(No Model.)

4 Sheets—Sheet 1.

G. BERTOLINI.

ELECTRICAL APPARATUS FOR FIRING SUBMARINE MINES.

No. 513,294. Patented Jan. 23, 1894.

Fig. 1.

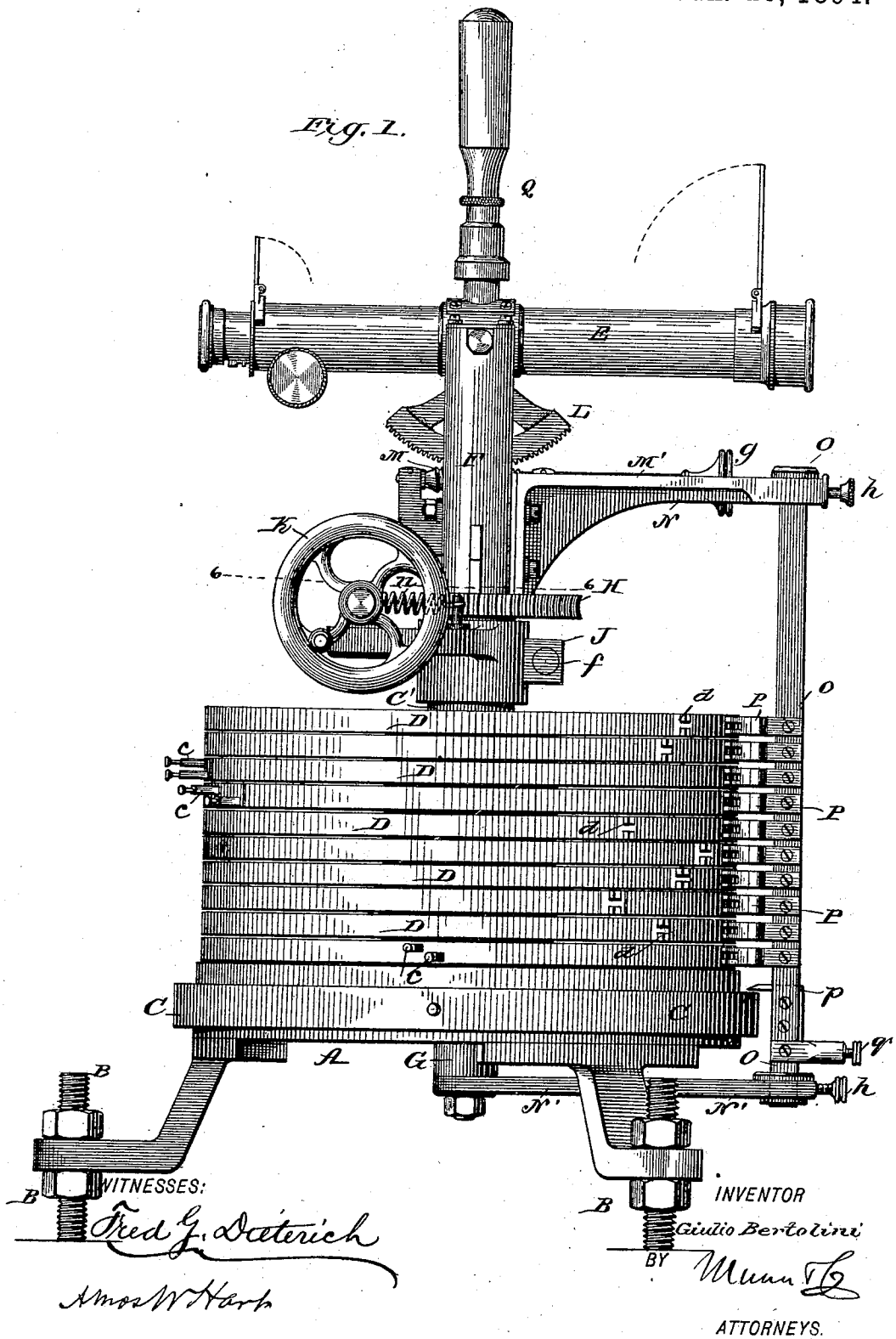

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