A. T. DAWSON & G. T. BUCKHAM.

ELECTRICAL APPARATUS FOR TRANSMITTING AND RECEIVING SIGNALS.

APPLICATION FILED NOV. 27, 1905.

938,830. Patented Nov. 2, 1909.

6 SHEETS—SHEET 1.

Fig. 1.

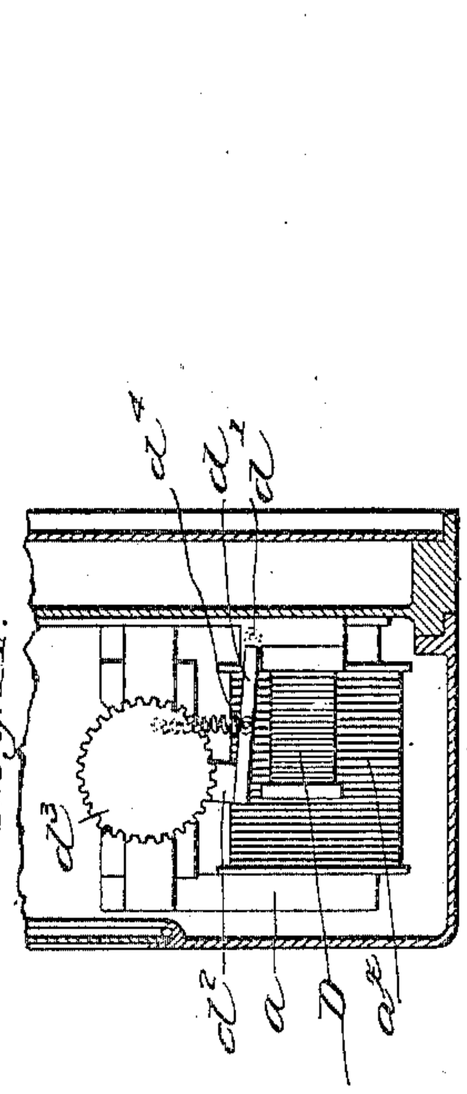


Fig. 3.

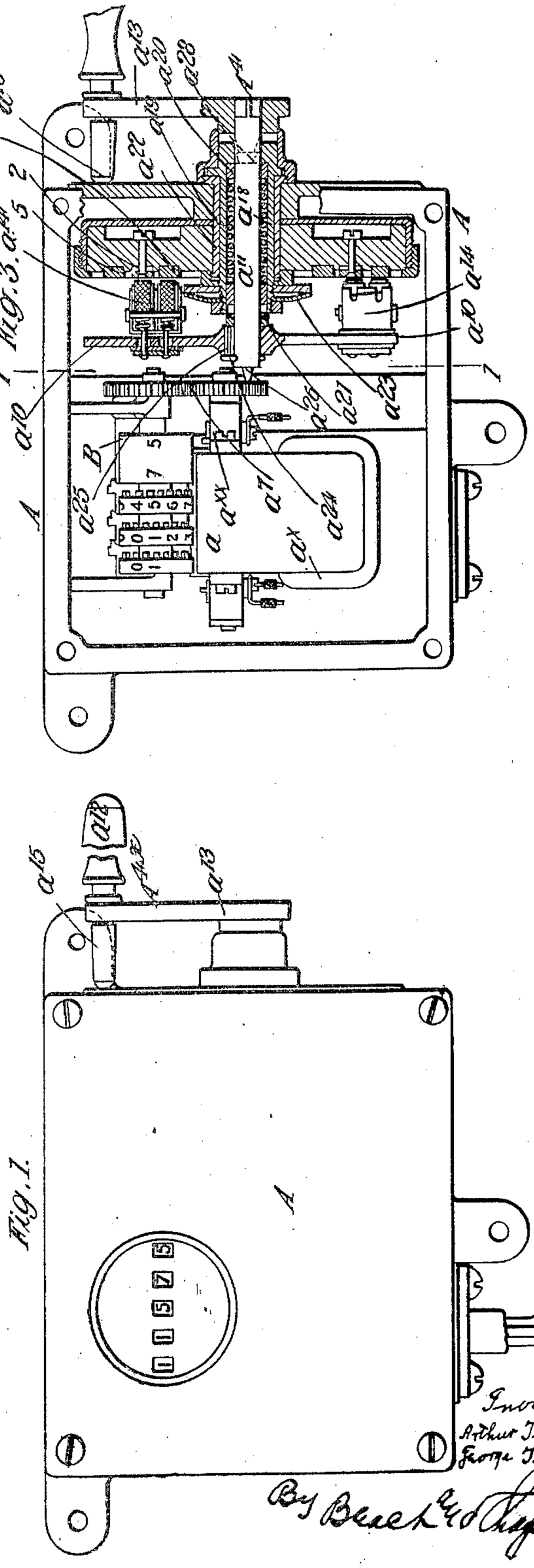


Fig. 14.

Fig. 13.

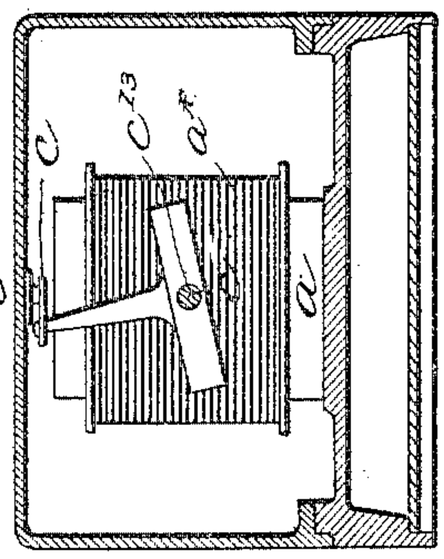


Fig. 2.

Witnesses:
M. Hershkowitz.
Grace L. Healey.

Inventors:
Arthur T. Dawson
George T. Buckham
By Buck & Stephenson.
Attys.

A. T. DAWSON & G. T. BUCKHAM.

ELECTRICAL APPARATUS FOR TRANSMITTING AND RECEIVING SIGNALS.

APPLICATION FILED NOV. 27, 1905.

938,830. Patented Nov. 2, 1909.

6 SHEETS—SHEET 2.

Fig. 4.

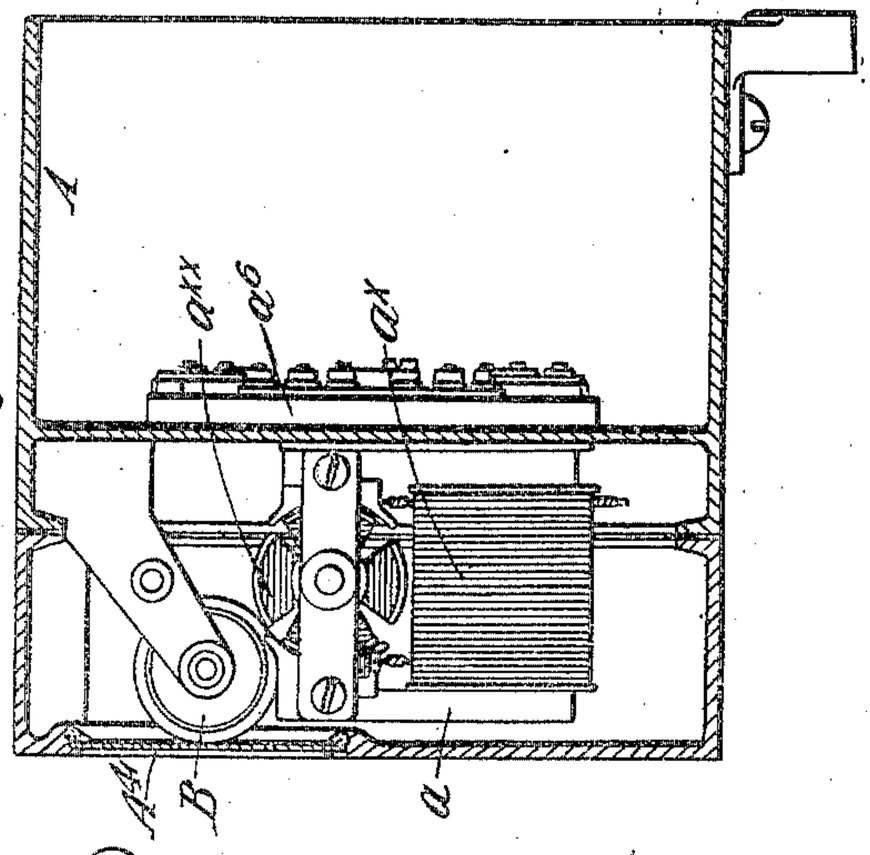


Fig. 12.

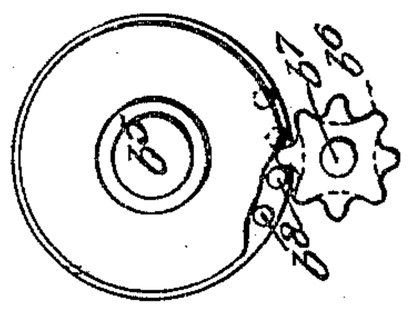


Fig. 11.

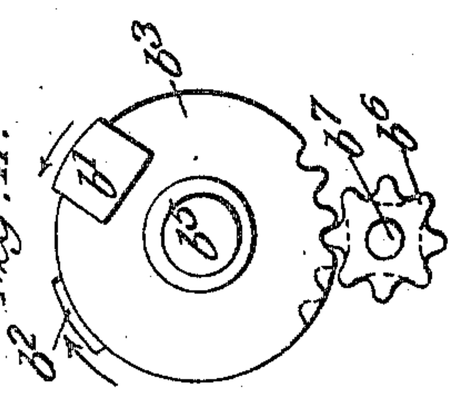


Fig. 10.

