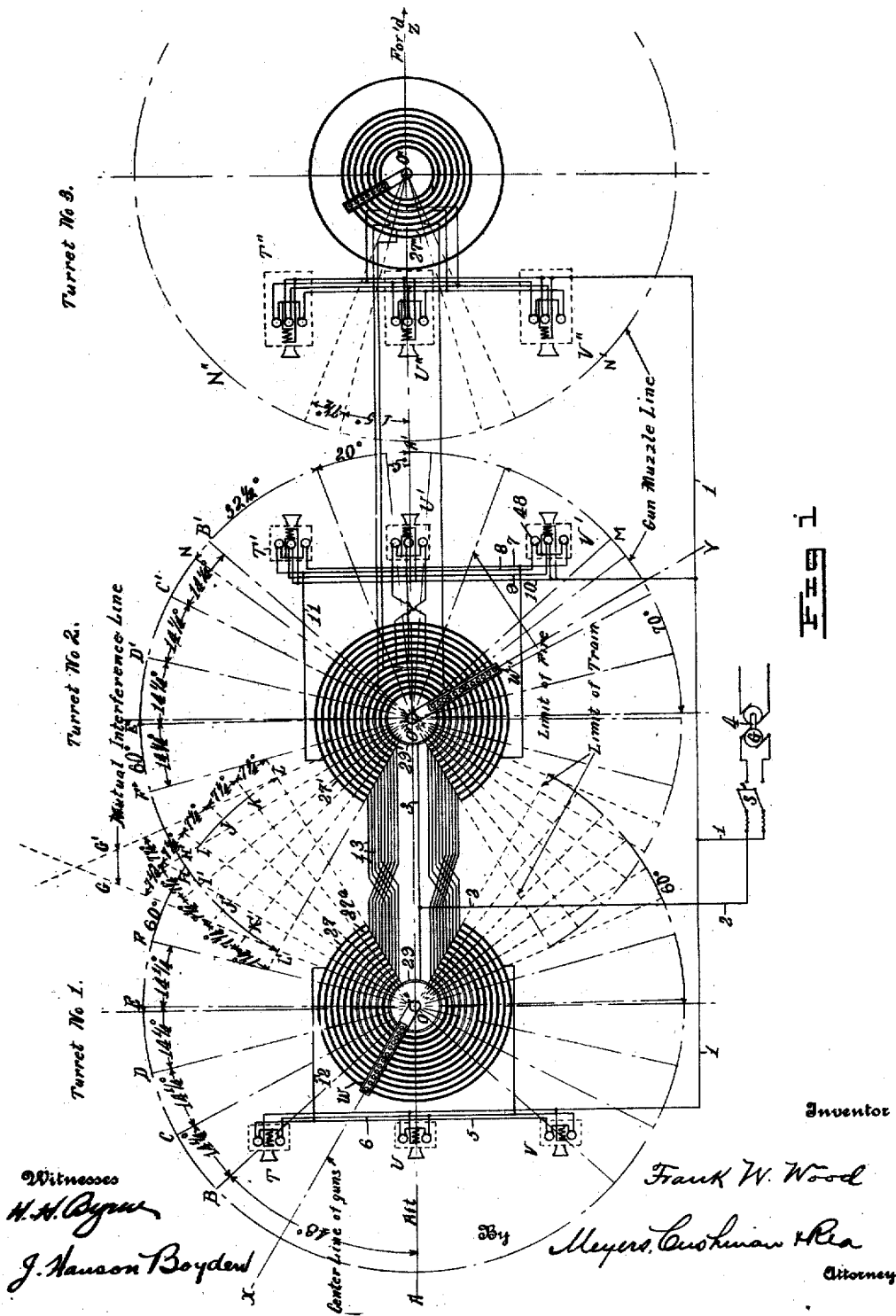


FIG 1

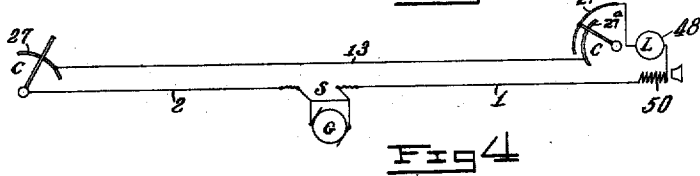
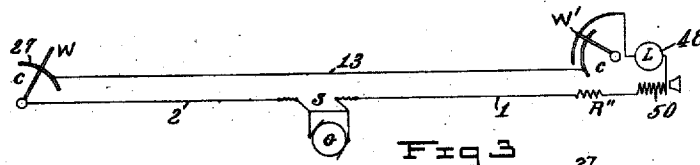
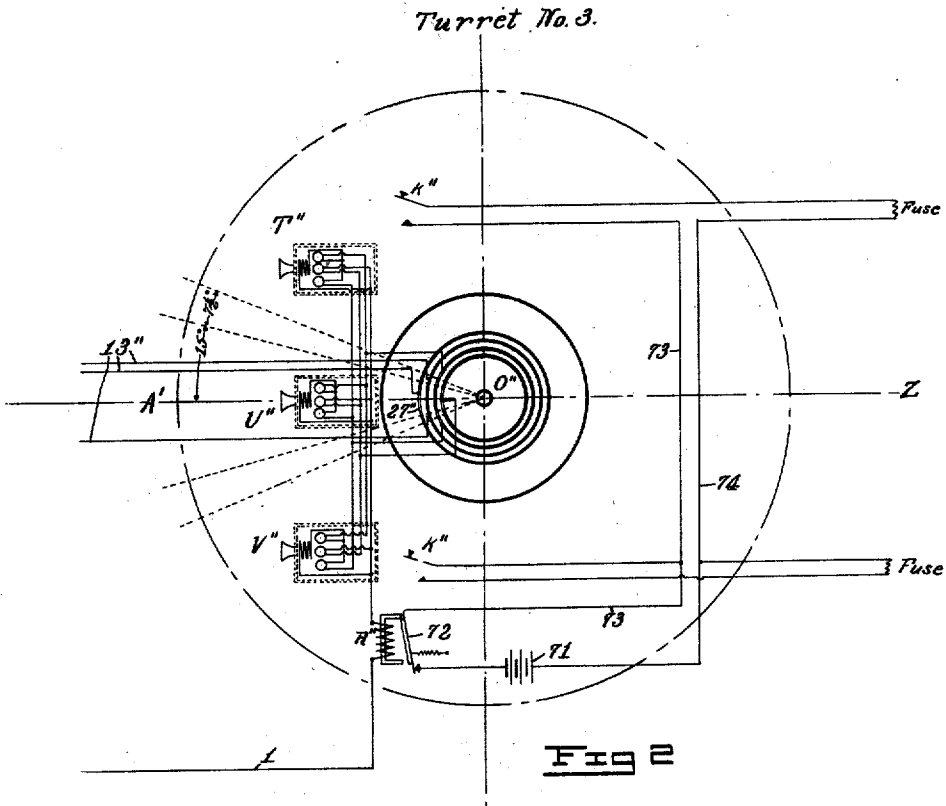
Witnesses