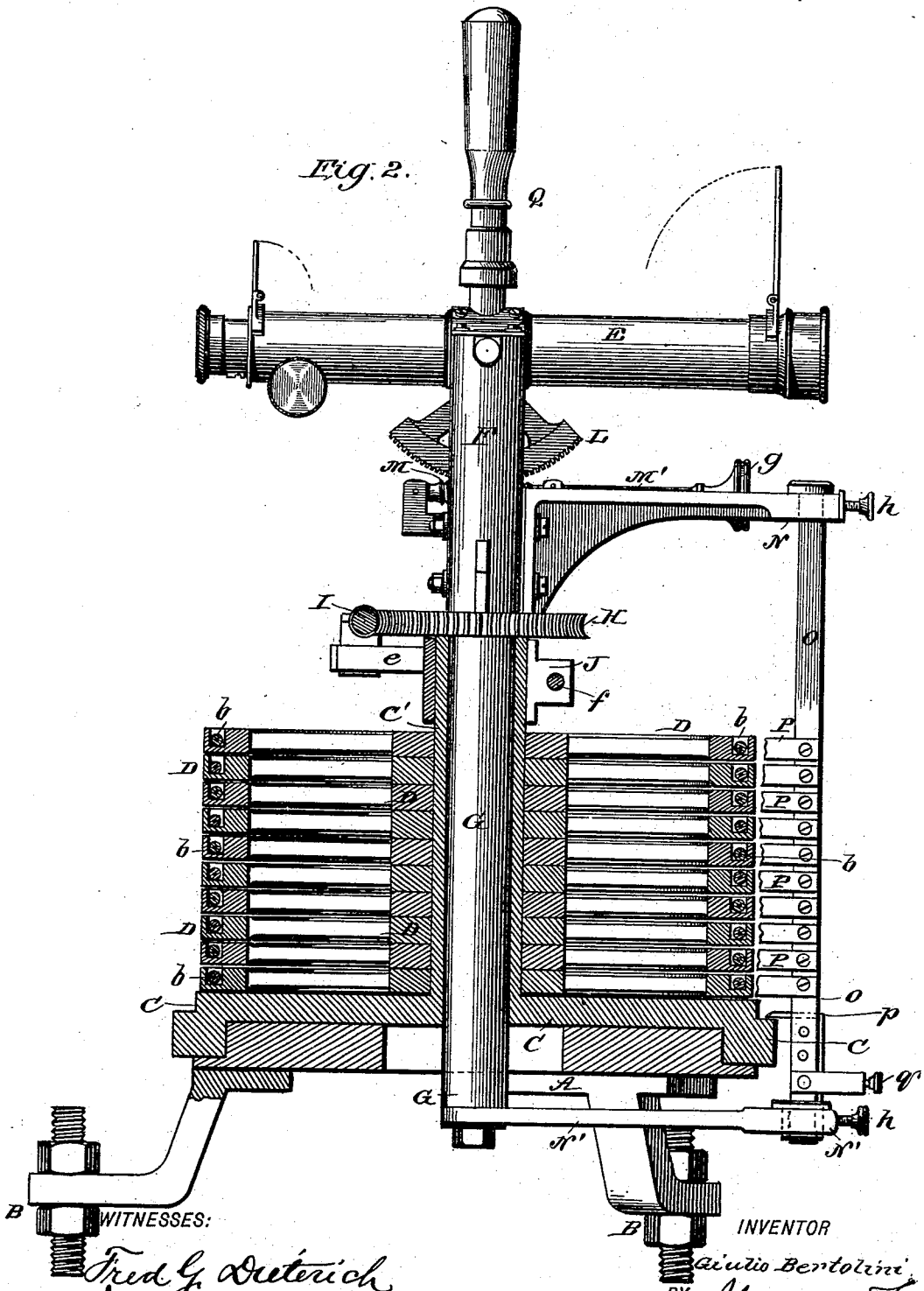
Fig. 2.



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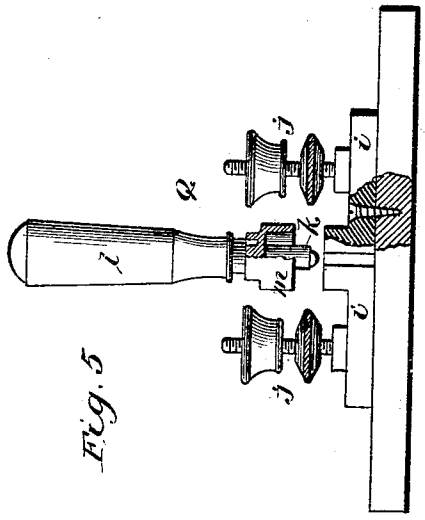

Fig. 5

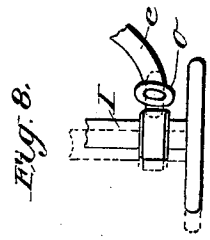

Fig. 8.