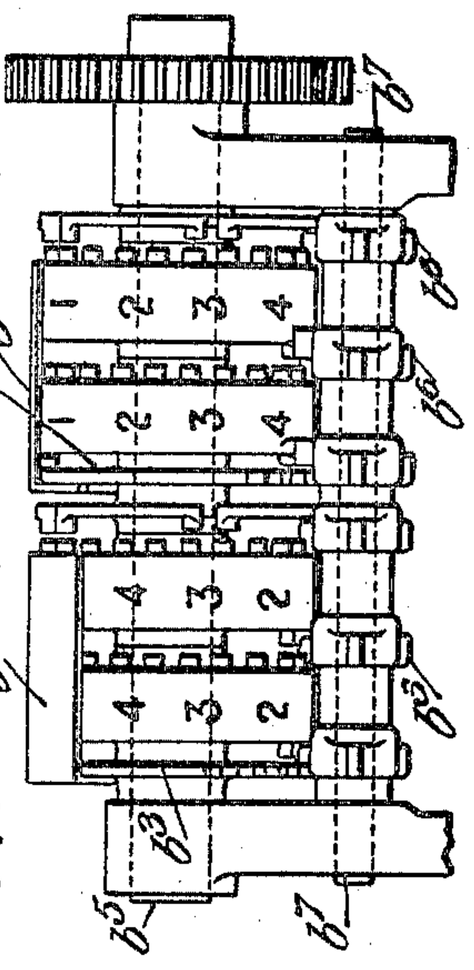
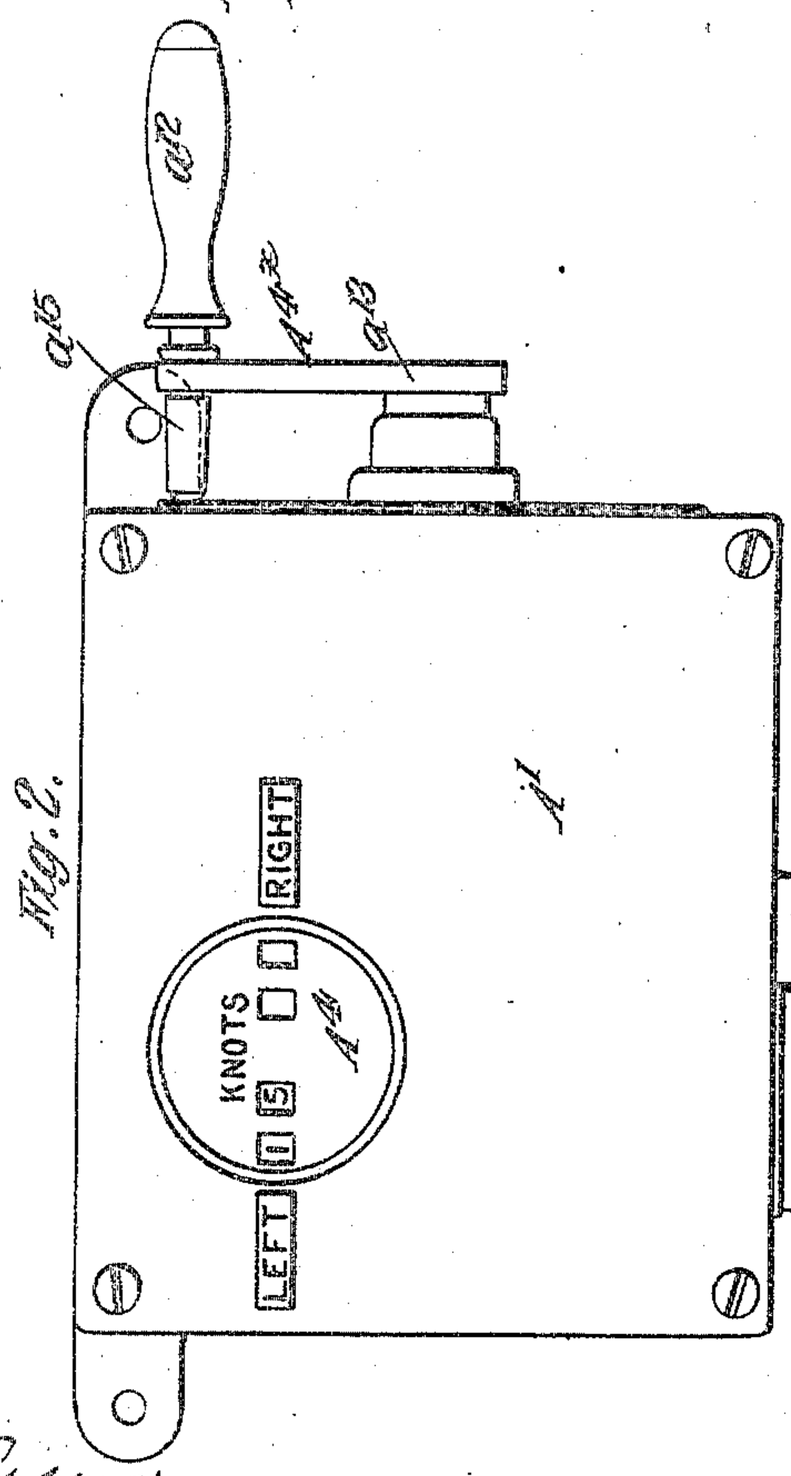


Fig. 2.



Witnesses:
W. Herskovitz
Grace L. Healey.

Inventors:
Arthur T. Dawson
George T. Buckham
By Church E. Chapman Attys.

A. T. DAWSON & G. T. BUCKHAM.

ELECTRICAL APPARATUS FOR TRANSMITTING AND RECEIVING SIGNALS.

APPLICATION FILED NOV. 27, 1905.

938,830.

Patented Nov. 2, 1909.