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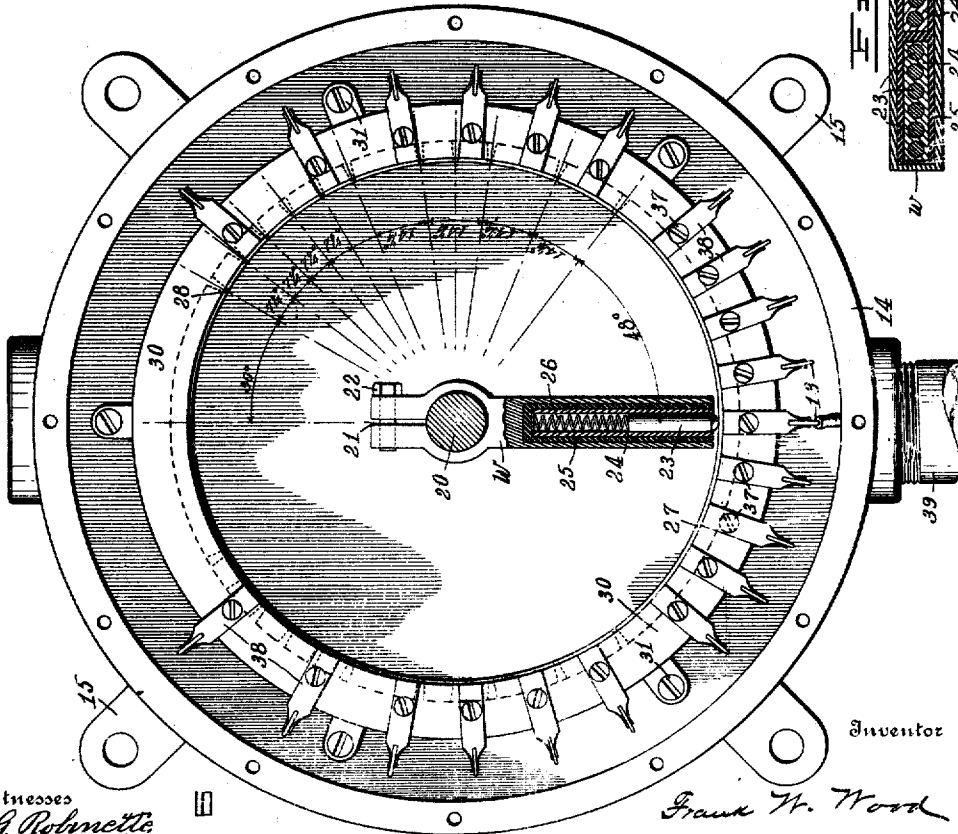
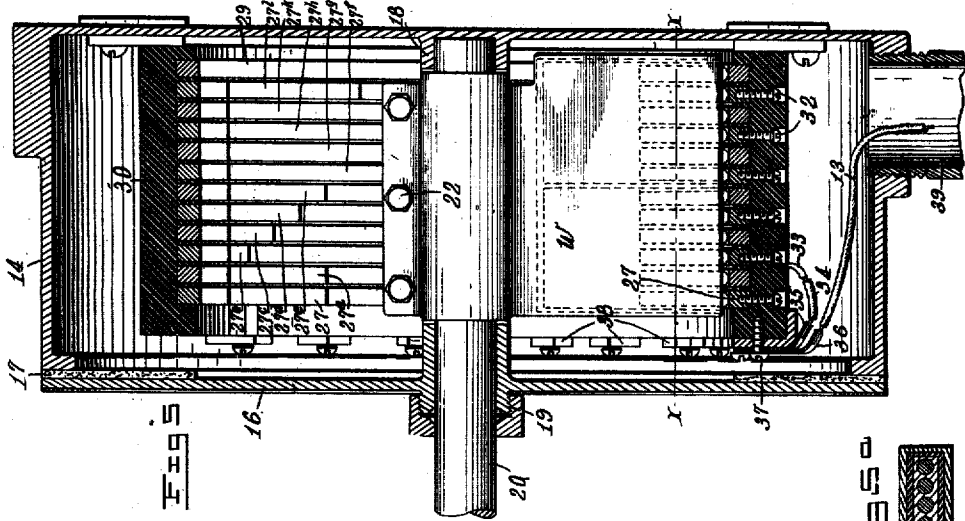
By *Meyers, Cochran & Co.*
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5 SHEETS—SHEET 3.



