

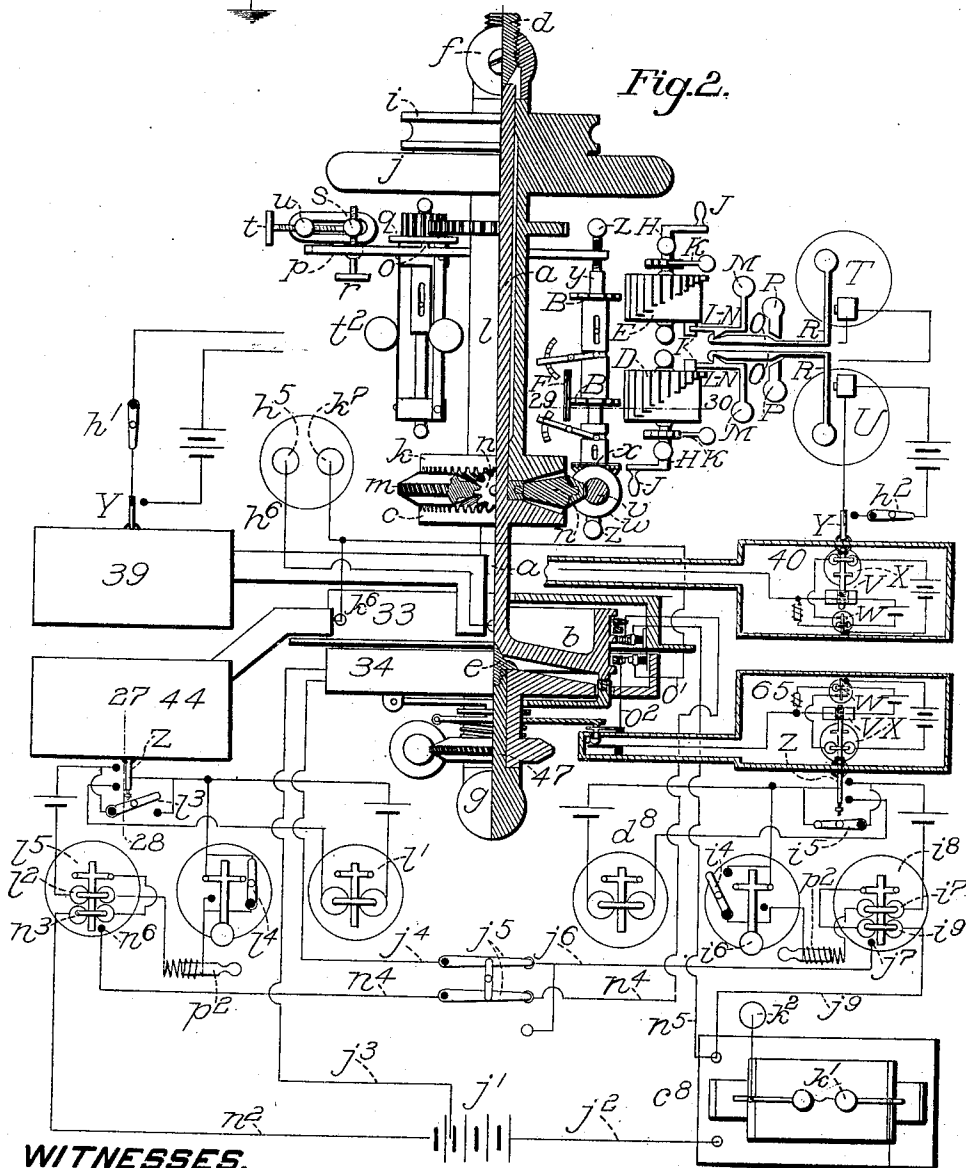
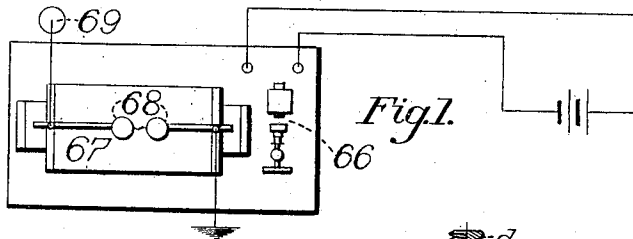
No. 761,256.

PATENTED MAY 31, 1904.

C. K. SALISBURY.
WIRELESS TELEGRAPHY.
APPLICATION FILED OCT. 30, 1902.

NO MODEL.

4 SHEETS—SHEET 1.



WITNESSES.

E. S. Myers
P. H. Junger.

INVENTOR.

Charles K. Salisbury.

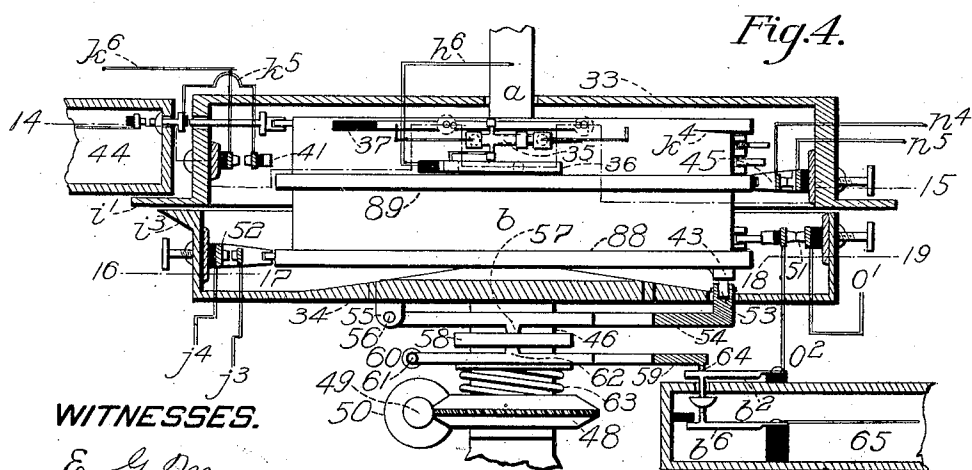
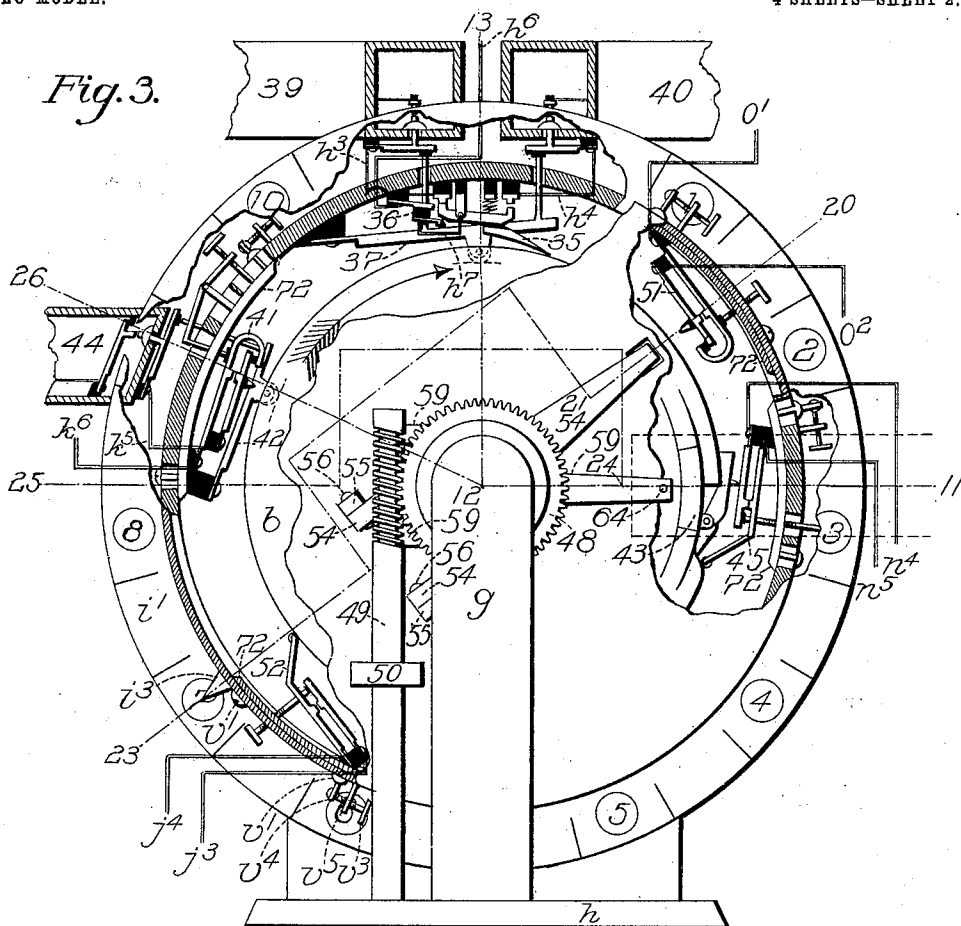
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4 SHEETS—SHEET 2.