6 SHEETS—SHEET 3.

Fig. 3a

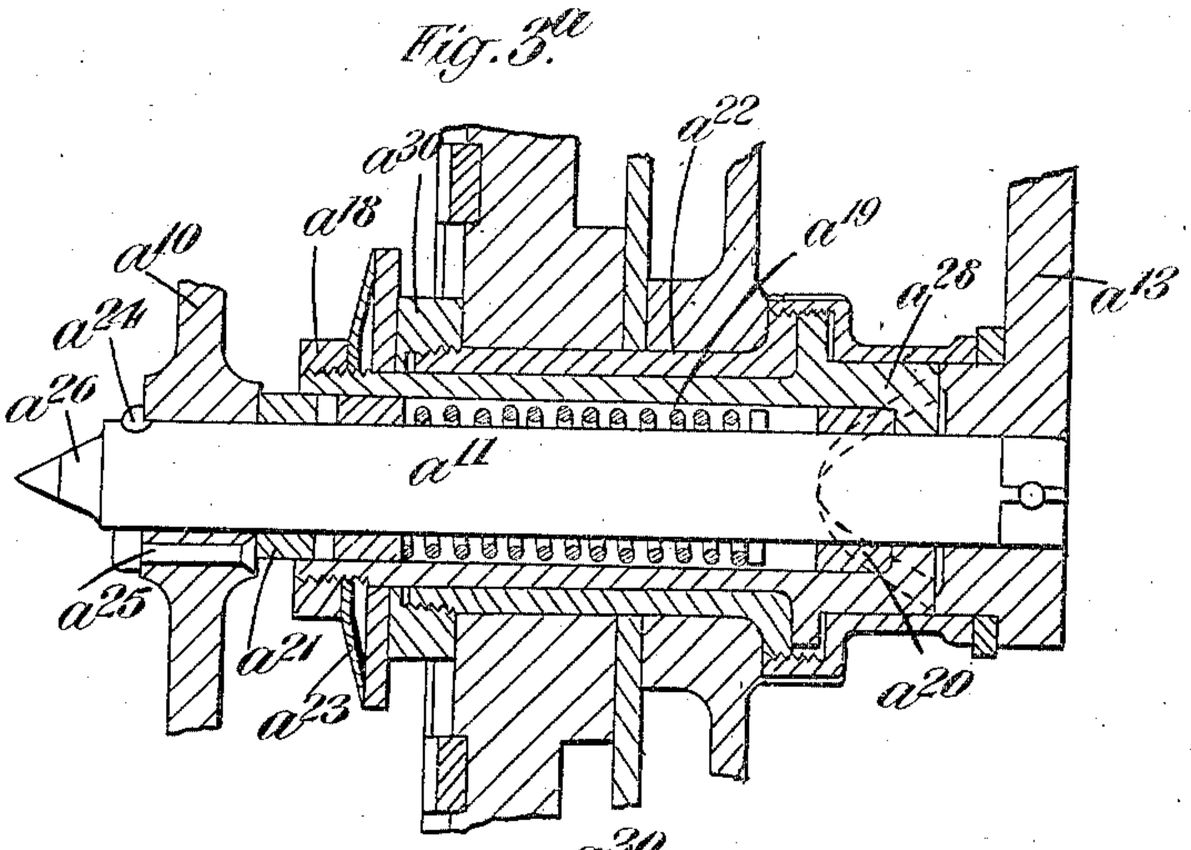


Fig. 3b

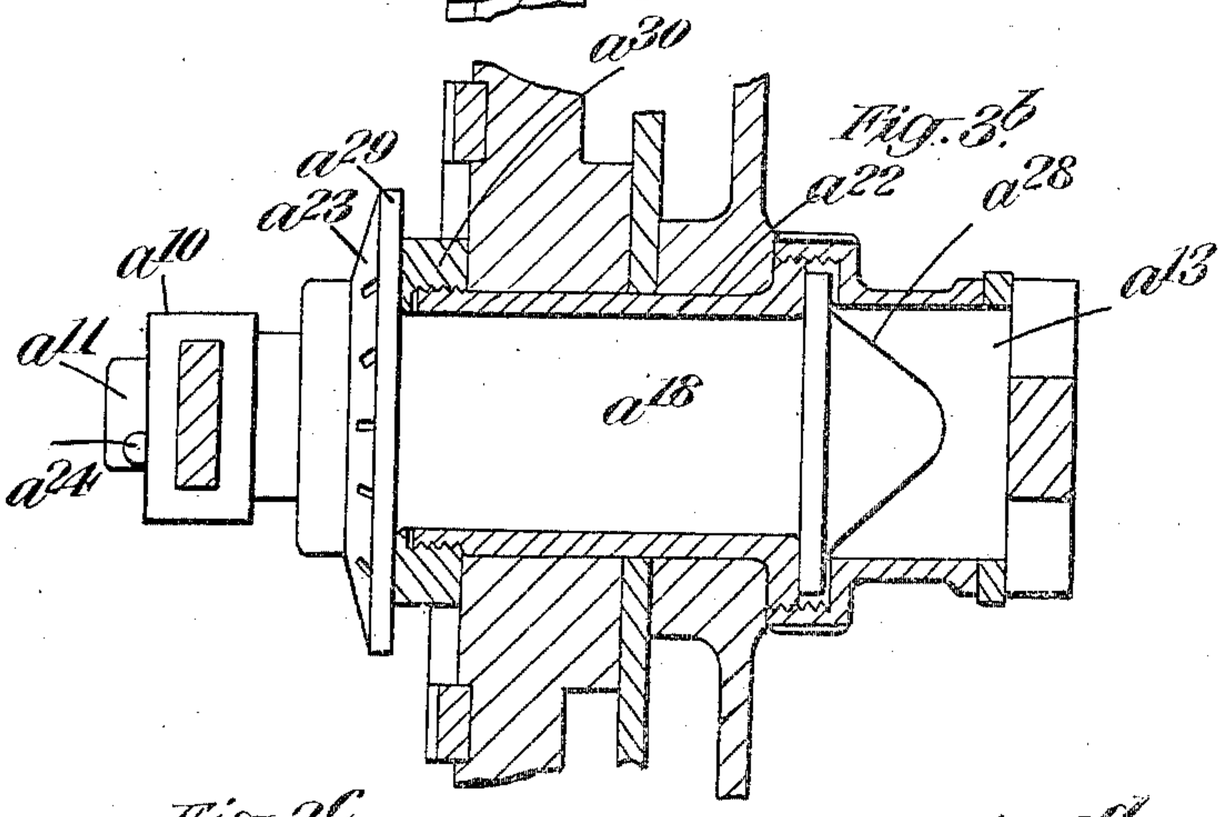


Fig. 3c

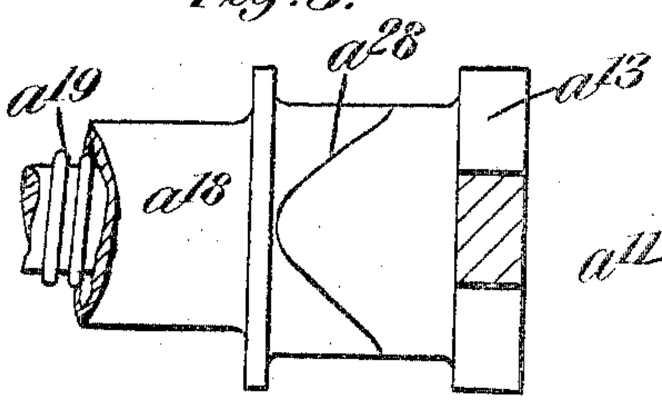
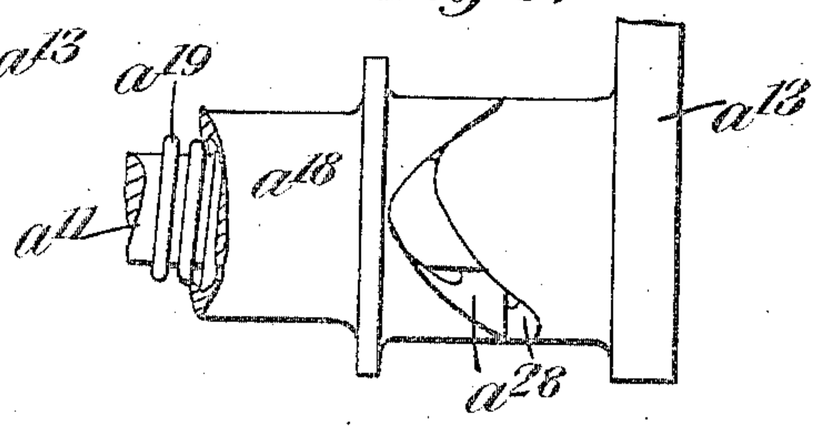


Fig. 3d



Witnesses:
H. Hasbrouck.
F. E. Nares.

Inventors:
Arthur T. Dawson
George T. Buckham
by their attorney
Edmund J. Reach

A. T. DAWSON & G. T. BUCKHAM.

ELECTRICAL APPARATUS FOR TRANSMITTING AND RECEIVING SIGNALS.

APPLICATION FILED NOV. 27, 1905.

938,830. Patented Nov. 2, 1909.

6 SHEETS—SHEET 4.

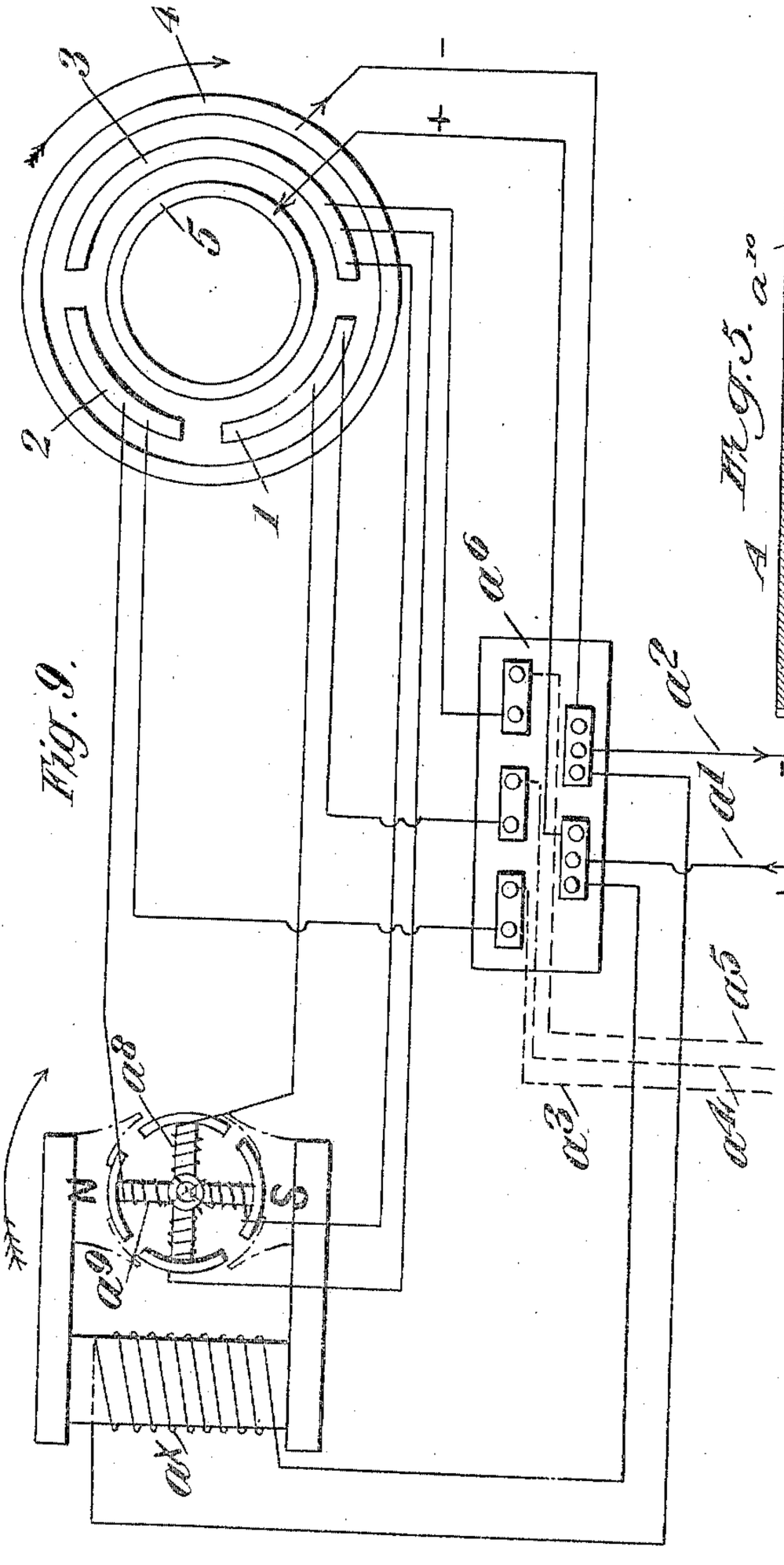


Fig. 9.