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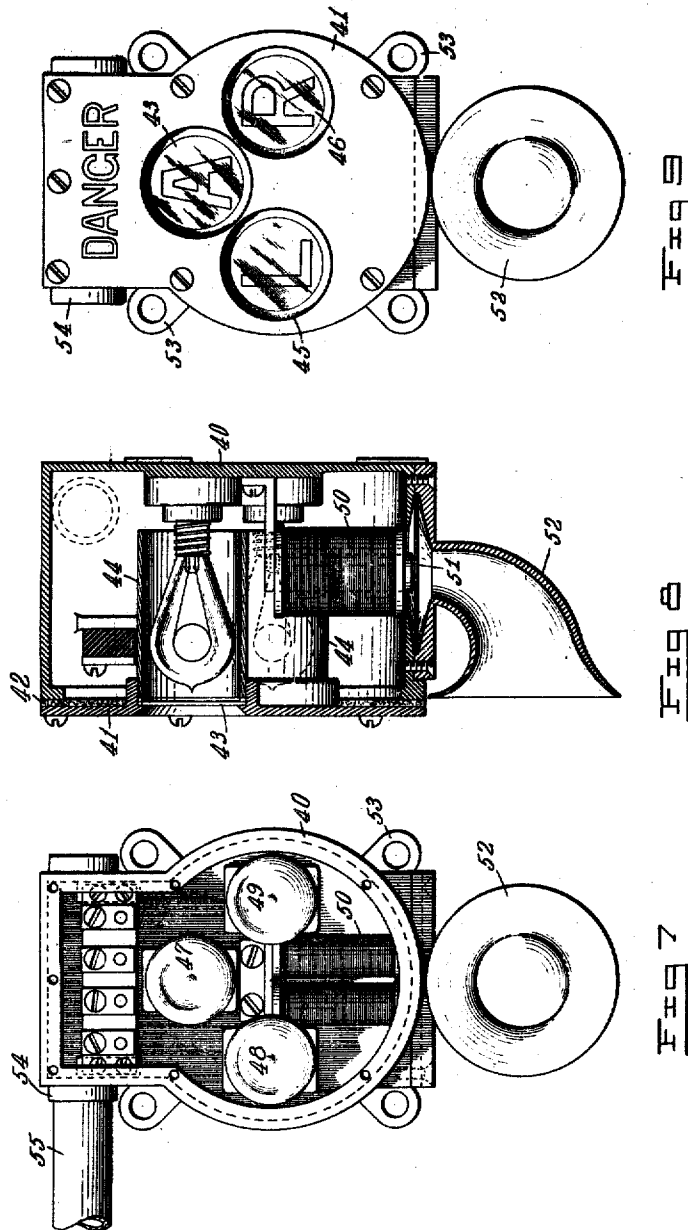
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6 SHEETS—SHEET 4.