WITNESSES.

E. G. Meyers.
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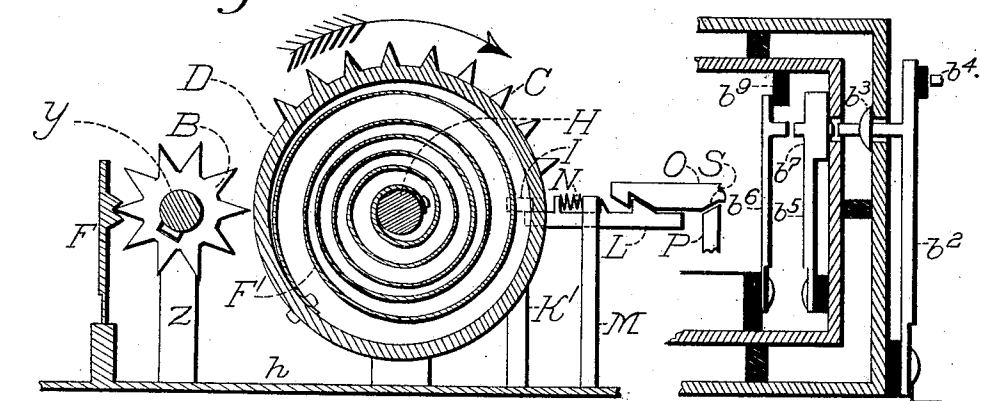
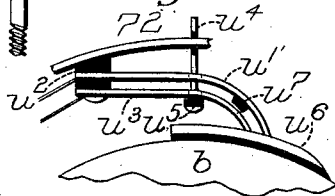
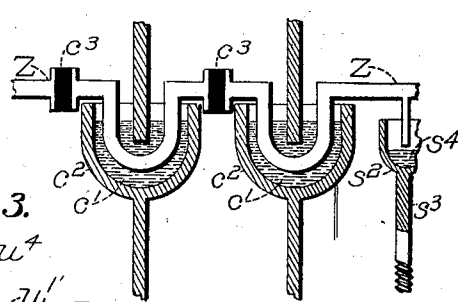
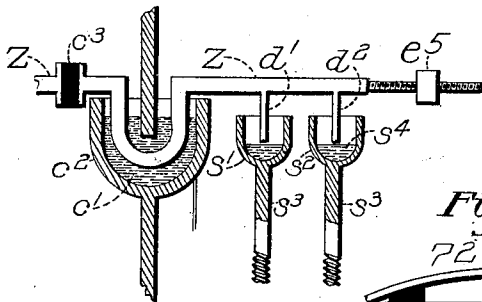
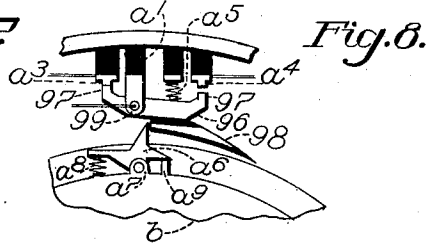
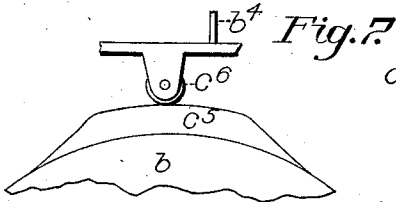
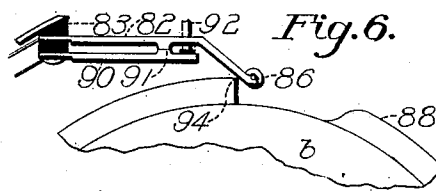
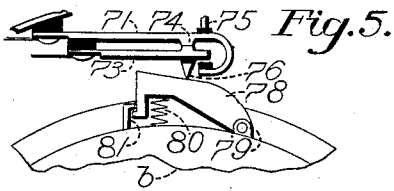
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NO MODEL.

4 SHEETS—SHEET 3.



WITNESSES.

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INVENTOR.

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No. 761,256.

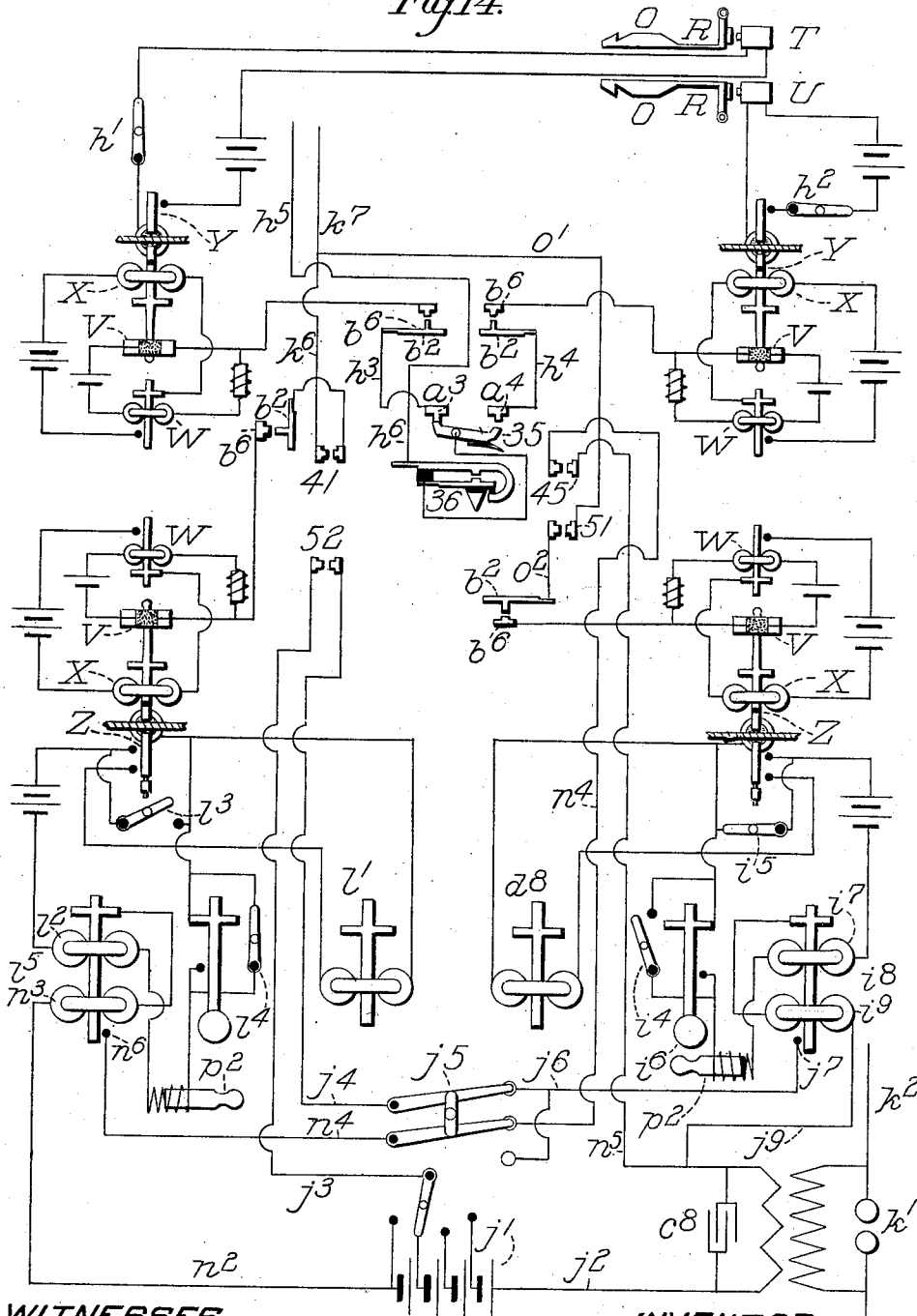
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NO MODEL.

4 SHEETS—SHEET 4.

Fig 14.