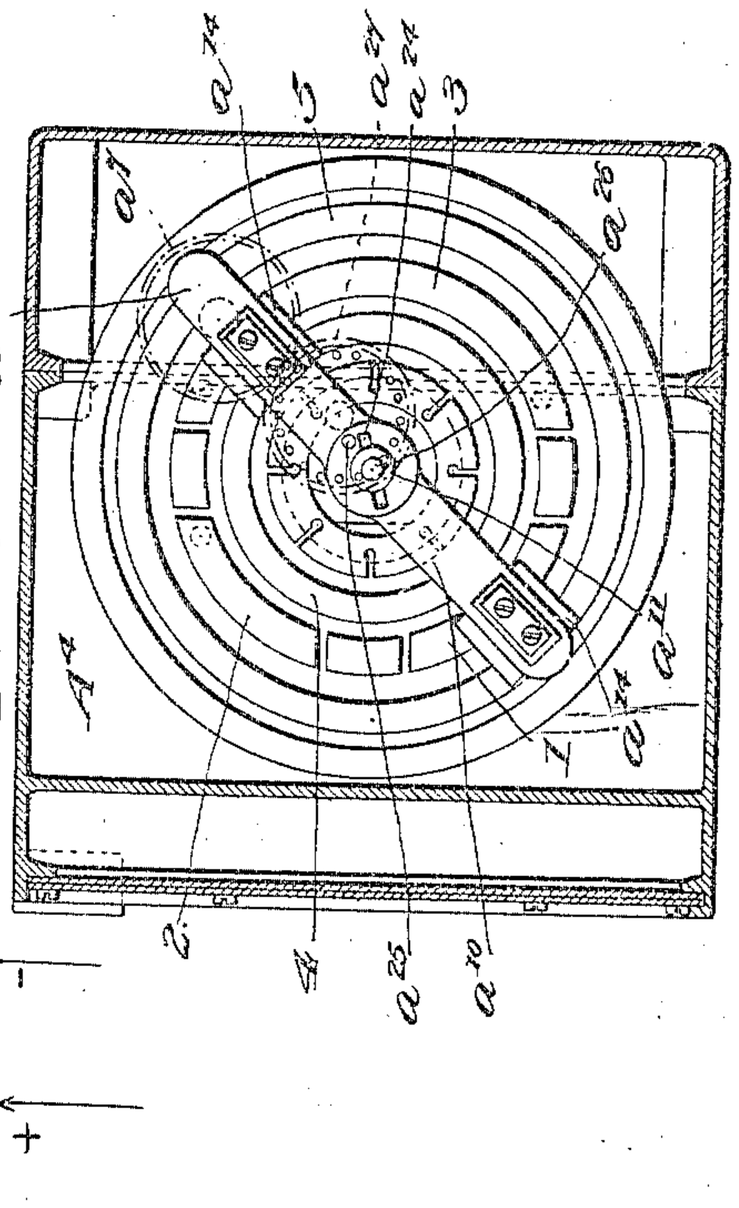
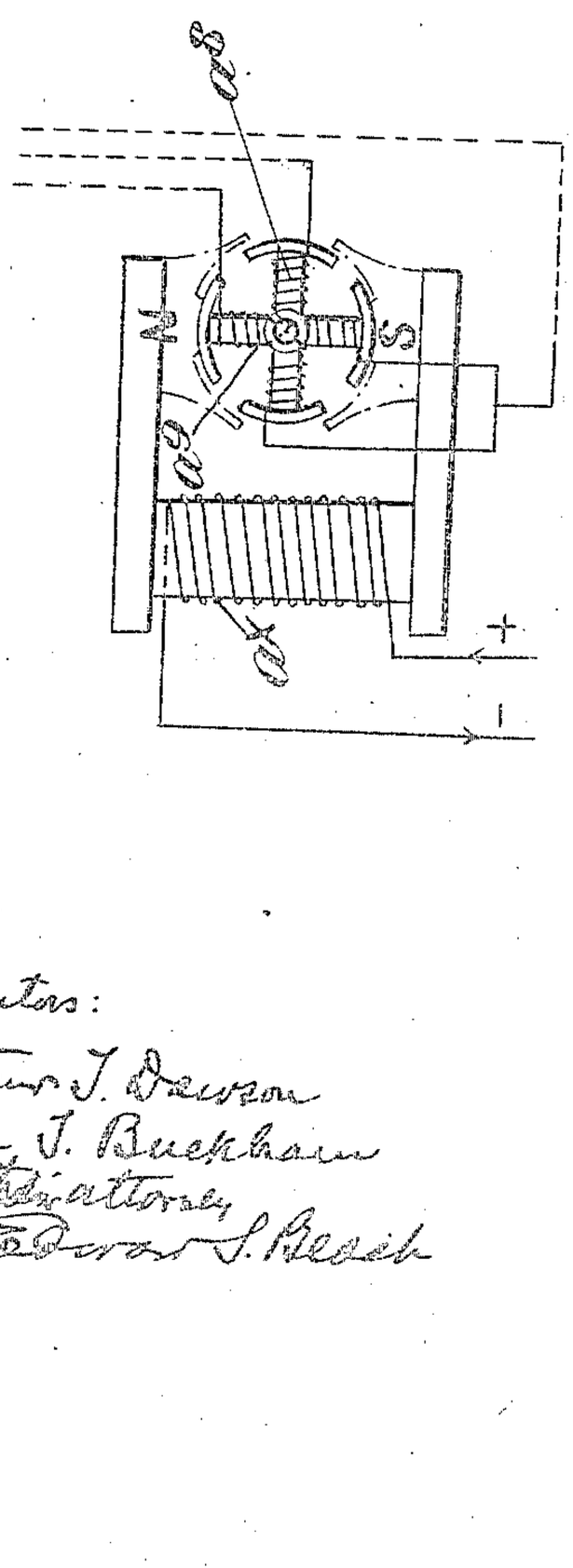


Fig. 5.



Witnesses:
H. Herbertz.
F. E. Nares.

Inventors:
Arthur T. Dawson
Geo. T. Buckham
by their attorney
Edmund L. Reed

A. T. DAWSON & G. T. BUCKHAM.

ELECTRICAL APPARATUS FOR TRANSMITTING AND RECEIVING SIGNALS.

APPLICATION FILED NOV. 27, 1905.

938,830. Patented Nov. 2, 1909.

6 SHEETS—SHEET 5.

Fig. 6.

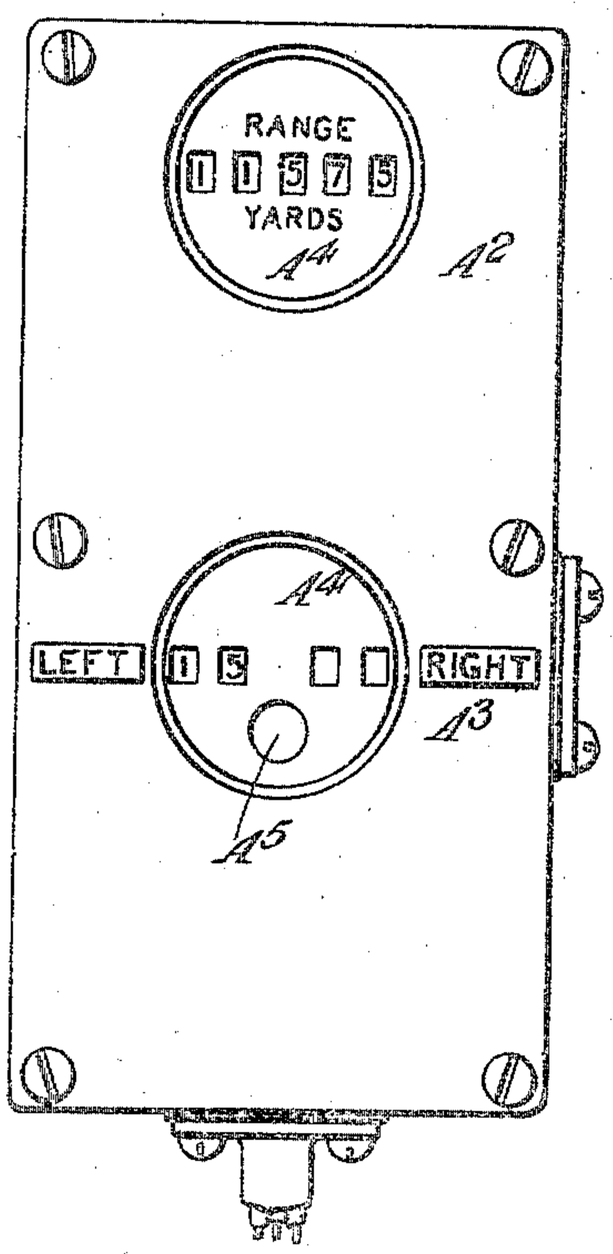


Fig. 7.