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5 SHEETS—SHEET 5.

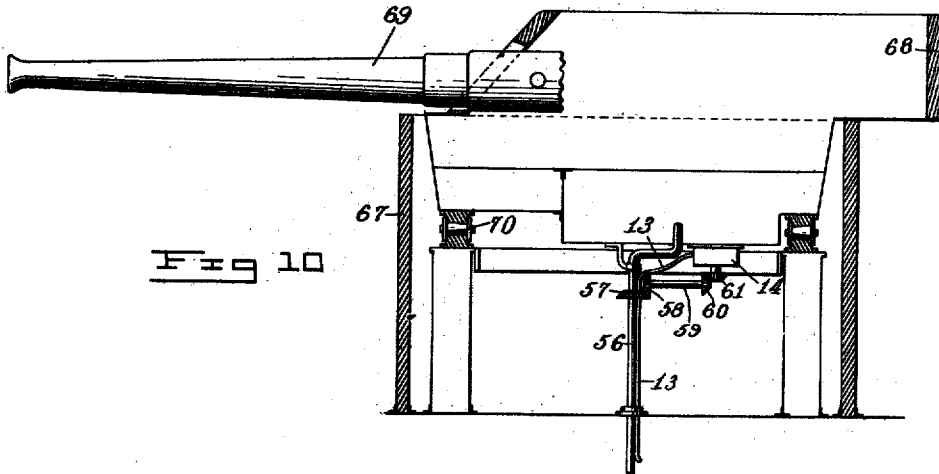


Fig 10

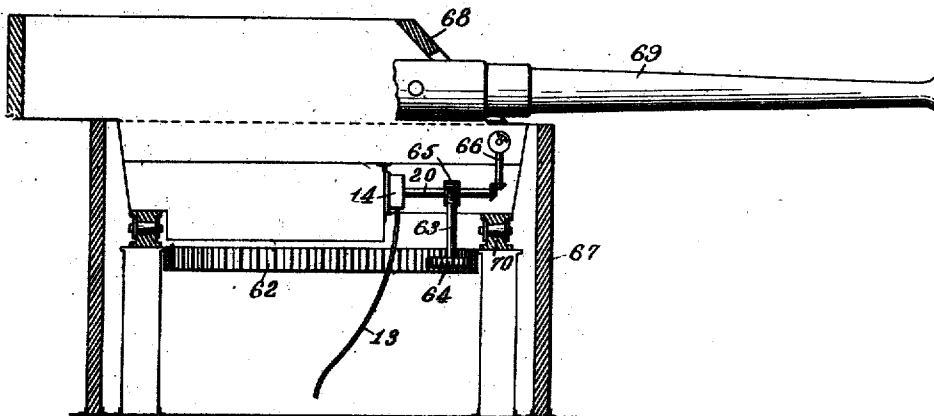


Fig 11

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UNITED STATES PATENT OFFICE.

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DANGER-ZONE SIGNAL FOR TURRETS.

933,218.

Specification of Letters Patent.

Patented Sept. 7, 1909.

Application filed June 8, 1908. Serial No. 437,414.

To all whom it may concern:

Be it known that I, FRANK W. WOOD, a citizen of the United States, residing at Newport News, in the county of Warwick and State of Virginia, have invented new and useful Improvements in Danger-Zone Signals for Turrets, of which the following is a specification.

My invention relates to an electric signaling system, and more particularly to a signaling system especially designed for use in connection with the gun turrets of battleships, and the like.