WITNESSES.

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UNITED STATES PATENT OFFICE.

CHARLES K. SALISBURY, OF LINCOLN TOWNSHIP, BLACKHAWK COUNTY,
IOWA.

WIRELESS TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 761,256, dated May 31, 1904.

Application filed October 30, 1902. Serial No. 129,447. (No model.)

To all whom it may concern:

Be it known that I, CHARLES K. SALISBURY, a citizen of the United States, residing in Lincoln township, in the county of Blackhawk and State of Iowa, have invented a new and useful Apparatus and Method for Wireless Telegraphy, of which the following is a specification.

My object is, first, to provide means for sending two or more messages simultaneously to an equal number of stations; second, to utilize relays for sending messages to stations outside the electrical influence of the transmitting-station; third, to simultaneously transmit messages in reverse ways between stations; fourth, to prove the correct delivery of a message to the transmitter.

My invention consists in the construction of elements and subcombinations and the arrangement and combination of parts at separate stations, as hereinafter set forth, pointed out in my claims, and illustrated in the accompanying drawings, in which—

Figure 1 is a plan view of the mechanism for producing synchronism between transmitting and receiving stations. Fig. 2 is a plan view of the mechanism for simultaneously transmitting and receiving. Parts of the devices are shown in section. Fig. 3 is a front elevation of the machine, partly in section, and shows the positions of operative projections, the stationary carrier-holder, the stationary set, the dial attached, the movable carrier and movable set, and shows the position of a synchronism-detector relative to the coherer-connectors and transmitting-breaks. Fig. 4 is a transverse sectional view of Fig. 3. Fig. 5 shows the coherer-connector and that portion of the wheel having a projection thereon for closing the connector. Fig. 6 shows the ordinary form of transmitting-break and the projection on the operative wheel. Fig. 7 shows a section of the wheel having a cam for operating the roller and lever, as required to cause contact to be made with the coherer in a case. Fig. 8 shows the synchronism-detector mechanism. Fig. 9 is a sectional view on the line 27 28 of Fig. 2 and shows a section of a protective case, a

relay-lever, a mercury-cup, contact-cups, and an adjustable weight. Fig. 10 is a sectional view corresponding with Fig. 9, but shows two mercury-cups and two bends in the relay-lever, as required when a double protective case is used. Fig. 11 is a sectional view of the adjustable regulator and the double governing-wheel, taken on line 29 30, Fig. 2. Fig. 12 is a sectional view of a double protective case that incloses a coherer and the devices for opening the cases and making connection with the coherer. Fig. 13 shows a modified form of transmitting-break for a primary circuit. Fig. 14 is a diagrammatical view of the electrical circuits and their relations to each other and intervening mechanical structures.

A shaft *a*, having a fixed wheel *b* and bevel gear-wheel *c*, rotates, as indicated by an arrow in Fig. 3, in bearings fixed to the standards *f* and *g* on the base *h*. A band-wheel *i*, balance-wheel *j*, and bevel gear-wheel *k* are on a sleeve *l* on the shaft *a*. The bevel gear-wheels *c* and *k* coact with bevel gear-pinions *n* and *n* and two others (not shown) diametrically opposite to *n* and *n* in the frame *m*, as shown in Fig. 2, to produce differential gear. This is to provide for adjusting and synchronizing the operating-wheel *b* without disturbing the speed or regulation of a balance-wheel *j* when that wheel is revolving at a required speed. The friction-surface of projection *o* on the governing-lever *p* bears on the end surface of a friction-wheel *q* of a friction-governor *t* for regulating the speed of the machine. The lever *p* is attached at one end to the shaft *y* of the governing-wheels *B B* by very fine screw-threads on the shaft *y* and in the lever *p* and at the other end by a thumb-screw *r* to the movable standard *S*, to be controlled by a thumb-screw *t* to slide to or from the stationary standard *u*, as required to permit fine adjustment of speed by automatically adjusting the lever *p*. The frame *m* has teeth on its face which engage with worm-gear threads on a shaft *v*, and a bevel gear-wheel *w* on a shaft *v* engages a bevel gear-wheel *x* to be disengaged from the gear-wheel *w* for the purpose of manually adjusting and synchronizing by

means of the wheel *b* on the shaft *a*. A shaft *y* is mounted on standards *z z*, fixed to the base *h*, as shown in Fig. 11. The slidable wheels *B B* (shown in Fig. 2) may engage one or more teeth *C* on wheels *D* and *E* by adjusting them on the shaft *y*, as required to engage any given number of teeth desired during a revolution of the wheels *D* or *E*. The teeth *C* on the wheels *D* and *E* vary longitudinally to permit of fine adjustment. The regulating electrical impulses received from the synchronizing-station impart intermittent motions to the wheel *b* and regulate speed by action on governor *z'*. The detent *F* (shown in Fig. 11) is designed to prevent the wheels *B B* from getting out of position from jars or other causes. *D* and *E* rotate in opposite directions relative to each other.

The wheels *D* and *E* are hollow and loosely placed on their shafts *H H*. Inside of these wheels are convolute springs *F'*, fixed to the wheels and shaft *H*, as shown in Fig. 11. Projections *l* on the peripheries of the wheels *D* and *E* serve as stops.

When the springs *F'* are wound up by means of cranks *J*, spring-actuated clicks *K* prevent the springs from unwinding. The click-carriers *L* slide through bearings in the fixed standards *M*. Hooks *O O* have inclined shoulders *S* on their sides to engage inclined ends of standards *P* to force hooks *O* from engagement with the spring-actuated click-carriers *L* when the hooks have moved a short distance toward the electromagnets *T* and *U*, but not until after they are disengaged from the projections *l* on the wheels *D* and *E*. This prevents more than one revolution of the wheels *D* and *E* for each action of the electromagnets *T* and *U*. The hooks *O* are secured at one end to the armature-levers *R R* of the electromagnets *T* and *U* in such a manner as to exert a spring-pressure on the click-carriers *L* and are designed when circuits are broken in electromagnets *T* and *U* and levers *R R* raised to be engaged with the clicks on the carriers *L*. The actions of the wheels *D* and *E* are intended to be extremely rapid.

It is absolutely necessary that only wheels *D* or *E* revolve at one and the same time.

Wheel covers and carriers *33* and *34* entirely protect the wheel *b* and also hold all the coherer-connectors, transmitting-breaks, cam-levers, and rollers and also the synchronizing-detector and all connections required at a station. The stationary set is placed in carrier *33*, which is solidly secured to the base *h* and consists of, first, the synchronism-detector *35*, the detector-connector *36*, the cam-roller and cam-lever *37* for making connection in the protective cases *39* and *40*, the coherer-connector making connection in case *44*, and the sending-break *45*. The movable set is placed in the carrier *34*, which consists of the operating wheel-cover portion joined by a sleeve *46* to the worm gear-wheel *48*, the

sleeve having bearings on the shaft-like portion *47* of a standard *g*. The wheel *48* has teeth which engage with the threads on the shaft *49*, which can be turned in its bearings in the base *h* without longitudinal motion by means of the thumb-nut *50*. The movable set, consisting of the coherer-connector *51*, the transmitting-break *52*, the cam-roller *53*, the cam-lever *54* outside of the carrier *34*, (divided a portion of its length, and the divided portion passes on each side of the sleeve *46* without touching the same,) is secured at the divided end to the standards *55* by pins *56*, and the standards *55* are securely fixed to the movable carrier *34*. Two projections *57* on the lever *54* engage the ring *58*, placed loosely on the sleeve to permit longitudinal motion. The lever *59* is also divided a portion of its length and the divided portion placed on each side of the sleeve *46*, and is also secured at the divided end to a standard *60* by a pin *61*. Said standard is securely fixed to the base *h*. Projections *62*, one diametrically opposite to the one shown in Figs. 2 and 4 on the lever *59*, are forced against the ring *58* by spiral spring *63*. The lever *59* at its opposite end has a projecting pin *64*, which engages with the protector-closer *65* and makes connection with the coherer in the case *65*. The reason for thus connecting the cam-lever with the protective case *65* is to permit indicator *z'* on carrier *34* being turned to any point of dial and cause the protective case *65* to admit contact made with the coherer at the same time that the coherer-connector *51* is closed by projection *78* of wheel *b*. The cam-roller *53* and lever *54* are operated by the cam projection *43* on the side of the wheel *b*.