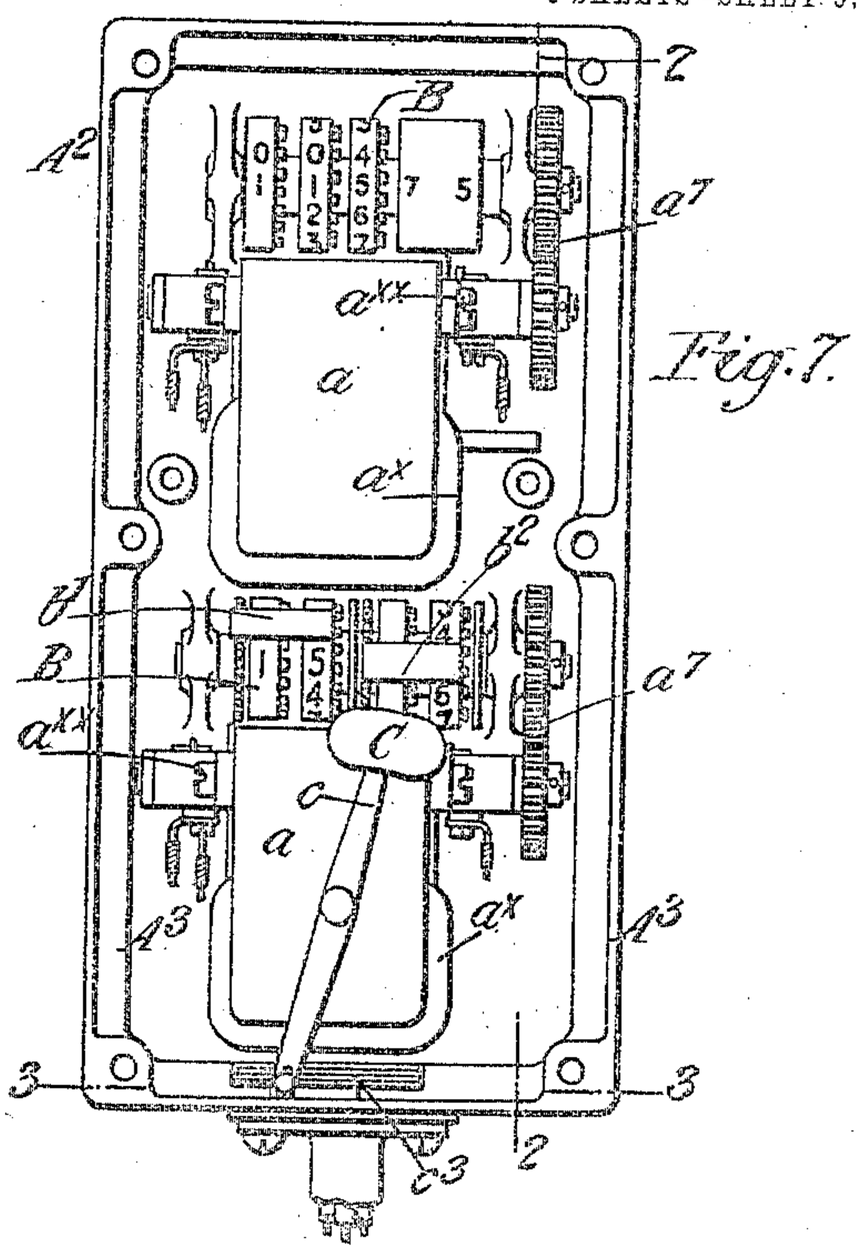
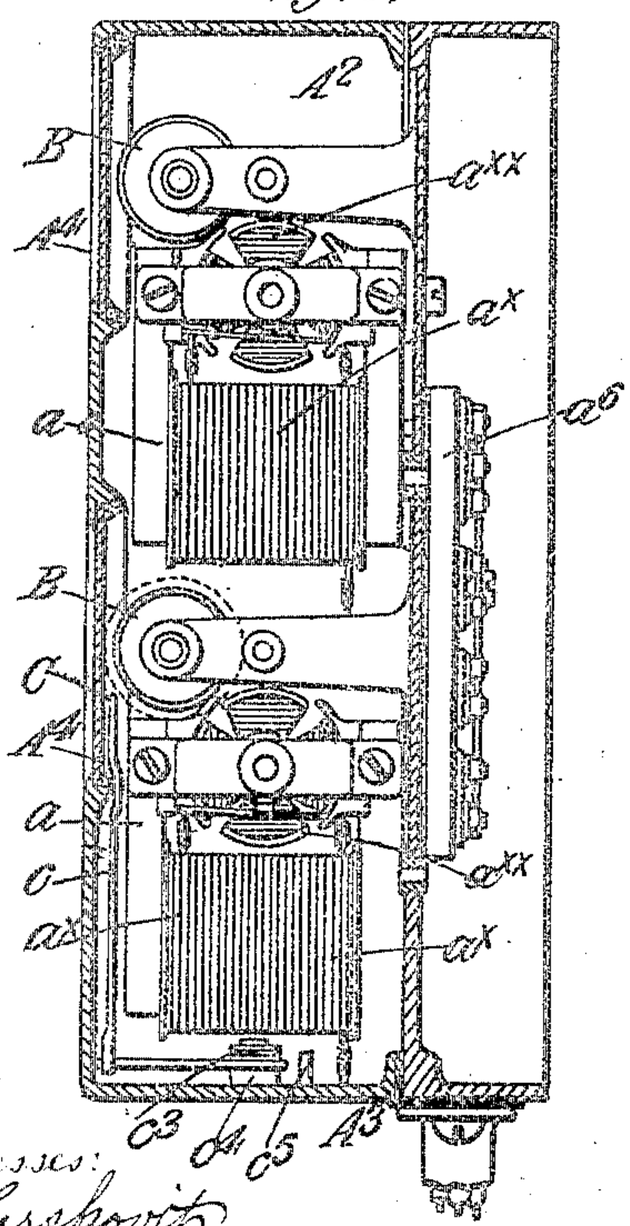


Fig. 8.



Witnesses:
M. Hirschowitz.
Grace D. Hawley.

Inventors:
Arthur T. Dawson 2d
George T. Buckham.
By
Beach and Chapman. Attys.

A. T. DAWSON & G. T. BUCKHAM.

ELECTRICAL APPARATUS FOR TRANSMITTING AND RECEIVING SIGNALS.

APPLICATION FILED NOV. 27, 1905.

938,830. Patented Nov. 2, 1909.