Certain recently developed classes of ships have been equipped with a plurality of revolving turrets, disposed along the length of the ship at comparatively short intervals apart. In some instances the spacing of the turrets is no greater than the length of the guns carried thereby, and the guns may lie in the same or different planes. Whatever the specific arrangement, it is obvious that the guns of adjacent turrets may frequently be trained in such direction that a shot or blast from one gun would be likely to injure or damage another gun, its turret, or parts of the ship. Since the gunners in the several turrets are so situated, on account of armor, etc., that the occupants of one turret cannot see the other turret, or the position of its guns, recourse must be had to signaling devices for warning the gunners of danger.

The primary object of the present invention is, therefore, to provide a signaling system which shall serve to automatically notify the gunners in any turret when their guns are trained in such a direction as to endanger any other turret or part of the ship.

A further object of the invention is to provide such a system which shall also serve to simultaneously notify the gunners in two or more adjacent turrets when their guns are trained in such a direction as to give rise to mutual interference.

A further object of the invention is to so arrange the system that not only will signals be given under danger conditions, but also the firing circuits of the interfering guns may be so controlled as to render an injurious shot impossible.

Still further objects of the invention are to provide a simple and effective circuit controlling mechanism for producing the above results, and to provide an improved signal-

ing instrument especially designed for the work which it has to perform.

With the above and other objects in view, the invention consists in the construction and arrangement of parts hereinafter described, and illustrated in the accompanying drawings, in which:

Figure 1 is a diagrammatic view illustrating the electrical connections employed in carrying out my invention; Fig. 2 is a similar diagrammatic view of a part of the circuits illustrated in Fig. 1, but showing a slightly modified arrangement; Figs. 3 and 4 are diagrams illustrating the elementary circuits as employed in Figs. 1 and 2; Fig. 5 is a central transverse section through my improved circuit controlling device; Fig. 5^a is a transverse section through the contact arm, on the line $x-x$ of Fig. 5. Fig. 6 is a plan view thereof, with the cover removed; Fig. 7 is a front elevation, with cover removed, of my improved signaling instrument; Fig. 8 is a central transverse section thereof; Fig. 9 is a front elevation of the signaling instrument as it appears in use; Fig. 10 is a sectional view conventionally illustrating a turret and showing the manner of applying my invention thereto; Fig. 11 is a similar view showing a slightly different arrangement.

Referring to the drawings in detail, and more particularly to Fig. 1, O, O' and O'' represent the centers of three adjacent turrets, two of which, those represented by O and O', having their guns lying in the same plane, and the third one having its guns disposed in a different plane. The line A-Z indicates the direction of the center line or keel of the ship.

In carrying out my improved system of signaling I make use of the apparatus illustrated in Figs. 5 to 9 inclusive, such apparatus comprising a circuit controller and a signaling instrument.

As shown in Figs. 5 and 6, the circuit controller comprises a suitable casing 14, preferably cylindrical, and provided with lugs 15, by means of which it may be secured in position on a turret. A top plate or cover 16 is secured to the casing, and suitable water proof packing 17 is interposed between the cover and casing. Journaled in a socket 18 formed at one end of the casing and extending through a stuffing box 19 carried by the cover plate, is a shaft 20. Rigidly secured to

this shaft 20 is the contact making arm, which is designated in its entirety by the reference character W. As clearly shown in Fig. 6, this arm comprises a bifurcated portion 21, which is slipped over the shaft and clamped in position by means of bolts 22.

At its end, the arm W carries a series of contact brushes 23 which preferably consist of sticks of carbon slidably mounted in metal blocks 24, 24', carried by said arm and surrounded by insulating material 25. The contact brushes, of which in the present instance, twelve are illustrated, are thus divided into two groups of six each, the groups being entirely insulated from each other, but all the brushes of each group being electrically connected by means of the blocks 24, 24'. Coil springs 26 bear against the inner ends of said brushes and urge them outwardly into engagement with the contact strips, now to be described. These contact strips, which are designated by reference characters 27, 27^a, 27^b, etc., and 29, are preferably rings of copper which are embedded in the inner face of an annular ring or drum, 30 of insulating material. (See Fig. 5). As clearly shown, these strips are separated by ribs of insulation, and are so formed as to constitute smooth continuous bearing surfaces for the brushes 23. The contact strips are divided by means of insulation 28, into the required segments, as hereinafter explained. The drum 30 is secured to the bottom of the casing 14, as by means of screws 31. Screws 32 pass through the drum 30 and tap into the several contact strips above described, and connections, such as 33, 34, 35, extend from these screws 32, to suitable binding posts 37, 38, secured to the edge of the drum 30. To these binding posts are also secured terminals 36, and from these terminals 36 extend wires 13 in the form of a cable, to a similar circuit controlling device on the other turret and to the signaling instruments. A pipe 39 is preferably screwed into the casing 14 to form a conduit for carrying and protecting this cable.