The coherer-connectors *41* and *51* and the synchronism-detector connector are all constructed alike and perform like functions. One of them is shown in Fig. 5, in which the stationary lever *71* is securely fixed to the slidable frames *72* in the coherer-connectors *41* and *51* and to the stationary carrier *33* and the detector-connector *36*.

The lever *73* is secured at one end to the lever *71* and insulated therefrom. The spring tendency of both levers is to force them apart, and a turn at the free end of the lever *71* restricts the limit of the motions of the lever *73*. A hard-rubber block is secured to the lever *71* to prevent electrical contact between the two. On the levers *71* and *73* are electrodes *74*, composed of pure silver or silver slightly amalgamated with mercury, to make contact between the vertical wire and coherer. A thumb-screw *75*, seated in the stationary carrier at *36* and in the frames *72* at *41* and *51*, forces the lever *71* downward for purpose of minutely regulating the intervals of contact between the electrodes *74*. The thumb-screw *75* is insulated from the lever *71* by a hard-rubber block secured to the lever *71*. The projection *76* is solidly secured to insulating material

fixed to the lever 73. This projection engages the connector 78 on the wheel b at the operating-point by being pivoted between standards 79. At one end of the connector 78 is a spiral spring 80, which forces it outward. A projection on the standard 81, solidly secured to the wheel b , prevents the connector 78 from moving beyond a certain point.

The spiral spring 80 is stronger than the spring force of the lever 73, and when the wheel has revolved so that the connector 78 strikes the projection 76 the two surfaces will slide on each other and first cause the lever 73 to yield and the contacts 74 to strike together, and further movements of the wheel b will cause the spring 80 to separate the connector 78 and projection 76, and the springs will then regain their normal positions and instantly separate the contacts 74.

The breaking-lever 82 is joined at one end to the insulating-block of hard rubber 83 by rivets or screws and the block by like means to the sliding adjustable frames 72 at 45 and 52. The lever 82 is bent downward near its free end and carries a small roller 86, which is pressed on the cam projections 88 and 89 of the wheel b by the spring 80. Below said lever 82 is a shorter lever 90, secured at one end to a hard-rubber insulating-block fixed to the lever 82. Near the ends of the levers 82 and 90 are platinum electrodes 91, to be brought in contact when the wheel b has caused the roller 86 to depress the cam 88. To effect a break, it is necessary to turn the wheel so that the shoulder 94 will strike the under surface of the lever 82 and force the lever 82 upward.

The spring tendency of the lever 90 is toward the lever 82. The synchronism-detector (shown in Fig. 8) consists of a lever 96 and two electrodes 97 and the detector shoulder and arm 98. The arm 98 is fixed to an insulating-block on the lever 96. The lever 96 is pivoted between the standards 99, fixed to an insulating-block a' on the carrier 33. Insulated electrodes 97 engage electrodes a^3 and a^4 . A spiral spring a^5 normally presses on the lever 96 and tends to keep the electrodes 97 and a^3 constantly in contact when not engaged with the projection a^6 , pivoted between two standards a^7 , that are fixed to the wheel b . A spiral spring a^8 exerts an outward pressure on a portion of the projection a^6 . Another projection of a^6 comes in contact with the projection a^9 , is fixed to the wheel b , and prevents a^6 from moving too far. The spiral spring a^8 is stronger than spring a^5 and will cause contact to be broken between the electrodes 97 and a^3 and force contact between the electrodes 97 and a^4 before the further motion of the wheel b compresses the spring a^8 . The projection a^6 strikes the shoulder and slides on the arm 98, which is long enough to prevent contact between the electrodes 97 and a^4

before the contact is broken in the detector-connector 36.

The protective cases 39, 40, 65, and 44 are so constructed as to permit of being rapidly opened and closed at every revolution of the wheel b . Apertures in the cases 39, 40, 65, and 44 allow the relay levers and tappers Z and Y to protrude, as shown in Fig. 2. The double case can be used when one case will not entirely protect the coherer within from the influence of the intense local sending impulses. When using the double casing, as shown in Fig. 12, the outside closing-connector b^2 is the same in action and construction as it would be in the single case. The closer b^3 , secured to b^2 , forms a part of it and fits against the inner surface of the outer casing and is held in position by the spring force of b^2 when the rod b^4 is not exerting a pressure on b^2 .

In the double case the contact-point of b^2 touches the contact on the inner case protector-connector b^5 instead of contacting with spring b^6 , as it would do if single case were used. This protector-connector b^5 is placed on the inside of the inner case and secured at one end to a hard-rubber block fixed to the inner case. The circular piece b^7 at the end of b^5 is made of pure silver or silver slightly amalgamated with mercury at its point of contact with the surface of the case and is held in firm contact with the surface of the inner case by the spring b^5 .

When the rod b^4 exerts a pressure on b^2 , it causes the closer b^3 to leave the surface of the outer case and the contact-point on b^2 to make contact with the point on b^5 , and a further motion of b^4 will cause the circular piece b^7 to leave the surface of the inner case, and a still further motion of b^4 inward will cause the point on b^5 to make a contact with the contact-point of the spring b^6 , which has a spring tendency toward b^5 , but is prevented from touching the same by the insulating-block b^9 , fixed to the inner case. When the rod b^4 is thus pressed in, an electrical union is established between b^2 and b^6 and at the same time insulates the connections of the above from the cases, as required to permit closing the protective cases and disconnecting the coherers once every revolution of wheel b from the connections outside of the cases and also from the cases when the sparks at the local transmitting-oscillators are taking place and to make connection through the aperture when an electrical impulse is expected to be received from some distant station.

Closing the aperture prevents impulses of the local transmitter from entering the cases and disturbing the action of the coherers. The mercury-cup c^2 is so placed over the aperture as to be raised at the rim a distance above the aperture in the case through which the relay-lever Y or Z is conducted. The levers Y and Z are bent in such a manner

relative to the aperture in the case as required to prevent contact with the cup or case while in operation. Mercury c' in the cup c^2 raises above the aperture in the case and allows
 5 free action to the relay-lever.

The levers 37 and 42, shown in Figs. 3 and 4 as attached to the carrier 33, have at the other end of the lever 42 and at one end and near the center of the lever 37 rods b^4 , secured to the levers and are intended to press
 10 against the protector-closers b^2 when the wheel b has turned and caused the rollers c^5 , carried by said levers, to mount the cam projection c^5 on the wheel b . The rods b^4 are insulated from the protector-closers b^2 by hard-
 15 rubber blocks secured to b^2 and against which the rods b^4 strike.

In place of the transmitting-break shown in Fig. 6 the one shown in Fig. 13 and adapted to be self-cleaning may be used. It is
 20 constructed and acts as follows: The lever u' is secured at one end to the insulating-block u^2 , fixed to the adjustable frame 72. Below u' is another lever u^3 , secured to the lever u'
 25 in the same manner. Both these levers are bent downward and have a spring tendency also downward, but are prevented from passing a certain point by means of the thumb-screw rod u^4 , passing through the levers, and
 30 an insulating-block u^5 , against which the lever u^3 strikes when not in contact with the plate u^6 on the wheel b . The plate u^6 , fixed to the wheel b , is insulated by a hard-rubber strip on the wheel b , and at one end u^6 is
 35 rounded into a gradual incline, and at the other end it makes an abrupt break, the break end of u^6 coinciding with operating-point on wheel b . Levers u' and u^3 are comparatively broad, as is also plate u^6 , so as to easily conduct the current of a primary coil, and the ends of the levers which come in contact with the plate u^6 may be split up lengthwise a short distance, so as to form a metallic brush to more readily adapt themselves to the surface of the
 40 plate. It will be noticed that until both levers u' and u^3 are in contact with the plate u^6 there is no electrical connection between u' and u^3 and that after plate u^6 does make connection the motion of the wheel b will cause both levers to slide on the surface of the plate until the continued motion causes the lever u^3 to leave the plate, when a break
 45 instantly occurs in the primary circuit.

A block of hard rubber u' is placed on the
 50 lever u' to prevent union between the brushes of the levers u' and u^3 . The brushes of the levers u' and u^3 and the plate u^6 are preferably platinum.

The coherer V, the coherer-relay W, and the tapper and relay X, with their batteries and connections, are the same in the case 39 as in case 40. (Shown in Fig. 2.)