6 SHEETS—SHEET 6.

Fig. 9a

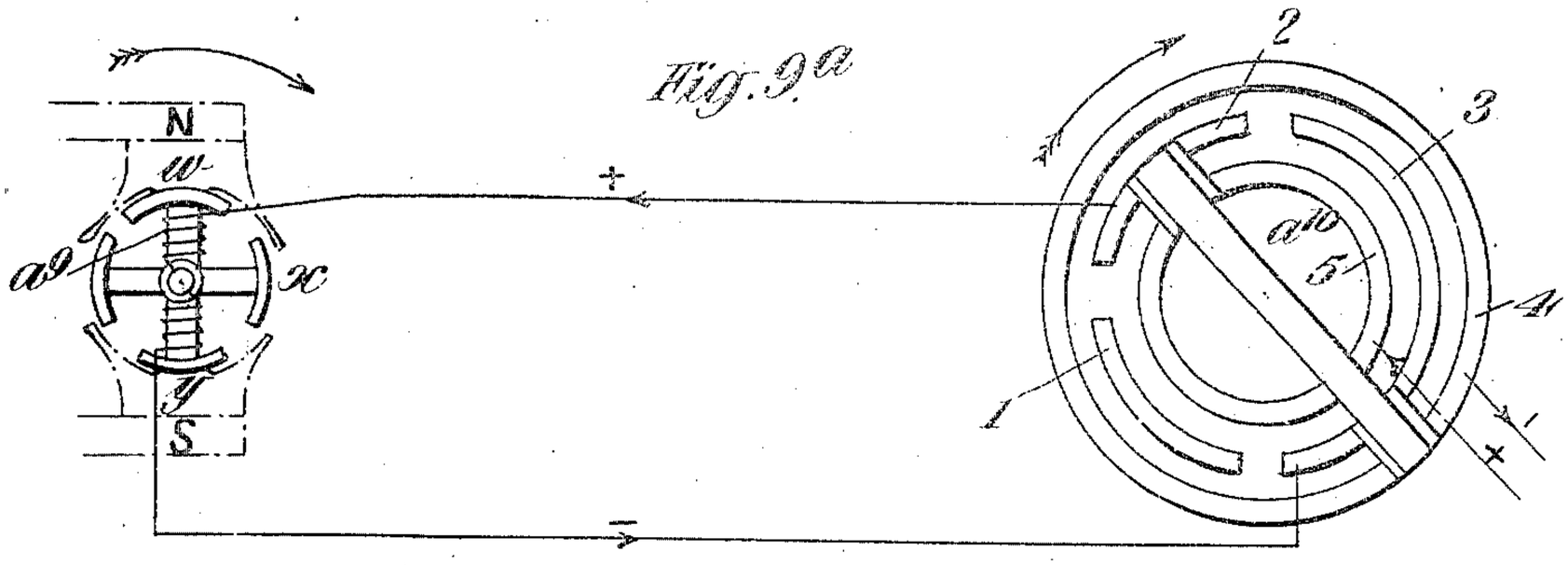


Fig. 9b

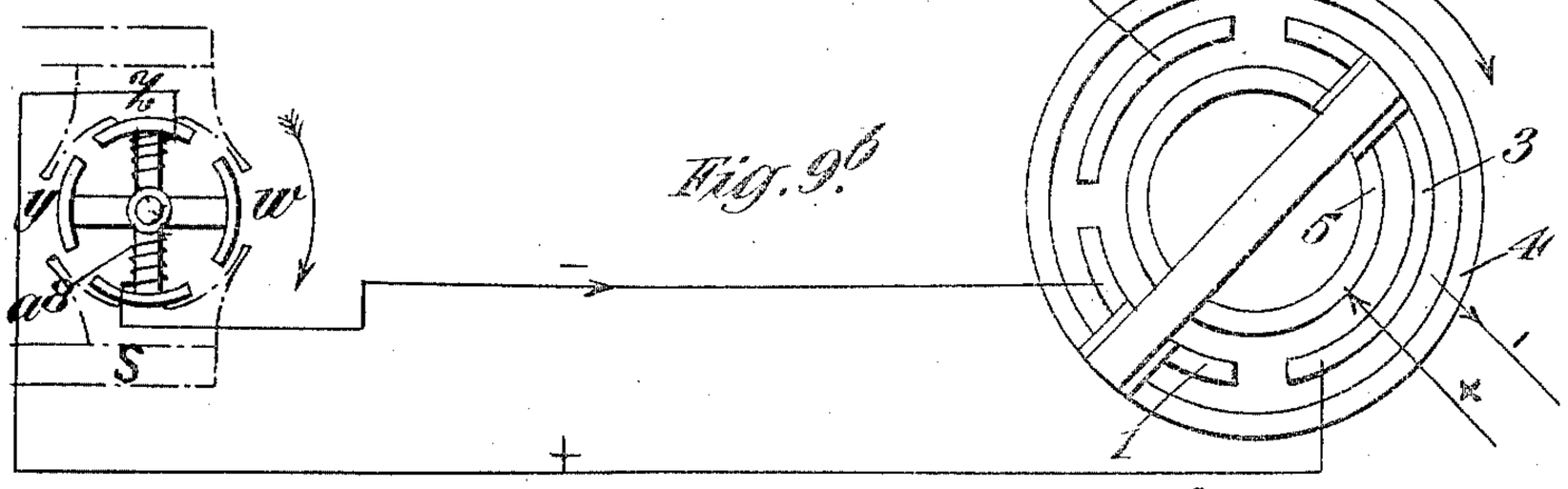


Fig. 9c

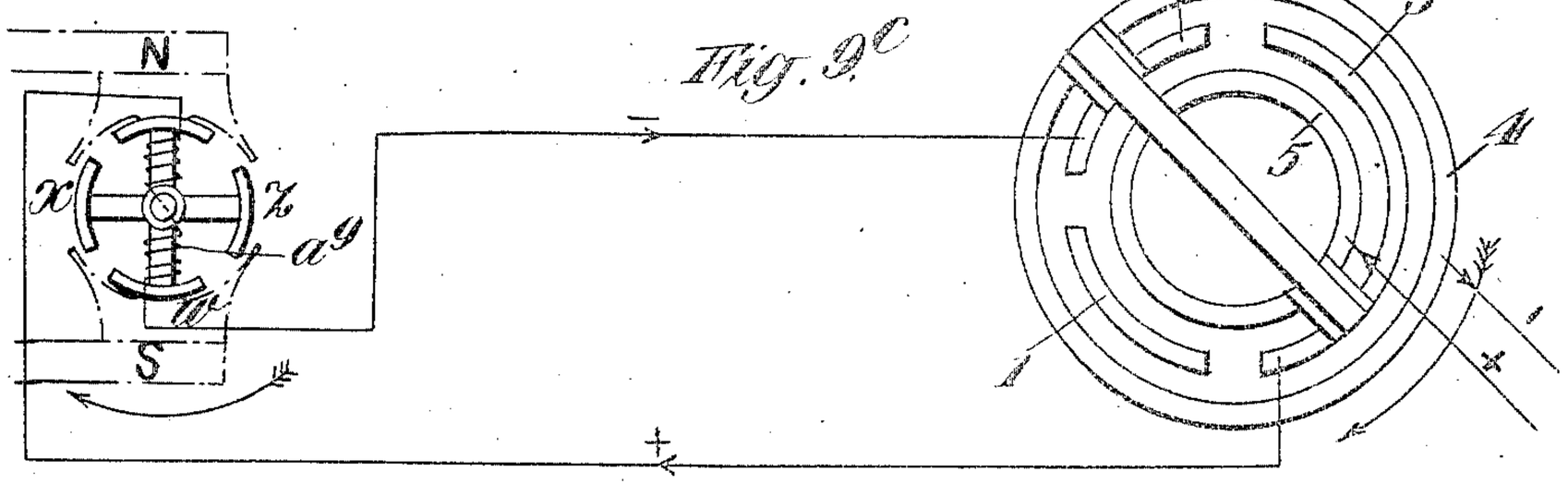
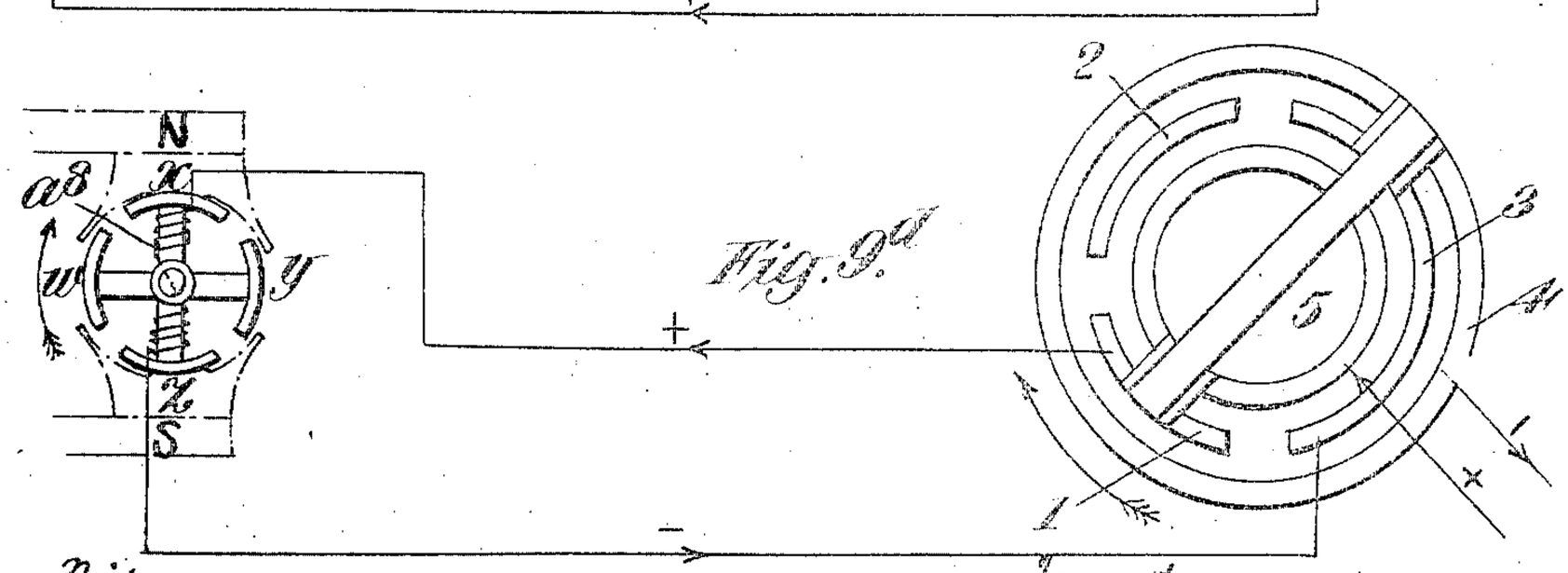


Fig. 9d



Witnesses:
M. Horkheimer.
F. E. Mares.

Inventors:
Arthur T. Dawson
George T. Buckham
by their attorney Edmund J. Reed

UNITED STATES PATENT OFFICE.

ARTHUR TREVOR DAWSON AND GEORGE THOMAS BUCKHAM, OF LONDON, ENGLAND, ASSIGNORS TO VICKERS SONS & MAXIM LIMITED, OF WESTMINSTER, ENGLAND.

ELECTRICAL APPARATUS FOR TRANSMITTING AND RECEIVING SIGNALS.

938,830. Specification of Letters Patent. **Patented Nov. 2, 1909.**

Application filed November 27, 1905. Serial No. 289,242.

To all whom it may concern:

Be it known that we, ARTHUR TREVOR DAWSON, lieutenant of the Royal Navy, director and superintendent of Ordnance Works, and GEORGE THOMAS BUCKHAM, engineer, both subjects of the King of Great Britain, residing at 32 Victoria street, Westminster, in the county of London, England, have invented certain new and useful Improvements Relating to Electrical Apparatus for Transmitting and Receiving Signals, of which the following is a specification.

This invention relates to apparatus for electrically transmitting and receiving signals and is more particularly intended for transmitting from the conning tower of a ship or other fixed point the necessary information as regards range and deflection to a number of receiving instruments situated contiguous to the guns, so that the officer in charge can transmit such information from the conning tower or other fixed point simultaneously to the sighting numbers of the various guns' crews.

According to our invention we provide at the transmitting or sending station a dynamo-electric transmitter and at the receiving stations a dynamo-electric receiver each of these instruments being furnished with a counting device mechanically connected with the armature of the dynamo-electric apparatus. The windings of the various armatures are electrically connected together through a circuit including a rotary hand switch at the transmitting or sending station, so that when said hand switch is revolved, a step by step rotation will be imparted to the various armatures and the counting devices mechanically connected therewith, so that such rotation takes place in unison or synchronously in all the instruments. One set of instruments and circuits is used for transmitting and receiving the range signals and another set for transmitting and receiving the deflection signals.

In order that our said invention may be clearly understood and readily carried into effect we will describe the same more fully with reference to the accompanying drawings in which:

Figure 1 is a front elevation of the range transmitter. Fig. 2 is a similar view of the deflection transmitter. Fig. 3 is a sectional elevation of the range transmitter with the front cover plate removed. Figs. 3^a, 3^b, 3^c and 3^d show details of the spindle and adjacent parts appertaining to the range transmitter illustrated in Fig. 3. Figs. 4 and 5 are vertical sections both taken approximately on the line 1. 1. of Fig. 3, the former as seen from the right and the latter as seen from the left. Fig. 6 is a front elevation of the range and deflection receivers. Fig. 7 is a similar view with the front cover plate removed. Fig. 8 is a vertical section taken approximately on the line 2. 2. of Fig. 7. Fig. 9 is a diagrammatic view illustrating the circuits of the range transmitter. The deflection transmitter also has its circuits similarly arranged. Figs. 9^a, 9^b, 9^c and 9^d are diagrams of electrical connections, and illustrate the manner in which the step-by-step motion is imparted to the transmitter by the actuation of a hand switch. Fig. 10 is a side elevation on an enlarged scale of the counting device of the range deflection transmitter and receivers. Fig. 11 is an end view of said device as seen from the left of Fig. 10 with the bearing removed. Fig. 12 is an end view of one of the counting drums and its actuating pinion. Fig. 13 is a cross section taken approximately on the line 3. 3. of Fig. 7. Fig. 14 is a vertical section of the lower part of the receiving apparatus showing a device for preventing the counting drums from being unintentionally shifted.

In all the figures like characters of reference indicate like parts.

A is the range transmitter and A′ the deflection transmitter. A^2 A^3 are the range and deflection receivers which are arranged one above the other and inclosed in a single casing for convenience in use. Each of these instruments has a detachable front cover plate for enabling the internal parts to be readily reached for inspection or repair.

The range and deflection transmitters are situated at the signal sending station, say the conning tower, and are respectively connected electrically with the range and deflection receivers which are affixed to the various gun mountings or other suitable points contiguous to the guns, in positions to be readily observed by the sighting members of the guns' crews.