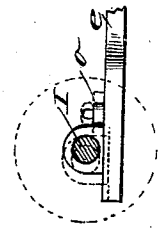

Fig. 7.

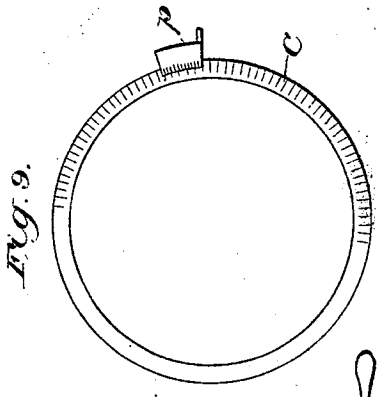

Fig. 9.

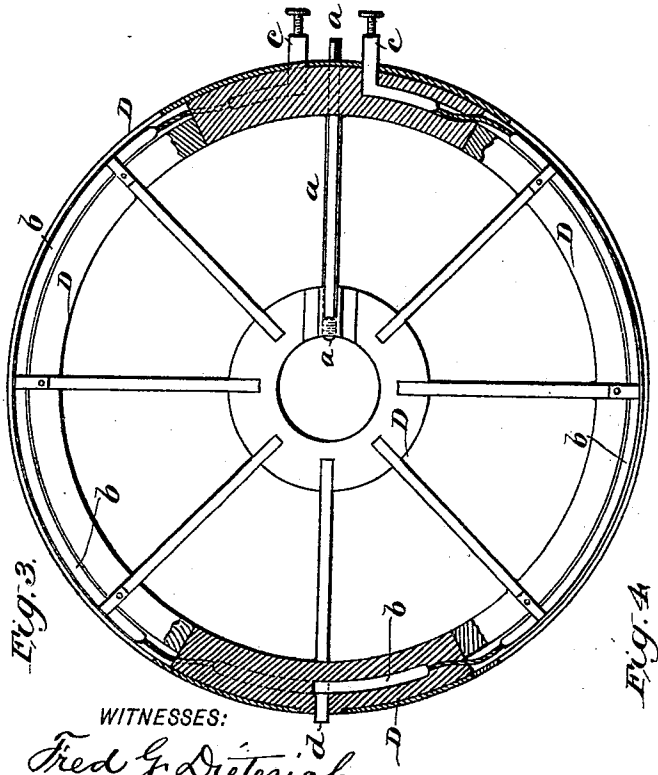

Fig. 3.

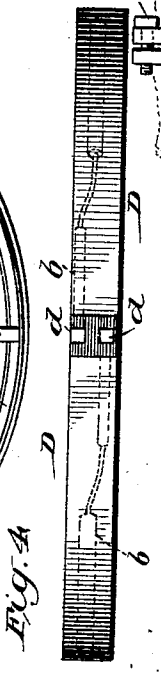

Fig. 4.

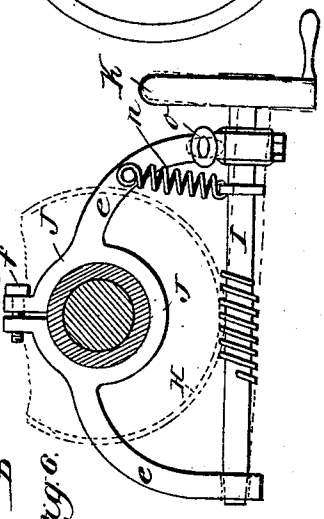

Fig. 6.

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Fig. 10.

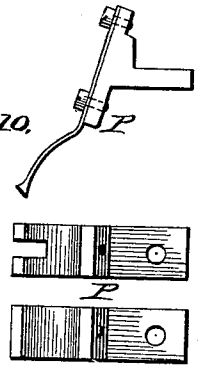


Fig. 11a.