The tapper and relay X is rapidly operated by a current started by the coherer-relay W.
 65 The levers Y tap the coherer V at one end

and extending through the cases at the mercury-cup at the other end to make contact in the circuits operating the electromagnets T and U are quick acting. The coherer V, coherer-relay W, and tapper and relay X are the same in case 44 as shown in case 65 and are the same in construction and action as those in the cases 39 and 40; but the tapper and relay lever Z is designed to move slowly, so that the contact-points d^2 and d' (shown in Fig. 9) will not entirely leave the mercury in the cups s' and s^2 until the coherer-relay W has again completed the circuit through the tapper and relay X coils and has again attracted the lever Z. This prevents a break in the circuits of reading instruments d' and d^2 and the coils l^2 and l' of the protective relays l^2 and l^3 when receiving a dash and causes the reading instruments to give out Morse signals without further action. The relay and tapper lever Z is to a certain extent regulated in speed of vibration by being made long and having a long stroke. The thumb-nut e^2 aids in regulating time of vibration and is assisted by a spring on the outside of the case (but not shown) for raising lever Z. Any other arrangement of parts may be used that will cause the lever Z to remain down when receiving a dash.

All the levers Y Z in cases 39, 40, 44, and 65 have the insulating-blocks e^2 (shown in Fig. 9) placed in relay-levers to prevent local impulses entering the cases by following relay-levers. All instruments and connections placed inside the cases must be insulated from case by means of hard-rubber blocks to prevent inductive capacity sufficient to effect the coherer. High-resistance coils of a non-inductive type must be placed across all contacts in parallel to prevent sparks of self-induction in all the instruments both inside and outside of the cases excepting the sending-breaks 45 and 52.

The adjustable sliding frames 72 72, to which the coherer connections 41 and 51 and the sending-breaks 45 and 52 are attached, are for adjusting the coherer-connectors and sending-breaks in relation to each other, in relation to the dial-spaces, and the indicator i^2 . They are all made alike, and a description of 72, to which the break 52 is attached, will answer for the whole. The frame 72 closely fits the inner surface of the carrier 34 and is held against the same by screw-pins v' , one being at each end of the frame and passing through long slots in same and having large heads prevent displacement of the frames 72, and when frame 72 is in position these screws may be turned so as to hold 72 solidly against carrier 34. To a projection v^4 , secured to v' , at one end of 72, a thumb-screw v^5 is secured. This thumb-screw passes through a hole in the standard v^5 , solidly secured to carrier 34, and which engages threads in the standard v^5 , and it will be possible when the screws v' are

loosened to move the frame 72 by revolving v^3 . The motor (not shown) for revolving the band-wheel i should be of such uniform power as to steadily rotate the operating-wheel b and still be controlled by the friction-governor t^2 and connected with the band-wheel i . The mercury contact-cups s' and s^2 are constructed as follows: The cup-shell is composed of a conductive metal and placed on a rod s^3 , fixed to the base h , and turning it right or left raises or lowers the cup s' or s^2 .

The method of adjusting, regulating, and synchronizing the operating-wheel b is as follows: Assuming that the wheel b is intended to make ten complete revolutions per second, then the synchronizing-station (shown in Fig. 1) must give out ten distinct electrical impulses per second. This is accomplished by means of the automatic make-and-break vibrator 66, placed in the primary circuit of the induction-coil 67. The secondary terminals of the coil 67 are attached to the oscillator-electrodes 68, one electrode being attached to the earth and the other to the vertical radiating wire 69, which is insulated from the earth and carried vertically into the air by a mast or pole.

The synchronizing-station shown in Fig. 1 should be centrally located in respect to the various transmitting and receiving stations and must give out impulses powerful enough to effect all the stations to be synchronized by said station, and only one synchronizing-station should be allowed to effect the same transmitting and receiving stations.

When the motor is started in such a direction as to cause the operating-wheel b to revolve in the direction indicated by the arrow in Fig. 3, the speed is regulated by adjusting the friction-governor t^2 until the wheel b makes approximately ten revolutions per second. The switches h' and h^2 are then opened and the bevel gear-wheel x disengaged from the bevel gear-wheel w and the shaft v revolved by hand until the relay-lever Y of either the protective case 39 or 40 by the coherers attached to the vertical wire h^5 gives out steady and uniform vibrations with no telegraphic breaks, or if the synchronizing-station gives out a series of impulses representing a predetermined signal or set of signals is revolved until these are received and given out by the relay-lever Y in the case 39 or lever Y of the case 40. Assuming that the lever Y of case 40 gives steady vibrations when the shaft v is stopped at a certain point, it will show that the operating-point on the wheel b is too far ahead and the projection a^6 will strike the shoulder on the arm 98 of the synchronism-detector 35 and disconnect the electrode 97 on the lever 96 from the electrode a^3 of the wire h^3 and connect electrode 97 to electrode a^4 of wire h^4 before the electrical impulse from the synchronizing-station reaches the vertical wire h^5 .

The electrode a^3 is connected by the wire h^3 to the protector-closer b^2 of the case 39, and the action of the cam-lever 37 produces contact between the electrodes on b^2 and the contact-springs b^6 , to which the coherer V is attached in the cases 39 and 40, and the connector 36 will at the same time keep connection between the vertical wire h^5 and the lever 96 by means of the wire h^5 to the lever 71 of the connector 36 by the lever 73 of 36 being connected to the lever 96 of the synchronism-detector 35 by the wire h^4 , which makes contact at the pivot of 35. The electrode a^4 is joined by the wire h^4 to the closer b^2 of the case 40. Assuming, as before stated, that the operating-point is too far ahead, or, in other words, the connection between the vertical wire h^5 and synchronizing-detector 35 is made at too early a period of revolution of wheel b , we will then rotate the shaft v in direction so as to cause the wheel b to revolve slightly slower than the wheels i and j until the lever Y of the case 40 ceases to vibrate. The shaft v being still turned in same direction, the lever Y of the case 39 will now vibrate and show that the operating-point is too far behind and that the contacts occur at too late a period of revolution of the wheel b . Reversing the rotation of the shaft v moves the operating-point ahead slowly until the levers Y in cases 39 and 40 do not vibrate—the electric impulses being received from the synchronizing-station on vertical wire h^5 when the lever 96 is being moved forward by projection a^6 on b and neither electrodes 97 and a^3 or 97 and a^4 are in contact. If this is maintained during several revolutions of b , the speed is near normal and no further manual adjustments may be needed in the governor t^2 . The bevel gear-wheel x is then engaged with the bevel gear-wheel w and the switches h' and h^2 closed and the further regulation and synchronism of the wheel b being automatically performed by the apparatus before shown and described. When the electromagnet U is excited by the lever Y of the case 40 closing the circuit through the lever U , the regulator-wheel D is released and makes a revolution, slowing down the speed of parts $i j l k$ by action on lever p of governor t^2 and at the same time causing b to momentarily revolve slower than $i j l k$ by the means acting on the differential gear. When the electromagnet T is excited by the lever Y of the case 39 closing circuit through T , the regulator-wheel E is released and makes one revolution, quickening the action of the parts $i j l k$ and causing b to revolve during part of one revolution at greater speed than said parts.

To produce readable signals in the Morse code, three revolutions of the operating-wheels b , each giving out an electric impulse, are required to make a dash, and one revolution will make a dot. At this rate seven revolutions are required to produce a letter, (the

average of the alphabet.) With the average number of letters in a word taken as five and one-half, ten revolutions of wheel *b* per second would give a speed of about fifteen words per minute. On the dial *v'*, which is fixed to the stationary carrier 33, are uniform spaces, and every second space has a consecutive number engraved thereon and the space diametrically opposite across the dial from any number left vacant. A large space is also left vacant on the dial, behind which the synchronizing-detector 35 is placed. Each of these numbers on the dial represents a separate station, the stations all having their dials numbered alike, and the point on the dial at which the lever 96 is shifted by the projection *a'* should be exactly at the same location at all stations in relation to the numbered spaces on the dial *v'*.

Directly back of the dial-number "9" (shown in Fig. 3) is the coherer-connector 41 of the station No. 9, and it belongs to the stationary set and is secured to the stationary carrier 33 and intended to be permanently located at that point. Diametrically opposite to the coherer-connector 41 is the transmitting-break 45 of the stationary set, secured to stationary carrier 33 directly back of the vacant space between the station-numbers "3" and "4" diametrically opposite to the station-number "9" on the dial. The same arrangement of parts is used at the various other stations, with the exception of the coherer-connectors being each placed permanently back of the number on the dial representing that station, the sending-breaks at their respective stations being placed diametrically opposite to their respective coherer-connectors across the dial, when the operating projections all coincide with each other on the same wheel. The transmitting-break 52 of the movable or calling set is placed in the movable carrier 34 directly opposite to the coherer-connector 51 of the same set. Directly outward from the point on the lever 82 against which the shoulder 94 of the operating-wheel *b* strikes and makes a break in the primary circuit of induction-coil *c'* an indicator *i'* is fixed to the outside edge of the movable carrier 34.