Referring now more particularly to Figs. 7 to 9, my improved signaling instrument comprises a casing 40, having a front wall or cover 41 secured thereto, and provided with a packing 42, to render the casing water tight. The front wall of the casing is provided with three bull's eyes 43, 45, 46, on which the letters "L," "A," and "R," are formed, and above these bull's eyes is written the word "Danger." Extending inwardly from each bull's eye is a tube 44 and arranged within these tubes are three electric lamps 47, 48, 49. Also located within the casing, and below these lamps, is an electromagnet 50, having downwardly projecting pole pieces, adjacent which is arranged a diaphragm 51. From the diaphragm pro-

jects a downwardly and forwardly extending horn or trumpet 52. Lugs 53 are provided, for securing the signaling instrument in position, and the casing is formed with a socket 54 for the reception of a pipe 55, which contains the wiring. In some instances, the middle lamp and bull's eye marked "A" may be omitted. The electromagnet 50 and diaphragm 51 constitute a device commonly known as an electric horn or "howler," which operates to produce a loud buzzing sound when the magnet 50 is supplied with an alternating or pulsating current.

Referring again to Fig. 1 it will be seen that there are three of these signaling instruments designated by the letters T, U, V, in each turret, arranged at the stations of the two gunners and the gun trainer. Current for operating the system is preferably furnished by a motor generator delivering an alternating current. Extending from this generator, and controlled by means of a switch S, are the two main supply wires 1 and 2. The wire 1 has branches extending to each of the turrets, and the wire 2 taps a wire 3, which extends between turrets Numbers 1 and 2. This wire 3 connects at its ends with the contact strips 29 and 29' which are continuous and which form a common return for the various other circuits hereinafter referred to. In this figure is diagrammatically shown a development of the circuit controlling device illustrated in Figs. 5 and 6, the contact arm being designated by the letter W, and the small circles on such arm representing the contact brushes 23. The solid black portions of the circular arcs represent those parts of the contact strips which are not active, and which are separated by insulation from the adjacent parts and the active portions are disposed on each side, in sets of progressively increasing length. The arrangement of the system will be best understood by a description of its operation. The arcs representing the path described by the muzzles of the guns has been arbitrarily divided into certain sections designated by the letters B, C, D, etc., and B', C', D', etc. The lines O X, O' Y represent the direction of the axes of the guns. It will be assumed that the guns of turret No. 1 are trained into the position indicated by the line C. It is evident therefore, that if at the same time, the guns of turret No. 2 are trained in a direction represented by the line O'—K', or O'—L', a shot from the guns of turret No. 2 would be likely to injure the muzzle of the guns of turret No. 1, since the line of fire crosses the axes of these guns. With the two turrets in this position circuit can be traced from wire 2 to wire 3, contact strip 29, then through block 24' of contact arm W to contact strip 37' thence by one of the wires 13 to the corresponding contact

strip on the circuit controlling device of turret No. 2, thence by block 24 of arm W', to contact strip 27', thence by wire 11, through the signal lamp and howler magnet of each of the signal instruments, T', U', V', in multiple relation to wire 1. A signal will thus be given to warn the gunners in turret No. 2 that they are in danger of damaging turret No. 1. It will be noted in this connection that the particular lamp of the signaling instruments, T', etc., which is illuminated is lamp 48, associated with the letter "L" and this serves to indicate to the gunners that the object which they are in danger of damaging is situated on their left. The signals so given will continue to sound, in turret No. 2 uninterruptedly until turret No. 2 is swung to the right, past the position K', or else turret No. 1 is swung to the left, past the position B.