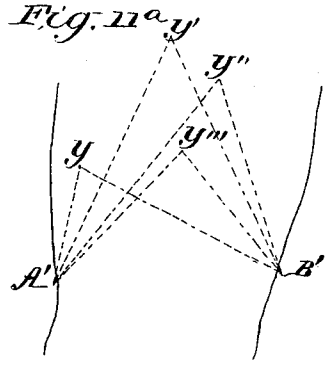


Fig. 11.

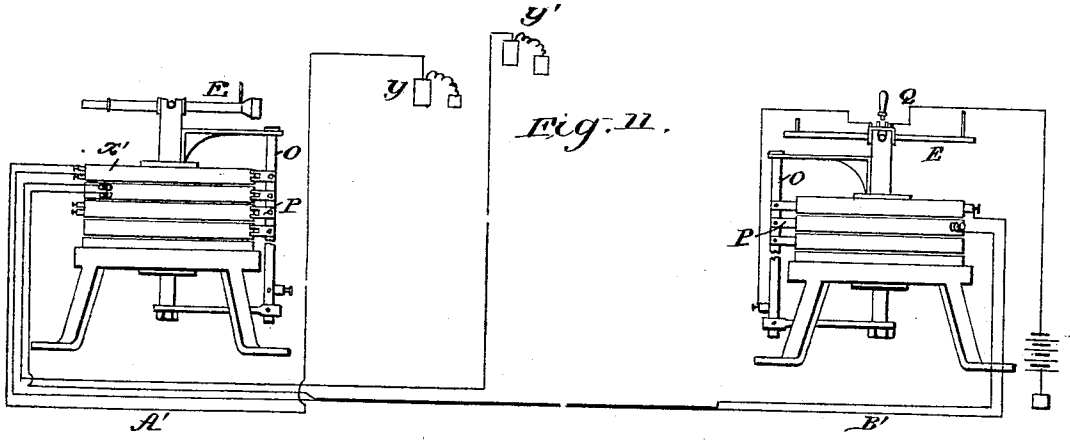
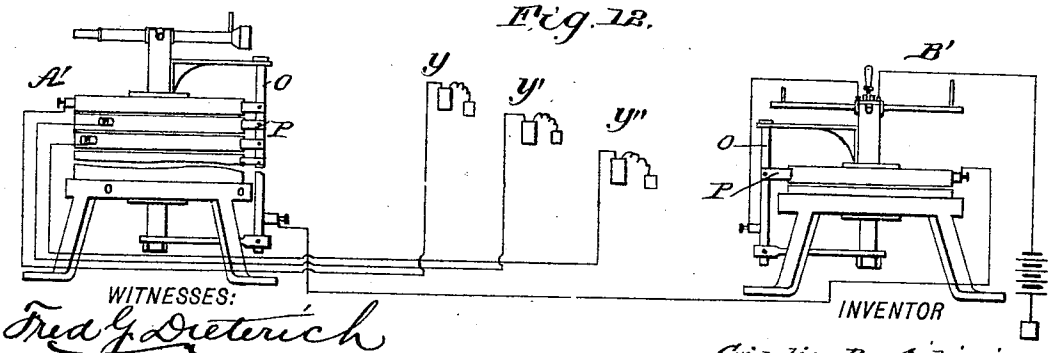


Fig. 12.



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UNITED STATES PATENT OFFICE.

GIULIO BERTOLINI, OF VENICE, ITALY.

ELECTRICAL APPARATUS FOR FIRING SUBMARINE MINES.

SPECIFICATION forming part of Letters Patent No. 513,294, dated January 23, 1894.

Application filed April 6, 1892. Serial No. 428,095. (No model.) Patented in Italy September 22, 1891, No. 30,304.

To all whom it may concern:

Be it known that I, GIULIO BERTOLINI, naval lieutenant, a subject of the King of Italy, and a resident of Venice, (Santi Apostoli, Calle della Pergola,) Italy, have invented certain new and useful Improvements in or Relating to Electrical Apparatus for Firing Submarine Mines, (for which I have obtained Letters Patent in Italy, No. 30,304, dated September 22, 1891,) of which the following is a specification.

My invention is designed for use in war, and mainly for exploding submarine mines, or torpedoes, by means of electrical connections which enable an electrical circuit to be formed at the required time. It is also applicable for some allied uses, such as firing guns on board ship, or in a shore battery.

The construction of the apparatus and its manner of use are hereinafter set forth.