The operation of transmitting, receiving, and relaying messages is as follows: The operating-wheels of the various transmitting and receiving stations having been started and synchronized, as previously described, and the synchronizing-station (shown in Fig. 1) giving out impulses continuously, the thumb-nut 50 on the shaft 49 is revolved in such a way as to cause the indicator *i'* to point to the number on the dial representing the station desired. (Shown in Fig. 3.) The indicator 13 shows that station No. 9 is in position to call the station No. 7, which is done by opening the switch *i'*, closing the switch *i''*, as shown in Fig. 2, and operating the key *i'''* in the usual manner of making a call. The

key *i'''* closing the circuit through the coils *j'* of the protective relay *i''* causes the lever of *i''* to descend and close the break in a primary circuit at that point of the induction-coil *c'*. The coils *j''* of the protective relay *i''* are placed in series or in parallel position with the primary coil of the induction-coil *c'*. This is done to prevent the armature-lever of the protective relay *i''* from rising, when the circuit of the primary coil is once completed by the break 52, breaking the primary circuit and causing a spark to take place between the oscillators before the contacts are broken by the break 52, and thus causing disturbances and being liable to disturb action of coherers of the transmitting-station. Such an arrangement and coöperation of parts absolutely secure the primary circuit, after it has been completed, being broken by the transmitting-break independently of the action of the keys or relay-levers *Z*. Assuming that the station No. 9 is calling No. 7 and that the call given is the Morse numeral seven, represented by two dashes and two dots, the key *i'''* will be held down while the wheel *b* will make three revolutions and breaks in the primary circuit for the dashes and one revolution of the wheel for each dot and one revolution for each space between the dashes and dots. When the key *i'''* is held down while the wheel *b* is making three revolutions, as stated, the armature-lever of the relay *i''* is also depressed and held down that length of time by the circuit through the coils *j'*, as before described, and this completes the circuit of the primary coil of *c'* at the electrode *j'*, and the transmitting-break 52 makes three breaks in the primary current of the induction-coil *c'* by means of the battery *j'*, connected at one pole to one terminal of primary induction-coil by the wire *j''*, the other pole of *j'* being connected by a flexible insulated conducting-cord *j'''* to the lever 90 of the break 52, and the lever 82 of said break is connected by a flexible insulated conducting-cord *j''''* through the relay-changer switch *j''''* (which is same in operation as an ordinary pole-changer switch) by a wire *j''''* to the contact-electrode *j''* of the protective relay *i''* and the other terminal of the primary coil joined by the wire *j''* through the coils *j''* of the protective relay *i''* to contact an electrode on the armature-lever of *i''*. These three breaks in the primary-coil circuit of *c'* produce three sparks in the secondary coil, the terminals of which are joined to the oscillator-electrodes *k'* *k''*, one of which is connected to the vertical radiator *k'''*, (which is a wire insulated from earth and carried vertically into the air by means of pole or mast,) the other electrode of the oscillator being connected to the earth. These three sparks thus produce three distinct electrical impulses, which are radiated in all directions and reach the vertical receiving-wires of various stations. The coherer of station No. 7 would be the only one,

however, which would be connected to the various vertical wires at the instant that the impulses are given out and received when all stations are in perfect synchronism and the transmitting-break 52 rightly adjusted.

The calling or movable set placed in the carrier 34 at one station always calls up and corresponds with the stationary set placed in the carrier 33 at any other station.

The stationary set placed in the stationary carrier of the station No. 7 are identical with those in the station 9, (shown in Fig. 3,) excepting that the coherer-connector of station 7 would be placed back of the number "7" on the dial at that station. The action of the receiving-set at station 7 would be the same as at station 9. To prevent confusion, I will describe the action of the stationary set placed in the carrier 33 of the station 9, with the understanding that the same represents station 7 in this case.

When the wheel *b* has revolved to a certain point, the cam projection *b*⁴ causes the roller *c*⁶ on cam-lever 42 to force a connection in the protective case 44 between the spring-contact *b*⁶ and the protective closer *b*² in case 44, *b*² is joined by the wire *k*⁵ to the lever 73 of the coherer-connector 41, and the lever 71 of the coherer-connector 41 is joined by the wire *k*⁶ to the vertical wire *k*⁷. A further movement of the wheel *b* causes the projection 78 to make contact between the electrodes 74 of the coherer-connector 41, thus making electrical union between the coherer V in the case 44 and the vertical wire *k*⁷, and when the three electric impulses are received on *k*⁷ from the station 7 the coherer V is rendered conducting and the coherer-relay W armature-lever is caused to descend and makes a circuit through the tapper and relay X coils, causing the lever Z to descend and complete the circuit through the coils *l*² of the protective relay *l*⁵; (the switch *l*³ being previously opened and the switch *l*⁴ closed, as must always be done when not using the key,) thus causing the armature-lever of the relay *l*⁵ to descend and close the break in the primary circuit of the induction-coil *c*⁸ at the electrode *n*⁶, and the three electrical impulses thus received from the station 9 causes the armature-lever *l*⁵ to remain down, as previously set forth, while the wheel *b* makes three revolutions and the transmitting-break makes three breaks in the circuit of the primary induction-coil *c*⁸ at 7. These breaks in the primary induction-coil are made by the following means: As before stated, one terminal of the primary is connected by the wire *j*² to the battery *j*⁷ at one pole, and the other pole of *j*⁷ is joined by the wire *n*² to the contact-electrode on the armature-lever of the protective relay *l*⁵ after passing through the coils *n*³ of the lever *l*⁵. The electrode *n*⁶, against which the electrode on the armature-lever of the relay *l*⁵ strikes,

is joined to the lever 90 of the transmitting-break 45 by the wire *n*⁴, which passes through the relay-changer switch *j*⁵. The lever 82 of break 45 is joined by the wire *n*⁵ to the other terminal of the coil *c*⁸. When any of these three electrical breaks are made in the primary induction-coil, an electrical impulse is radiated from the vertical wire *k*² at station 7 and strikes the vertical wire *k*⁷ of station 9, when the coherer and vertical wire at that station are joined together by the action of the wheel *b* and all other coherers and vertical wires at other stations disconnected by the same means. When the transmitting-break of one station is in position to act on the coherer of a second station, the transmitting-break of said second station is in position to act on the coherer of the first station mentioned and to the exclusion of all other stations. When the impulse from station 7 reaches the vertical wire *k*⁷ of station 9, it travels along the flexible insulated conducting-cord *o*¹ to the lever 71 of the coherer-connector 51, through the contacting electrodes 74, along the lever 73 of the coherer-connector 51, and along the flexible insulated and stock conducting cord *o*², adapted to permit the carrier 34 being turned freely in any direction to the protector-closer *b*² of the case 65; but the cords must not run close together for any distance, as the effects of capacity and induction would be to excite the coherer even if disconnected from the vertical wire, the electric contact thus made through the aperture in the case 65 and completed by the pin 64 on the lever 59 striking the contact point *b*² and forcing the electrode thereon against the electrode on the contact-spring *b*⁶, which is directly joined to coherer V. These three electrical impulses, which have been automatically relayed from station 7, cause the lever of the reading instrument *i*⁸ to record the signal sent and shows that the two instruments are in synchronism and working order. When the operator at station 7 answers the call, he closes the switch *l*³ and opens the switch *l*⁴ and operates the key of the stationary set in the usual manner, when a message may be sent in either direction.

In relaying a message through one station to a station outside the electric influence of the transmitting-station the station desired to relay the message is called up in the manner described and, having responded, is requested to relay a message to the station desired. It is done by the relay-station calling the station desired, and which, having responded, the relay-changer switch *j*⁵ is then thrown at the relay-station in such a way that the signals received by the coherer of the stationary set are transmitted by the break of movable set instead of the stationary set, the signals received by the coherer of the movable set at the relaying-station being transmitted by the break of stationary set when the receive-

ing-station is replying or automatically relaying back the message received. When relaying through more than one station, the same operation is performed in all intermediate relaying-stations.

