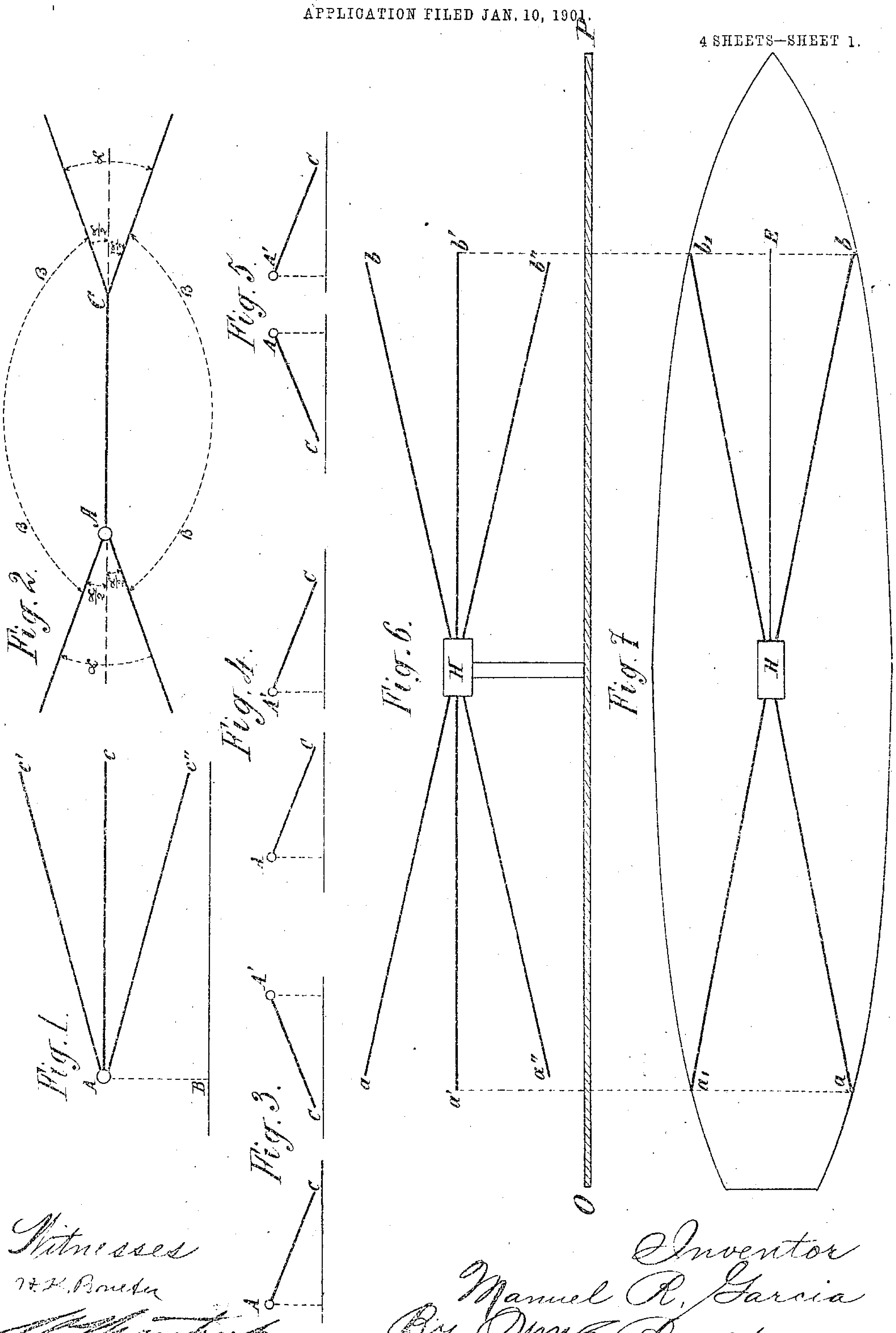
No. 795,762. PATENTED JULY 25, 1905.

M. R. GARCIA.

WIRELESS TELEGRAPHY.

APPLICATION FILED JAN. 10, 1901.