The construction of the apparatus and its manner of use are hereinafter set forth. The main part of the apparatus is an instrument adapted for use for closing an electrical circuit through any one of several torpedoes, or guns, with which it is connected by suitable conductors.

Figure 1 is a side view of such instrument. Fig. 2 is a vertical central section of the same. Fig. 3 is a plan view of one of the disks containing an electrical conductor and forming part of the said instrument. Fig. 4 is a side view of such disk. Fig. 5 is a detail view of the circuit-closer employed in connection with said instrument. Fig. 6 is a horizontal section on line 6—6 of Fig. 1. Figs. 7, 8, 9, and 10 are detail views hereinafter referred to. Fig. 11 is, mainly, a diagrammatic view illustrating the position or relative arrangement of instruments and torpedoes, and the electrical connections of the same, in a practical plant. Fig. 11ª is a diagram illustrating the position of torpedoes relative to the observation stations A′ and B′ when no two torpedoes are in line with either station. Fig. 12 is a diagrammatic view, corresponding to Fig. 11 in most particulars, but illustrating the connection of the two instruments at stations A′, B′, when the torpedoes are in line with one of the latter.

Referring, in the first instance, particularly to Figs. 1 and 2, the working parts of my instrument are shown supported upon a stand, A, whose legs are provided with leveling screws, B. The top of this stand is a circular plate, C, provided with an integral, central, vertical tube, or cylinder, C′, on which are placed as many circular plates, or disks, D, as there are submarine mines, or other electrical devices, to be fired. Each disk, D, is secured on the tube, C′, by means of a radial clamp-screw, *a*. Shown best in Fig. 3. Each disk has a circular groove (see Figs. 3 and 4) in its upper side, near its periphery, in which is laid an electrical conductor, *b*, whose terminals are a binding post, *c*, and a contact piece, *d*, both of which (*c* and *d*) project from the periphery of the disk. I use one or two such conductors, *b*, according to conditions hereinafter stated. It will be understood that the said conductor and its terminals are insulated from the disk.

A sighting telescope, E, is mounted by trunnions in the forked upper end of a column, F, which has a fixed attachment with a spindle, G, (see Fig. 2), that passes through the tube, C′, of the base plate, C. A segmental worm gear, H, is fixed on the lower end of said column, F, and normally engages a horizontal worm shaft, I, whose bearings are supported on the branched arms, *e*, (see Fig. 6,) of a collar J, which is secured on the tube, C′, by means of a screw passing through radial flange, *s*, as shown in Figs. 1 and 2. A hand wheel, K, (Figs. 1 and 6) is fixed on one end of the worm shaft, I, for use in rotating it to turn and adjust the telescope in horizontal range.

For the purpose of adjusting the telescope in vertical range, a worm segment, L, is attached to it at the pivotal point, and engages a worm, M, which is operated by a shaft, M′, having an enlarged milled head, *g*. By means of the two worm segments H, L, and worm shafts, I, M, above referred to, the telescope, E, may obviously be made to follow a ship, or other vessel, sailing on any course.

The horizontal adjustment of the telescope effects the simultaneous and like adjustment of an electrical contact device, whose construction and arrangement are as follows:

An arm, N, in the nature of a bracket, is bolted to the column, F, above the worm gear, H, and extends horizontally to a point beyond the peripheries of the disks, D. The outer end of this bracket is provided with a lengthwise slot to receive a bar, O, which hangs vertically parallel to the superposed disks, D,

and whose lower end is held in a slot of a horizontal arm, N′, whose inner end is secured on the polygonal lower end of the spindle, G. The vertical bar is held in the slots of such parallel arms N, and N′, by means of clamp-screws, *h*. Plate springs, P, are attached to the bar O, one for each disk, D, and their ends bear on the peripheries of the disks, as shown in Figs. 1, 11, and 12. It will now be apparent that, if the telescope be moved to the right or left, in following a vessel, the column, F, and spindle, G, being rigidly connected, will be also rotated at the same time, or correspondingly, and the pendent vertical bar, O, will necessarily be carried around with them, so that the springs, P, will be caused to sweep over the peripheries of the disks, D, and thus come in contact with the pieces, *d*, which project from the disks, as shown in Figs. 3 and 4, and form part of the electrical circuit. It is further apparent that, if the bar, O, be electrically insulated from the arms or brackets N, N′, and suitable circuit connections be made, a circuit will be completed whenever the springs, P, touch one of the contact pieces, *d*.