In automatically repeating back a message or relaying same it is absolutely necessary to guard against giving out either more than or less than the number of electrical impulses received. The armature-lever of the protective relays ℓ^6 and ℓ^7 should be made adjustable in length of stroke by the same means as that employed in adjusting telegraph-sounders, and an adjustable self-inductive resistance p^2 is placed in the series with coils ℓ^6 and ℓ^7 of the protective relays i^6 and i^7 to allow a quick adjustment.

Mercury-cups, such as s' and s'' , can be used in conjunction with the electrodes on the armature-lever of relays i^6 ℓ^6 in place of electrodes n^6 and j^7 , and an adjustable thumb-nut similar to ϕ^6 , as shown in Fig. 9, can be used as a weight to regulate the time of vibration of the said armature-levers. The induction-coil c^6 , with its radiator and connections, may be placed at some distance from the other instruments and long connections used. Each sending-break has in its circuit the required number of battery-cells, as shown in Fig. 2. In determining the number of stations which may be used together without interference, the speed of electrical-wave propagation through space, the distance these waves must travel between the most distant coöperating stations, the number of revolutions per second that the operating-wheels make, the space of time allowed over and above the time required for the electrical impulse to travel, the spaces required behind which the synchronism-detector is placed, and the equal space opposite of which no use is made must all be considered. If we take one hundred and eighty-six thousand miles per second as the first, one hundred miles as the second, ten revolutions per second as the third, one-third extra as fourth, twice the space of the station-number as space required for detector as fifth, we will have very near to one hundred and thirty spaces laid off on dials, of which only sixty-five would be numbered, thus giving close to sixty-five stations under these conditions if the various station-wheels are kept in perfect synchronism at all times. If stations were nearer together, more could be jointly used. Higher speed would reduce the number. Each dial may be divided into numerous short-distance stations and a few long-distance ones and relay-messages between the two interchangeable.

A large number of short-distance stations of limited signaling range may be kept in synchronism by the one station and have the same station-numbers, the same numbers being far enough removed from each other so any sta-

tion calling another station will not disturb a more distant one having the same number, and thus work at a distance by relaying.

In automatically regulating and synchronizing the operating-wheel b it is necessary to use great care in adjusting the various parts. The distance between the electrodes 97 and a^4 or 97 and a^3 should be as short as possible and still not permit the coherers in both cases 39 and in case 40 to act from the same impulse received on the vertical wire h^5 .

The wheels B should be so adjusted in relation to the wheels D and E as to rotate the operating-wheels b and i j l k very slightly slower or faster by acting on the governor and to cause most of the changes to be made by momentarily revolving the wheel b slower or faster than i j l k by acting on the differential gear, and thereby cause the next electrical impulse received from the synchronizing-station after the wheels B have acted to be received on the vertical wire h^5 when neither electrodes 97 a^3 or 97 and a^4 are in contact.

If the operating-wheel b is turned too far by means of the automatic regulator, the next impulse received would reverse the action of the wheel B and make it difficult to obtain steady and uniform action of the operating-wheel b . The cams should not keep the protective cases opened longer than necessary, and the duration of the sending-coil primary circuits should be as short as possible, (when both senders use same coil,) as required to prevent interferences when the movable set is being worked close to the stationary set at either sending-break or coherer-connector.

A station giving out electrical impulses regularly and at long intervals for the purpose of synchronizing the action of transmitting and receiving stations has heretofore been suggested with a wheel for putting the synchronizing-current on geared down from the operating-commutator; but in my system the impulses are given out and received once every revolution of the operating-wheel and permits maintaining much closer synchronal action.

Having thus described the various purposes of my invention and the construction and function of each element and subcombination and the arrangement and combination of all the parts relative to each other, the practical operation and utility of my complete apparatus and method will be understood by persons familiar with the art to which it pertains, and

What I claim as new, and desire to protect by Letters Patent, is—

1. In a wireless-telegraph instrument, a rotatable wheel having a cam projection on its face, mechanism for adjusting said wheel, and a second projection on the face of said wheel to make electrical contact between a vertical

wire and a coherer, at a certain determinable point of the revolution of the wheel, for the purpose of receiving signals, in the manner set forth.

2. In a wireless-telegraph apparatus, the combination of a rotatable wheel having a projection on its face for operating the mechanism for automatically regulating and adjusting said wheel, a second projection on the face of said wheel to make contact and break contact in the primary circuit of an induction-coil at each revolution of the wheel and a third projection on the face of said wheel to make contact of short duration at a certain point of each revolution of said wheel between a vertical wire and a coherer and suitable reading instruments, substantially as described.

3. In a wireless-telegraph apparatus, the combination on one revolving wheel of a suitable projection on face of said wheel for operating the apparatus for automatically regulating and adjusting said wheel, a suitable projection on the face of said wheel to make contacts and breaks in a primary circuit of an induction-coil at a certain determined point of the revolution of said wheel, a third projection on the face of said wheel to make contact of short duration between a vertical wire and a coherer at a certain determined fractional part of the revolution of said wheel, a fourth projection on the face of said wheel adapted to make and break contact in the primary circuit of the induction-coil and a fifth projection to contact with a coherer at any determinable point of each revolution of said wheel, substantially as described.

4. In means for shielding a wave-responsive device, a metallic case having an aperture in the wall thereof, a metallic cup partially surrounding said aperture and having mercury therein entirely closing said aperture, a relay-lever having a lateral bend extending through said aperture, an insulating-division placed in said relay-lever on the inside of said case.

5. In means for shielding a wave-responsive device, a metallic case having an aperture in the wall thereof, a metallic cup partially surrounding said aperture and having mercury therein entirely closing said aperture; a second metallic case entirely inclosing first said case and insulated therefrom, second said case having an aperture in the wall thereof coincident in position with aperture in first said case, a metallic cup partially surrounding said aperture and having mercury therein entirely inclosing said aperture, a relay-lever having two lateral bends extending through said apertures, an insulating-division placed in said relay-lever on the inside of first said case, a second insulating-division placed in said relay-lever between the first said case and the second said case.

6. In means for intermittently rendering an

electromagnetic wave-responsive device operable, a wave-responsive device, a metallic case inclosing same, an aperture in the wall of said case, a spring-actuated lever on outside of said case having an enlargement at free end extending through said aperture and normally closing same, an electrode inside of said case and insulated therefrom, said electrode electrically connected to said wave-responsive device, means for opening said aperture and making contact with said electrode.

7. In a device for protecting a wave-responsive device a metallic case inclosed within a second metallic case and insulated therefrom, an electromagnetic wave-responsive device within the first said case, an aperture in the wall of the first said case, an aperture in the wall of the said second case coincident in position with first said aperture, said apertures being normally closed, means for opening said apertures and making electrical contact with said responsive device.

8. In a wireless-telegraph apparatus, a protective case having an aperture, means for rapidly closing said aperture, coherers in the case and means for disconnecting the coherers, substantially as described.

9. In a wireless-telegraph instrument, a rotatable wheel having a spring-actuated cam projecting from its periphery, a spring-actuated lever having electrodes at its ends and coherers in position to be alternately engaged by the said electrodes, substantially as described.

10. In a wireless-telegraph system, a rotatable operating-wheel at each station, means at each station for receiving electrical impulses from a synchronizing-station every revolution of said wheel, a synchronizing-station uninfluenced by message transmitting or receiving apparatus, said station having means for giving out electrical impulses once every revolution of said wheel.

11. In a synchronizing-station uninfluenced by message transmitting and receiving apparatus, a transformer, a source of electrical energy in primary circuit of said transformer, automatic means for regularly interrupting said primary circuit.

12. In a synchronizing-station uninfluenced by message transmitting and receiving apparatus, a transformer, a source of electrical energy in primary circuit of said transformer, automatic means for regularly interrupting said primary circuit, a vertical radiator under the electrical influence of secondary circuit of said transformer.

13. In a synchronizing-station uninfluenced by message transmitting or receiving apparatus, a transformer, a source of electrical energy in primary circuit of said transformer, automatic means for regularly interrupting said primary circuit, a vertical radiator under electrical influence of secondary circuit of said

transformer and an earthed plate under electrical influence of said secondary circuit.

14. In an apparatus for maintaining synchronism, an electromagnetic wave-responsive device intermittingly under electrical influence of a vertical conductor, a second responsive device adapted to be under the electrical influence of a vertical conductor a very short interval of time after the first said responsive device has left said electrical influence.