It will be supposed that turret No. 2 continues to swing to the right until it occupies the position indicated by the line G'. If, then, turret No. 1 is swung toward the right until it reaches the position indicated by the line O—G, circuit can be traced as before through the signaling instruments, T', U', and V', and also through wire 3, contact strip 29', block 24' of contact arm W', to one of the contact strips associated therewith, thence over one of the wires 13 to contact strip 27', on turret No. 1, thence by wire 12, through the signaling devices T, U, and V, on turret No. 1, back to wire 1. It will thus be seen that in certain positions which I have designated "positions of mutual interference," signals will be given in both turrets, and will continue uninterruptedly until such mutual interference zone has been passed. It will be understood that this line of mutual interference is reached just before the guns mechanically foul each other. In such position, although the guns are not in the actual line of each other's fire, each is liable to be damaged by the blast from the other.

Suppose now that turret No. 2 continues to swing to the right, and that the guns occupy the position indicated say, by the line D'. In this position it will be observed by reference to the diagram that the signals in turret No. 2 will be silent, owing to the fact that the contact arm W' has moved out of contact with the outer series of contact strips. If, however, the guns of turret No. 1 are now trained to the position indicated by the line K, for instance, a circuit can be traced from wire 2, contact strip 29', block 24' of arm W', one of the longer contact strips of turret No. 2, over a corresponding wire 13, to contact strip 27', of turret No. 1, thence through block 24 of contact arm W, to contact strip 27, thence over wire 12, through the signaling instruments of turret No. 1, back to the generator by way of wires

5, and 1. It will therefore be seen that as soon as the guns of one turret are in danger of injuring any adjacent turret, the signals will be continuously displayed in such turret and that in case the guns of two adjacent turrets are so trained as to give rise to mutual interference, the signals of both turrets will be sounded continuously until one or the other moves out of such mutual interference zone, whereupon the signals of one turret will continue to sound so long as it is in an "endangering" position in regard to the other, or until the danger zone has been passed.

Similar operations may take place and similar circuits be traced between turrets No. 2 and No. 3, when they occupy the mutual interference zone indicated by the letters M, N, N', N'', and it is believed that the operation of this part of the system will be readily understood from the preceding description. It will be noted, too, that the active insulated contact segments for this purpose form smooth continuations of the segments 27, etc., employed for turrets No. 1 and No. 2. In connection with turrets No. 2, and No. 3, it may be stated that the guns are normally housed in the "amidship" position, when not in use, and the middle bull's eye, bearing the letter "A" is then illuminated. By reference to Fig. 1, however, it will be noted that the middle lamp in these instruments is not in circuit with the howler, and therefore no audible signal is produced for the "amidship" indication. The contact strips of turret No. 2 are so arranged that this "amidship" signal is displayed, immediately upon the guns passing the "limit of fire" line, and in approaching this line from either direction, the "R" or "L" signal is displayed, and the horn sounded, so as to keep the gunners on the alert.

By reference to Figs. 3 and 4, the connections of the circuits just traced will be made clearer. The same reference characters are used as in the other diagrams in order to maintain uniformity of description, and to show the relation of the parts.

While, in most cases, the mere giving of the signals described will be sufficient, it may, in some instances, be desirable to positively prevent the firing of the guns of any turret when they are in "endangering" position. To this end, I arrange a relay as indicated at R'' (see Fig. 2) in the common return wire 1, and provide this relay with an armature 72 which controls the circuit of a battery 71, which battery, by means of the wires 73, 74 furnishes current for the firing fuses of the guns. Such fuses are controlled manually by means of the firing keys K'', but it will be evident that the circuit can not be closed by these keys when the armature 72 is attracted by its relay.

This attraction will always occur whenever the signals T'', U'', V'' are in operation, or in other words, whenever the guns of the turret lie within the danger zone. It will be understood, of course, that while I have shown a relay applied only to turret No. 3, in this figure, I contemplate the application of relays such as R'', to the circuits of as many of the turrets as may be desirable.

In Fig. 10 I have illustrated one method of mounting my improved circuit controller 14 on the bottom of the turret 68. The shaft 20 of the circuit controller is provided with a beveled gear 61, which meshes with the beveled gear 60, carried by a shaft 59, on which shaft is also mounted a beveled gear 58, which meshes with a similar gear 57, rigidly secured to the usual compressed air pipe 56, which is stationary, and which projects up along the axis of the turret. It will, therefore, be obvious that as the turret revolves on its rollers 70, the beveled gears will cause the operation of the contact arm W, as described.

In Fig. 11, I have shown a slightly different arrangement. Here the circuit controller 14 has a worm gear 65 secured to its shaft 20, and driven by means of a shaft 63, carrying on its end a pinion 64, which meshes with a large annular gear wheel 62, secured to the turret foundations. It will be apparent that as the turret revolves, this gear wheel 64 will impart movement to the contact arm W as above.