In Fig. 10, I show two forms of the springs, one being forked at the free end and the other not. I preferably use the forked spring in connection with disks having two contact pieces, and the other form with a disk having but one contact piece.

I will now describe the practical application and use of the invention, as illustrated in Figs. 11, 11ª, and 12.

In the diagram shown in Fig. 11ª, a number of submarine mines, or torpedoes, *y*, *y′*, *y″*, is shown, they being arranged at different points in the water, and no two of which are in line with either of the two points A′ and B′, which are observing stations on shore. An instrument such as has been described is located at each point A′ and B′ as shown in Fig. 11. Each disk of the instrument at A′ has two contacts and two conductors and binding-posts, as shown in Fig. 4. From one of the binding-posts of the upper disk, *x′*, a wire extends to the torpedo, *y′*, and from the adjacent post of the same disk another wire extends to a disk of the instrument at station B′. The connections are similar, or correspond, for each of the other torpedoes that may be used, as will be readily understood. Each torpedo is grounded, and a grounded battery is connected in open circuit with the bar, O, of the instrument at B′. It will be understood that each disk of the instrument at A′, is so adjusted that its contact pieces, *d*, are directly opposite one of the torpedoes, and no other—as illustrated in Fig. 11. If, now, a hostile vessel should attempt to pass through the channel occupied by the torpedoes, the observers at both stations A′ and B′ will follow it with their respective telescopes, and should the vessel pass over any torpedo, the visual lines of the instruments will intersect at that point, as shown in Fig. 11ª, and, at the same instant, the springs, P, of their respective bars, O, will form electrical contacts with the pieces, *d*, of certain disks, and, thus, the circuit being closed, the torpedo will be exploded. If, for example, the vessel pass over the torpedo located at *y′*, the electrical circuit will be completed through such torpedo by contact of the springs, P, of the respective instruments at A, B, with the points, *d*, of conductors in the upper disk, *x′*. Similarly, if the vessel pass over one of the other torpedoes, say *y″*, at the instant when the lines of vision from A and B intersect at a point where the torpedo is located, the contacts will be made on the respective instruments, and the circuit thereby completed through the contacts of disk, *x″*, and the torpedo, *y″*, thus causing explosion of the latter.

In Fig. 12, I illustrate the arrangement and connection of parts when the torpedoes are arranged in line with one of the instruments A′, B′. In this case, but one disk is necessary on the instrument at B′, and it is connected with the bar, O, of the other instrument, A′, by a single wire. The disks of the instrument at A′ have each, also, but one conductor, one contact point, and one binding screw. From the several binding screws, wires lead to the torpedoes *y y′ y″*, as shown. The observer at station B′ always holds his telescope directed in line with the torpedoes, while the observer at A′ must follow with his telescope any hostile vessel that may attempt to force a passage. When the lines of vision intersect at the point where the torpedo is located, the electrical circuit through the latter will be completed, and thus the desired explosion will be produced.

It will be seen that no explosion can take place save when a vessel is over one of the torpedoes, since the contact points, *d*, of the disks on the instrument at A′ are so located that the point, *d*, of one disk coincides with the torpedo *y*, another with the torpedo *y′*, and another with the torpedo *y″*. If a vessel occupy any place intermediate two torpedoes, then all the springs, P, of the instrument at A′ would at that time be in contact with blank spaces of the several disks.

I have described the torpedo circuits as being closed by the operation of the two instruments at A′ and B′, but normally, *i. e.*, when no hostile vessel is being observed, such circuits are kept open, so that the mere adjustment or swinging movement of the telescope, E, of either one could not complete a circuit and explode a torpedo. That is to say, the potential circuit through the bar, O, and contact springs, P, of each instrument is completed at will, by means of the closing-device, Q, see Fig. 5, which is applied to the telescope, as shown in Figs. 1, 2 and 11. The circuit-closer consists of two contact pieces, *i*, *i*, having binding-screws *j*, for attachment of wires, and a pin, *k*, having an insulated handle, *l*, and cup-like flange, *m*, adapted to fit over

semicircular flanges on the said contact pieces *i i*. The parts are shown detached in Fig. 5, and connected in Figs. 1 and 2. In practice—as will be apparent—the circuit is to be closed by this device, Q, only when an enemy has closely approached the point where one or more torpedoes are located.