Each of the transmitters and receivers has an electric motor *a* of which the field coils a^x are excited by current obtained from the main electric supply through wires a^1 a^2 (Fig. 9) and of which the armatures a^{xx} are

electrically connected together by wires a^3 a^4 a^5 joined to the terminal supports a^6, the said armatures being also mechanically connected, by means of gearing a^7, to suitable counting devices situated contiguous to the armatures. Each of the transmitters is provided with a hand switch or the like A^{4x} which is included in the circuit of the said armatures. Each armature is advantageously made with four poles w x y z and two independent windings a^8 a^9 (Fig. 9) and the hand switch comprises a series of fixed segmental contacts 1, 2, 3 and fixed inner and outer concentric contacts 4, 5. Over these contacts a rotary contact piece a^{10} mounted on the inner end of the spindle a^{11} can be caused to revolve by the handle a^{12} at the outer end of said spindle. The inner and outer contacts 4, 5 are electrically connected with the + and — mains a^1 a^2 (Fig. 9). The segmental contacts 1 and 2 are respectively connected electrically with one end of the armature windings a^8 a^9 (Fig. 9), the other ends of said windings being connected with the segmental contact 3. The said segmental contacts are also respectively connected electrically with the wires a^4 a^3 a^5 leading to the corresponding receiving instrument.

The function of the contact rings 4, 5, (which are connected to the + and — mains as aforesaid) is to supply a current to the armature a^{xx}, which current is made to flow alternately in the different windings of the armature by means of the contact arm a^{10} connecting alternately the segmental contacts 1, 2, 3, to the concentric contacts 4, 5.

When the rotary contact piece a^{10} is in the position represented by Fig. 9^a it makes electrical contact between segmental contact 2 and concentric contact 5, and between segmental contact 3 and concentric contact 4. This causes the current to flow through the armature winding a^9 in the direction shown by the arrow, making pole w of south polarity and pole y of north polarity, which poles are respectively attracted by the field magnet poles N and S. If the rotary contact piece a^{10} be now turned in a clockwise direction, it will assume the position shown in Fig. 9^b, thereby breaking the circuit in armature windings a^9, and making connection between contacts 3 and 5, and between contacts 1 and 4. The current can then flow through the armature winding a^8 in the direction shown in Fig. 9^b, thereby making pole z of south polarity and pole x of north polarity, which poles are respectively attracted by the field magnet poles N and S, thus causing the armature to perform a quarter revolution in a clockwise direction. If the rotary contact piece a^{10} be now further turned in a clockwise direction until it assumes the position shown in Fig. 9^c, the current will flow through the armature winding a^9 in the direction indicated in this figure, thus making pole y of south polarity and pole w of north polarity, which poles are in turn attracted by the field magnet poles N and S, thus causing the armature to perform a further quarter revolution in a clockwise direction. If in Fig. 9^b the rotary contact arm a^{10} had been moved in the reverse direction, that is to say anti-clockwise, to a position shown in Fig. 9^a, it will be obvious that the armature would have also moved in an anti-clockwise direction, as the pole y would have been of north polarity and the pole w of south polarity. If in Fig. 9^c the rotary contact arm a^{10} be moved a further revolution in a clockwise direction to bring it to the position indicated in Fig. 9^d, the armature will make a corresponding quarter turn.

It will therefore be seen from the above description that the armature is compelled to move in the same direction as the rotary contact arm a^{10}, and that therefore the direction of movement of the said arm determines the direction in which the armature will revolve. Consequently, in order to return the counting drums of the transmitter and receiver to zero, it is only necessary to turn the said arm a^{10} in the opposite direction to that above stated, whereupon the armature will be caused to immediately follow the movement of said arm step by step.

The wires a^3, a^4, a^5 which are connected to the segmental contacts 2, 1 and 3, respectively, are connected to the armature of the receiving instrument in a similar manner to that in which the segmental contacts 2, 1 and 3, are connected to the armature of the transmitter as shown in Fig. 9. It will be observed that the wire a^5 is a common wire for the two armature windings of the receiving instrument, which arrangement is feasible because the current is so controlled by the segmental contacts and the rotary contact arm that it can only flow in one winding at one time. The armatures of the transmitting and receiving instruments will, by having their polarity changed at each angular movement of the switch perform a succession of angular movements, whereby the armatures will impart rotary movement to the counting-devices of the various instruments through the gearing a^7, thus causing said counting-devices to revolve any desired number of revolutions until the required number is indicated by the counting-devices B. It will of course be understood that only the range and deflection transmitters are provided with the hand switches and that all the range receivers are in circuit with each other and with the range transmitters, while all the deflection receivers are in circuit with each other and with the deflection transmitter, the transmitters being independent of each other in their action.

The counting devices used with the in-

struments are of the well known kind comprising a series of drums bearing figures which are visible through glazed openings A^4 in the casing of the instruments, said drums having toothed wheels and pins for enabling the motion of one to be transferred to that of the next succeeding drum after it has performed a given number of revolutions, as is well understood. The drums of the counting device of the range transmitter and the range receivers are four in number and bear figures indicating yards, and they read in tens (advancing in steps to 25), hundreds, thousands, and tens of thousands. The counting devices of the deflection transmitter and the deflection receivers have two series of drums one at the right hand and the other at the left hand, the readings being in knots; indications such as the words "right" and "left" being provided on the casings for representing when the deflection is to be to the right or to the left. In order that the figures of the counting devices shall not be visible on the "right" indications when the "left" indications are exhibited and vice versa, we provide shutters or screens b^1 b^2 (as best seen in Figs. 10 to 12) which are adapted to automatically come into a position for hiding the "right" or "left" indications according as the deflection is to be in one or other of these directions. The two sets of counting drums of the deflection transmitter and receivers are adapted to revolve simultaneously in the same direction, but the numerals are so arranged that during their revolution, the numerals of one set increase in value while those of the other set diminish. The aforesaid shutters or screens are attached to disks b^3 b^4 which are carried on the axle b^5 of the counting drums and have teeth formed on their circumferences by which they gear with pinions b^6 on a counter-shaft b^7. The left hand drum of each pair has on its edge suitable pins b^8 which gear with these pinions in such a way that when the drums are turned in either direction from the zero position shown in Fig. 12, movement is imparted to one or other of the pinions b^6 and from the pinion to the shutter disk in gear with it. When at zero, the figures on both pairs of drums can be seen, but when the drums are turned in one direction, just sufficient movement is given to the shutter b^1 to hide the figures on the left hand pair of drums, while those on the right remain exposed. If the drums are turned in the other direction, the right hand figures will be hidden and the left hand figures will remain exposed.

The aforesaid spindle a^{11} has a sleeve a^{18} inclosing a helical spring a^{19} and two bushes a^{20} a^{21}. This sleeve is mounted in a main bush a^{22} secured to the casing of the instrument. Between this main bush and a nut at the inner end of the sleeve is a spring washer a^{23} which operates to cause a certain amount of friction between these parts, so that the sleeve a^{18} will be restrained from turning before the contacts of the rotary arm touch the fixed segmental contacts. This is effected by the longitudinal movement of the spindle, which movement is obtained by providing inclines a^{28} (Figs. 3^a—3^d) on the sleeve a^{18} and on the boss on the crank a^{13} which is secured to the spindle a^{11}, so that when the handle is gripped and the crank a^{13} moved angularly, the incline on the boss on the crank a^{13} will operate against the corresponding incline on the sleeve a^{18} (Fig. 3^d) and thus impart an outward motion to the spindle which will cause the contacts on the rotary arm to be pressed against the fixed contacts. At the inner end of the aforesaid spindle a^{11} is a pointed extension a^{26} which when the switch handle is released engages, by the action of the aforesaid helical spring on the spindle, with one or other of a series of recesses a^{27} in the adjacent face of one of the wheels of the gearing a^7, thus locking the parts so that the counting device cannot be moved otherwise than by the actuation of the switch handle. The rotary arm a^{10} is loosely mounted on said spindle a^{11} and is actuated by a lateral pin a^{24} on the latter coming against a stop a^{25} on the rotary arm, whereby a certain amount of free angular motion will exist between these parts, so that when the switch handle is reversed in its direction of movement there will be a lapse of time during which the rotary arm a^{10} will remain unaffected by this reverse movement of the spindle. In that way it will not be possible for the counting device to move unintentionally if the switch handle be quickly moved to and fro, as might otherwise occur. A sufficient time interval will also exist for the counting device to move and come to rest before reversing the movement of the switch handle.

Referring to Figs. 6, 7, 8 and 13, c is a pivoted arm which is situated within the cover of each of the receiving instruments. One end of this pivoted arm is furnished with a plate C bearing a sign or signs which are adapted to be exposed to view through a suitable glazed opening A^5 in the said cover of the instruments. The other end of the pivoted arm is forked and connected with an oscillatory magnetized bar c^3, which is pivoted at c^4 to one end of the cover of the instruments in a position to move in a plane parallel to the plane of the contiguous portions of the windings of the field-magnets a^x of the electric motor. The said oscillatory magnetic bar will thus be under the influence of the current passing through the said field-magnet windings and will, in accordance with the direction of such current, be deflected in one or other direction

against suitable stops c^5. The main-circuit through which current is supplied to the transmitting instrument is provided with a reversing switch, by the operation of which the direction of the current through the various instruments can be reversed and in that way the position of the magnetized bar and its indicator changed as required. The chief advantage arising from this arrangement is that any extra wires and magnets are unnecessary; we only require to make the ordinary cut out switch in the form of a reversing switch, as it is immaterial with our instruments in which direction the current is passing through them during their working. This device serves to give indication to the gun's crew that signals are about to be transmitted to the receivers and that their attention must be given to the receivers.

Any appropriate means (such as stationary recesses and a spring bolt a^{13} on the aforesaid rotary handle a^{12} of the hand switches of the transmitters) may be employed for insuring that the parts shall not overrun *i. e.* shall stop in a correct position to bring any desired indication correctly in register with the glazed openings A^4.