67 represents the barbette armor, and 69 the guns. 66 is the usual mechanical indicator employed. 13 indicates the cable of controlling wires which extends from one turret to the other, and, in Fig. 10, is arranged adjacent the axis of the turret, so that the movement of the parts will not be interfered with.

While I have shown my signaling system as applied to gun turrets, it is evident that, in many of its aspects, my invention may be employed to indicate the relative angular position of any pivotally mounted objects whatsoever.

It will thus be seen that I have devised a system of signaling which readily lends itself to any practical requirements, and it is thought the many advantageous features of my invention will be quickly appreciated by those skilled in the art.

What I claim is:—

1. In combination with a pair of turrets, an electrical signaling system therefor including signaling instruments, and circuit controlling devices carried by and within said turrets, each of said circuit controlling devices comprising a series of contact strips of progressively increasing length, and a sweep arm having contact brushes adapted to engage said strips as the turret is turned,

and electrical connections between some of said strips and said signaling instruments.

2. In an electric signaling system for turrets, signaling instruments and circuit controlling devices carried by and with the turrets, each circuit controlling device comprising a series of annular contact strips, contact brushes coöperating with said strips, circuit wires connecting the corresponding strips of each series, and circuit wires connecting one strip of each series with its respective signaling instrument.

3. In an electric signaling system for turrets, a signaling instrument for each turret comprising "right" and "left" signals, a circuit controlling device carried by and within each turret and actuated by the movement thereof, each such circuit controlling device comprising a contact arm and two series of annular contact strips coöperating therewith, said series of contact strips being arranged at opposite sides of the center of rotation of said contact arm, an electrical connection between a strip of one series and said "right" signal, and an electrical connection between a strip of the other series and said "left" signal.

4. In an electric signaling system for turrets, a signaling system for each turret comprising "right" and "left" signals, a circuit controlling device carried by and within each turret and actuated by the movement thereof, each of said circuit controlling devices comprising a contact arm, and two series of annular contact strips coöperating therewith, said series of contact strips being arranged at opposite sides of the center of rotation of said contact arm, and said contact arm being mechanically geared to the inside of the turret by toothed gearing in such a manner that uniform rotation of said contact arm is had upon the movement of the turret, and electrical connection between a strip of one series and said right signal, and electrical connection between a strip of the other series and said left signal.

5. In an electric signaling system for turrets, a circuit controlling device mounted on each turret, and actuated by the rotation thereof, a signaling instrument for each turret comprising an audible signal, and a plurality of visual signals including "right," "left" and "amidships" indications, and means governed by said circuit controlling devices for closing a circuit through either said "right" or "left" signal and said audible signal, under one set of conditions, and for closing a circuit through said "amidships" signal, alone, under another set of conditions.

6. In an electric signaling system for turrets, a signaling instrument for each turret, comprising a plurality of signals including "right," "left," and "amidships" indications, circuit-controlling devices mounted on

each turret and comprising three sets of contacts, and a single controlling arm cooperating therewith to close, under one set of conditions, a circuit through one set of contacts to the said "right" signal, to close under another set of conditions through another of said sets of contacts a circuit through said "left" signal, and to close under a third set of conditions a circuit through the third of said sets of contacts, and through said "amidships" signal.

7. In combination with a pair of adjacent turrets, a signaling instrument for each turret, a circuit-controlling device carried by and within each turret and actuated by the movement thereof, and comprising an annular series of contacts and a single cooperating arm, and connections from the controlling devices to the signaling instrument, the parts being so arranged that in certain positions the said devices jointly serve to close a circuit through one of said instruments, and in certain other positions jointly serve to close a circuit through both of said instruments.

8. In combination, a pair of adjacent guns movable angularly with respect to each

other, a signaling instrument and circuits therefor controlled by the relative angular position of the guns, and arranged to be operated when the guns are in a predetermined angular position with respect to each other to warn gunners of danger of cross fire, and means in said signaling circuits for positively preventing the firing of a gun in disobedience to a danger indication of the signaling instrument.

9. In combination with a gun, a signaling instrument, and circuits therefor controlled by the position of the gun for indicating the position of the gun which will endanger an adjacent object upon the firing of the gun, and means in the said signaling circuits for positively preventing the firing of the gun in disobedience of the indication of said signaling instrument.

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

FRANK W. WOOD.

Witnesses:

J. E. WARREN,
E. W. HOUSE.