15. In an apparatus for maintaining synchronism, a plurality of electromagnetic wave-responsive devices, means actuated by a rotary wheel for rendering said responsive devices alternately and successively operable.

16. In an apparatus for maintaining synchronism, a rotatable power-shaft at each station, an operating-wheel rotated by said power-shaft, a governor controlling speed of said power-shaft, an electromagnetic wave-responsive device responsive to synchronizing waves, means actuated by said responsive device actuating said governor to lessen speed of said power-shaft.

17. In an apparatus for maintaining synchronism, a rotatable power-shaft, an operating-wheel rotated by said power-shaft, a governor controlling speed of said power-shaft, an electromagnetic wave-responsive device, means actuated by said responsive device actuating said governor to increase speed of said power-shaft.

18. In an apparatus for maintaining synchronism, a rotatable power-shaft, an operating-wheel rotated by said power-shaft, a governor controlling speed of said power-shaft, an electromagnetic wave-responsive device, means actuated by said responsive device actuating said governor to lessen speed of said power-shaft, a second responsive device, means actuated by said second responsive device actuating said governor to increase speed of said power-shaft.

19. In an apparatus for maintaining synchronism, a rotatable power-shaft, a rotatable operating-wheel, a differential connection joining said operating-wheel to said power-shaft, an electromagnetic wave-responsive device responsive to synchronizing waves, means actuated by said responsive device actuating one of component parts of said differential connection to lessen speed of said operating-wheel relative to speed of said power-shaft.

20. In an apparatus for maintaining synchronism, a rotatable power-shaft, a rotatable operating-wheel, a differential connection joining said operating-wheel to said power-shaft, an electromagnetic wave-responsive device responsive to synchronizing waves, means actuated by said responsive device actuating one of component parts of said differential connection to increase speed of said operating-wheel relative to speed of said power-shaft.

21. In an apparatus for maintaining synchronism, a rotatable power-shaft, a rotatable operating-wheel, a differential connection joining said operating-wheel to said power-shaft, an electromagnetic wave-responsive device responsive to synchronizing waves, means actuated by said responsive device actuating one of component parts of said differential connection to lessen speed of said operating-wheel relative to speed of said power-shaft, a second electromagnetic wave-responsive device responsive to synchronizing waves, and means actuated by said second responsive device actuating said component part of said differential connection to increase speed of said operating-wheel relative to speed of said power-shaft.

22. In an apparatus for maintaining synchronism, a rotatable power-shaft, an operating-wheel differentially connected to said power-shaft and rotated thereby, a governor controlling speed of said power-shaft, an electromagnetic wave-responsive device responsive to synchronizing waves, means actuated by said responsive device actuating one of component parts of said differential connection to lessen speed of said operating-wheel relative to speed of said power-shaft and means actuated by said responsive device actuating said governor to lessen speed of said power-shaft.

23. In an apparatus for maintaining synchronism, a rotatable power-shaft, an operating-wheel differentially connected to said power-shaft and rotated thereby, a governor controlling speed of said power-shaft, an electromagnetic wave-responsive device responsive to synchronizing waves, means actuated by said responsive device actuating one of the component parts of said differential connection to increase speed of said operating-wheel relative to speed of said power-shaft and means actuated by said responsive device actuating said governor to increase speed of said power-shaft.

24. In an apparatus for maintaining synchronism, a rotatable power-shaft, an operating-wheel differentially connected to said power-shaft and rotated thereby, a governor controlling speed of said power-shaft, an electromagnetic wave-responsive device, means actuated by said responsive device actuating one of the component parts of said differential connection to lessen speed of said operating-wheel relative to speed of said power-shaft, means actuated by said responsive device actuating said governor to lessen speed of said power-shaft, a second electromagnetic wave-responsive device, means actuated by said second responsive device actuating one of component parts of said differential connection to increase speed of said operating-wheel relative to speed of said power-shaft and means operated by said second responsive device ac-

tuating said governor to increase speed of said power-shaft.

25. In an apparatus for maintaining synchronism, a rotatable power-shaft, an operating-wheel differentially connected to said power-shaft and rotatable thereby, a governor controlling speed of said power-shaft, a double spur-wheel, a detent holding said spur-wheel in position, a shaft rotated by said spur-wheel, means on said shaft for controlling action of said governor, means on said shaft for controlling action of said differential connection, electromagnetic wave-responsive devices and means operated by said responsive device for intermittently rotating said spur-wheel in opposite directions.

26. In an apparatus for obtaining accuracy of wave transmission, a transmitting-transformer, a source of electrical energy in primary circuit of said transformer, an interrupter in said primary circuit and actuated by a rotatable wheel, a relay controlling said primary circuit, a circuit controlled by a key controlling one winding of said relay and another winding of said relay controlled by said primary circuit.

27. In an apparatus for obtaining accuracy of wave transmission, a transmitting-transformer, a source of electrical energy in primary circuit of said transformer, an interrupter in said primary circuit and actuated by a rotatable wheel, a relay controlling said primary circuit, a circuit controlled by means actuated by a wave-responsive device controlling one winding of said relay and another winding of said relay controlled by said primary circuit.

28. In an apparatus for obtaining accuracy of wave transmission, a transmitting-transformer, a source of electrical energy in said primary circuit, an interrupter in said primary circuit and actuated by a rotatable wheel, a relay controlling said primary circuit, a circuit controlled by a key and also by means actuated by a wave-responsive device controlling one winding of said relay and another winding of said relay controlled by said primary circuit.

29. In a synchronously-operated wireless-telegraph system, means operated by a rotatable wheel for rendering a wave-responsive receiving device operable, said means permanently fixed in a different angular position at each station, means operated by a rotatable wheel at each station for interrupting the primary circuit of a transmitting-transformer, said interrupting means adapted to be adjusted to any angular position of said receiving means.

30. In a synchronously-operated wireless-telegraph system, means operated by a rotatable wheel for intermittently rendering a wave-responsive device operable, said means adapted to be adjustably placed in any angular position

at each station, means operated by a rotatable wheel for interrupting the primary circuit of a transmitting-transformer, said transmitting means adapted to be adjustably placed in any angular position at each station.

31. In a synchronously-operated wireless-telegraph system, a stationary receiving means operated by a rotatable wheel for rendering a wave-responsive device operable, said means fixed in its predetermined position at each station, a stationary transmitting-circuit interrupting means operated by said wheel, said interrupting means fixed in a predetermined angular position in advance of said receiving means, an adjustable transmitting-circuit interrupting means adapted to be adjustably placed in any desired position, an adjustable receiving means operated by said wheel for rendering a wave-responsive device operable, said adjustable receiving means placed in the same angular position in advance of said adjustable transmitting means as said stationary transmitting means is in advance of said stationary receiving means.

32. In means for relaying messages in a synchronously-operated wireless-telegraph system comprising a stationary set of transmitting means and receiving means and an adjustable set of transmitting means and receiving means, a relay normally controlling the primary circuit of a transmitting-transformer operated by interrupter of stationary set, means operated by a wave-responsive device for actuating said relay, a second relay controlling primary circuit of a transmitting-transformer, said circuit being normally operated by interrupter of adjustable set, a wave-responsive device actuating said second relay, means for placing the primary circuit operated by the said interrupter of stationary set under control of said second relay and means for placing the primary circuit operated by the said interrupter of the adjustable set under control of first said relay.

33. In a synchronously-operated wireless-telegraph system, a dial at each station having station-indicating lines engraved thereon, means for rendering wave-responsive devices operable, said means rendered operative at definite positions relative to said lines on said dial, means for interrupting transmitter-circuits, said means rendered operative at definite positions relative to said lines on said dial and a rotative wheel operating said means.

34. In means for shielding wave-responsive devices, a metallic case having an aperture in the walls thereof, a wave-responsive device inside of said case, means extending through said aperture for closing said aperture and breaking electrical contact with said responsive device, said means adapted to open said aperture and make contact with said responsive device, an opening in the walls of said

case, a relay-lever protruding through said opening and a metallic cup partially surrounding said opening and mercury in said cup.

35. In a transmitting-break, a metallic brush
5 in contact with one terminal of an electric circuit, a second metallic brush insulated from first said brush and in contact with the other terminal of said circuit and a metallic plate having an abrupt termination at one end, said

plate adapted to be intermittingly in contact with the said brushes.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES K. SALISBURY.

Witnesses:

R. B. FERGUSON,

W. M. BLOUGH.