In Fig. 14, D is a small stationary electro-magnet which is adapted to operate a bar-armature d pivoted at d^1 to or near the base of said electro-magnet. The free end of said bar-armature is furnished with a block d^2 of brass or other suitable material having projections or teeth thereon, which, when the current is not passing through the instruments will engage with teeth or the like of a disk d^3 mounted on the armature-axle of the receiver-motors. This engagement is effected by the action of a spring d^4, the said block d^2 thus acting as a stop for arresting the motion of the motor-armature. As soon as current is allowed to pass through the receivers, however, the electro-magnet D will be energized and will immediately disengage the motor armature, so as to enable it to turn and operate the counting device.

We wish it to be understood that our apparatus is applicable for use either on land or ship-board.

What we claim and desire to secure by Letters Patent of the United States is:—

1. In electric signaling apparatus, the combination with a source of electric supply, of a dynamo electric device at the sending station having an armature formed with a plurality of pairs of poles, each pair of which is provided with an independent winding, a counting device mechanically connected to said armature, a similar dynamo electric device and counting device at each of the receiving stations, a transmitter at the sending station, electric circuits connecting said transmitter with the various dynamo electric devices and the latter with each other, and means whereby the movement of the transmitter causes the armature poles of the various dynamo electric devices at the receiving stations, together with the similar device at the sending station, to be excited in pairs successively and reversed in polarity at each excitation whereby said dynamo electric devices perform a step-by-step rotation in unison.

2. In electric signaling apparatus, the combination with a source of electric supply, of a dynamo electric device at the sending station having an armature formed with a plurality of pairs of poles, each pair of which is provided with an independent winding, a counting device mechanically connected to said armature, a similar dynamo electric device and counting device at each of the receiving stations, a transmitter at the sending station comprising a rotary hand switch and rotary contacts coöperating with stationary contacts, electric circuits connecting said stationary contacts with the independent windings on the pairs of armature poles of the dynamo electric devices and the latter with each other, and means whereby the movement of the said rotary hand switch and contacts from one stationary contact to another causes the armature poles of the various dynamo electric devices at the receiving stations, together with the similar device at the sending station, to be excited in pairs successively and reversed in polarity at each excitation whereby said dynamo electric devices perform a step-by-step rotation in unison.

3. In electric signaling apparatus, the combination with a source of electric supply, of a dynamo electric device at the sending station having an armature formed with two pairs of poles, each pair being provided with an independent winding, a counting device mechanically connected to said armature, a similar four pole dynamo electric device, and a counting device, at each of the receiving stations, a transmitter at the sending station, electric circuits connecting said transmitter with the various dynamo electric devices and the latter with each other, and means whereby the movement of the transmitter causes the armature poles of the various dynamo electric devices at the receiving stations, together with the poles of the similar device at the sending station, to be excited in pairs successively and reversed in polarity at each excitation whereby said dynamo electric devices perform a step-by-step rotation in unison.

4. In electric signaling apparatus the combination with a source of electric supply, of a dynamo electric device at the sending station having an armature formed with a plurality of pairs of poles, each pair of which is provided with an independent winding, a

counting device mechanically connected to said armature, a similar dynamo electric device and counting device at each of the receiving stations, a transmitter at the sending station comprising a rotary hand switch and rotary contacts coöperating with stationary contacts, electric circuits connecting said stationary contacts with the various independent windings on the pairs of armature poles of the dynamo electric devices and the latter with each other, means for normally keeping said rotary and stationary contacts separated, and means for causing said contacts to come together simultaneously with the initial angular movement of the hand switch to operate the rotary contacts.

5. In electric signaling apparatus, the combination with a source of electric supply, of a dynamo electric device at the sending station having an armature formed with a plurality of pairs of poles, each pair of which is provided with an independent winding, a counting device mechanically connected to said armature, a similar dynamo electric device and counting device at each of the receiving stations, a series of stationary contacts at the sending station, rotary contacts adapted to coöperate with said stationary contacts, electric circuits connecting said stationary contacts with the various independent windings on the pairs of armature poles of the dynamo electric devices and the latter with each other, a longitudinally sliding spindle carrying the rotary contacts, a handle on said spindle, a sleeve surrounding said spindle, a spring arranged between said spindle and sleeve, inclines on said spindle and sleeve coöperating with each other whereby the initial angular movement of the handle causes said spindle to slide in a direction to bring the rotary contacts in opposition to the aforesaid spring and means whereby said spring reacts to shift the spindle in the reverse direction when said handle is released.

6. In electric signaling apparatus, the combination with a source of electric supply, of a dynamo electric device at the sending station having an armature formed with a plurality of pairs of poles, each pair of which is provided with an independent winding, a counting device mechanically connected to said armature, a similar dynamo electric device and counting device at each of the receiving stations, a series of stationary contacts at the sending station, rotary contacts adapted to coöperate with said stationary contacts, electric circuits connecting said stationary contacts with the various independent windings on the pairs of armature poles of the dynamo electric devices and the latter with each other, a longitudinally sliding spindle carrying the rotary contacts, a handle on said spindle, means for enabling said spindle to actuate said rotary contacts with a certain amount of lost motion, a sleeve surrounding said spindle, a spring arranged between said spindle and sleeve, inclines on said spindle and sleeve coöperating with each other whereby the initial angular movement of the handle causes said spindle to slide in a direction to bring the rotary contacts against the stationary contacts in opposition to the aforesaid spring and means whereby said spring reacts to shift the spindle in the reverse direction when said handle is released.

7. In electric signaling apparatus, the combination with a source of electric supply, of a dynamo electric device at the sending station having an armature formed with a plurality of pairs of poles, each pair of which is provided with an independent winding, a counting device mechanically connected to said armature, a similar dynamo electric device and counting device at each of the receiving stations, rotary contacts adapted to coöperate with said stationary contacts, electric circuits connecting said stationary contacts with the various independent windings on the pairs of armature poles of the dynamo electric devices and the latter with each other, a longitudinally sliding spindle, an arm loosely mounted thereon and carrying the rotary contacts, a crank on said spindle, a handle loosely mounted on said crank, means for enabling said handle, by means of the crank and spindle, to actuate the aforesaid loosely mounted arm with a certain amount of lost motion, a sleeve surrounding said spindle, a spring arranged between said spindle and sleeve, inclines on said spindle and sleeve coöperating with each other whereby the initial angular movement of the crank handle causes said spindle to slide in a direction to bring the rotary contacts against the stationary contacts in opposition to the aforesaid spring and means whereby said spring reacts to shift the spindle in the reverse direction when said handle is released.

8. In electric signaling apparatus, the combination with a source of electric supply, of a dynamo electric device at the sending station having an armature formed with a plurality of pairs of poles, each pair of which is provided with an independent winding, a counting device, toothed gearing connecting said armature with said counting device, a similar dynamo electric device, counting device, and toothed gearing at each of a plurality of receiving stations, a series of stationary contacts at the sending station, rotary contacts adapted to coöperate with said stationary contacts, electric circuits connecting said stationary contacts with the various independent windings on the pairs of armature poles of the dynamo electric devices and the latter with each other, a longitudinally sliding spindle carrying the ro-

tary contacts, means whereby said spindle normally operates to restrain movement of the aforesaid toothed gearing and to keep said rotary and stationary contacts separated, a handle on said spindle, a sleeve surrounding said spindle, a spring arranged between said spindle and sleeve, inclines on said spindle and sleeve coöperating with each other whereby the initial angular movement of the handle causes said spindle to slide in a direction to liberate the said toothed gearing and bring the rotary contacts against the stationary contacts in opposition to the aforesaid spring and means whereby said spring reacts to shift the spindle in the reverse direction when said handle is released.

9. In electric signaling apparatus, the combination with a source of electric supply, of a dynamo electric device at the sending station having an armature formed with a plurality of pairs of poles, each pair of which is provided with an independent winding, a counting device mechanically connected to said armature, a similar dynamo electric device and counting device at each of the receiving stations, a transmitter at the sending station for controlling the current through the various dynamo electric devices, two sets of indications on the counting devices for indicating deflections "right" or "left", and means for automatically hiding from view one or other set of indications, in accordance with the direction of revolution of the aforesaid counting device.

10. In electric signaling apparatus, the combination with a source of electric supply, of a dynamo electric device at the sending station having an armature formed with a plurality of pairs of poles, each pair of which is provided with an independent winding, a counting device mechanically connected to said armature, a similar dynamo electric device and counting device at each of the receiving stations, a transmitter at the sending station for controlling the current through the various dynamo electric devices, electric circuits connecting said transmitter with the various dynamo electric devices and the latter with each other, a magnetized oscillatory bar at each receiving station under the influence of the current passing through the field coils of the receiving dynamo-electric devices, a pivoted arm to which a rocking movement is imparted by the oscillatory bar, and a visual indicator carried by the said pivoted arm for drawing attention to the counting devices when signals are about to be sent.

11. In electric signaling apparatus, the combination with a source of electric supply, of a dynamo electric device at the sending station having an armature formed with a plurality of pairs of poles, each pair of which is provided with an independent winding, a counting device mechanically connected to said armature, a similar dynamo electric device and counting device at each of the receiving stations, a transmitter at the sending station for controlling the current through the various dynamo electric devices and the latter with each other, a toothed disk mounted on the armature axle of each of the receiving dynamo electric devices, a pivoted arm, a toothed block carried thereby normally engaging with said disk, and electro-magnetic means adapted to disengage said disk and block and thus liberate the dynamo electric devices when the circuit through the dynamo electric devices at the sending station and the various receiving stations is completed.

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses this fifteenth day of November 1905.

ARTHUR TREVOR DAWSON.
GEORGE THOMAS BUCKHAM.

Witnesses:
ALFRED PEAKS,
HENRY KING.