It is sometimes necessary to quickly readjust a telescope, E, in position, and, to avoid the slow operation of the worm gear by which this is normally effected. To this end, I provide for taking the worm shaft, I, out of mesh with the worm gear, H, so that the telescope may be rotated freely. For this purpose, one of the bearings of said shaft (see Figs. 6, 7 and 8) is adapted to slide on one of the arms *e*, and the other end of the shaft is allowed a certain play in its bearing. (See especially Fig. 6.) A spiral spring, *n*, holds the shaft, I, normally in mesh with worm wheel, H, but its tension is readily overcome by a lateral pull on the shaft. The latter is held out of engagement with the wheel, H, by means of an elongated button, *o*, which is pivoted to an arm *e*. When adjusted in alignment with the arm it holds the shaft, I, out of engagement, see dotted lines Figs. 6 and 7, but not when adjusted transversely, as shown by full lines in said figure.

The degree or horizontal angle, to which the telescope is adjusted may be ascertained by observing the graduations on the edge of the base plate C, (Fig. 9,) and the vernier *p*, which slides thereon, the same being secured to the bar O, by a clamp-screw, *q*, as shown in Figs. 1 and 2.

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

1. A circuit-closing apparatus, for the purposes specified, consisting of two instruments, each having a supporting frame, one or more insulated plates, or disks, placed thereon and having one or more electrical conductors with peripheral contact points, a vertical rotary shaft, and a sighting device supported on and adapted to revolve with it, one or more arms, or brackets, rigidly attached to said shaft, and extending horizontally beyond the said plates, or disks, and a vertical contact-piece, or bar, which is supported by said arms, and one or more spring contacts, P, adapted to strike the said points, means for adjusting the conductors which connect the two instruments and the mines, &c., to be fired, and a supplementary circuit-closing device, for completing a circuit through the two instruments and the device to be fired, substantially as shown and described.

2. In a circuit-closing instrument for the purpose specified, the combination, with the stand, or frame, having the horizontal base and vertical tube C′, one or more circular plates, or disks, D, set on such stand and secured in place, one or more electrical conductors held by said plates, and having contact points that project from the peripheries of the latter, a shaft that is supported and rotates in the said tube, horizontal arms that are rigidly connected with the shafts, a bar, O, held vertically by said arms, springs, P, attached to the bar and pressing on the peripheries of the plates, or disks, a telescope supported by trunnions on the said shaft and rotating with it and the bar O, gearing for moving the latter and its connections, and means for adjusting the telescope vertically, as shown and specified.

3. In a circuit-closing instrument, for the purpose specified, the combination, with the frame or stand, having a vertical tube, C′, disks secured thereon and having electrical conductors and contact points, a shaft supported and rotating in the tube, a contact-piece carried by the shaft, a worm wheel, H, affixed to the shaft, a worm shaft journaled in bearings affixed to the tube, one of its bearings being adapted to slide as described, and means for holding it normally engaged with the worm wheel, and holding it abnormally disengaged, substantially as shown and described.

4. In a circuit-closing instrument, for the purpose specified, the combination, with the frame, or stand, having a vertical tube, C′, disks secured thereon, and having electrical conductors and contact points, a shaft supported and rotating in the tube, a contact-piece carried by the shaft, a worm wheel, H, affixed to the shaft, a worm shaft journaled in bearings affixed to the tube, one of its bearings being adapted to slide as described, and the spring *n* and button *o*, for holding the worm shaft engaged with and disengaged from the worm wheel, as shown and described.

5. In a circuit-closing instrument for the purpose specified, the combination, with the frame, or stand, one or more disks and electrical conductors having contact points, the rotating shaft and a contact-piece secured to and rotating with it, a telescope trunnioned on the shaft, a segmental gear affixed to the telescope and pendent therefrom and a worm shaft, M′, adapted to engage the said gear, as shown and for the purpose specified.

6. In a circuit-closing instrument, the combination, with the frame, or stand, disks supported thereon and having electrical conductors with contact points, a shaft rotating on said stand, a vertical contact-piece O carried by the shaft, the telescope trunnioned on the shaft, contacts *i* affixed to the telescope, and the device *l* adapted to be inserted between the said contacts, as shown and described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 18th day of January, 1892.

GIULIO BERTOLINI.

Witnesses:
GIOVANNI TUBINO,
E. V. DOBRILOVIDEL.