4 SHEETS—SHEET 1.



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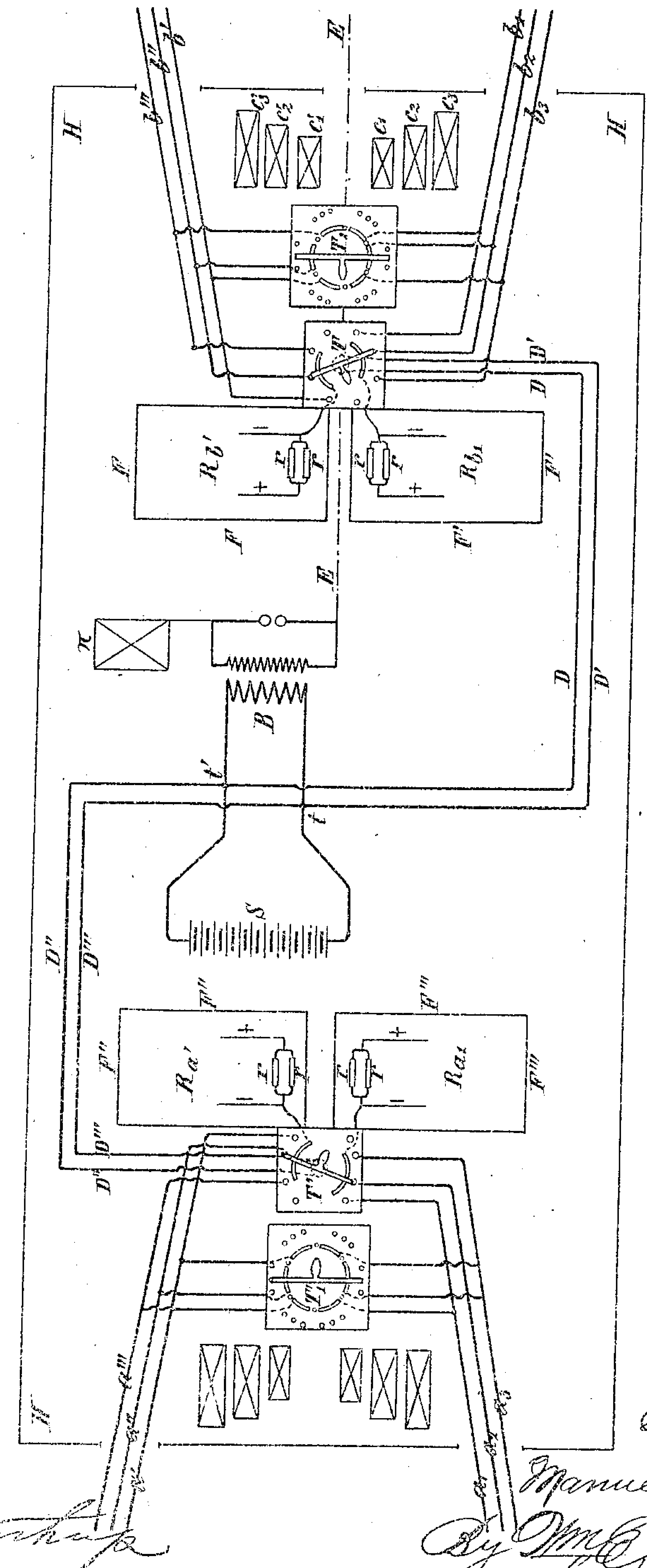
4 SHEETS—SHEET 2.

Fig. 8.



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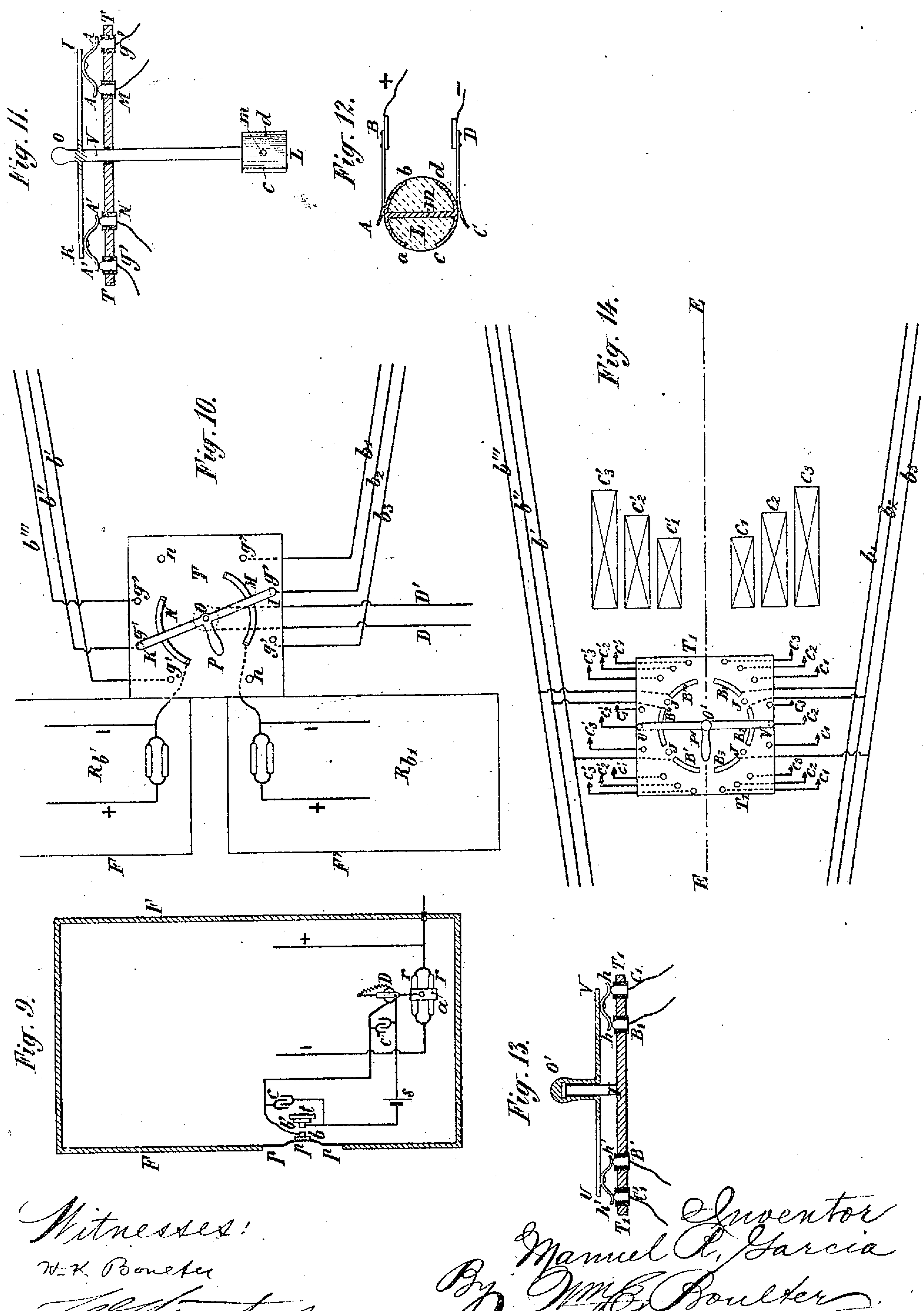
SHEETS—SHEET 3.



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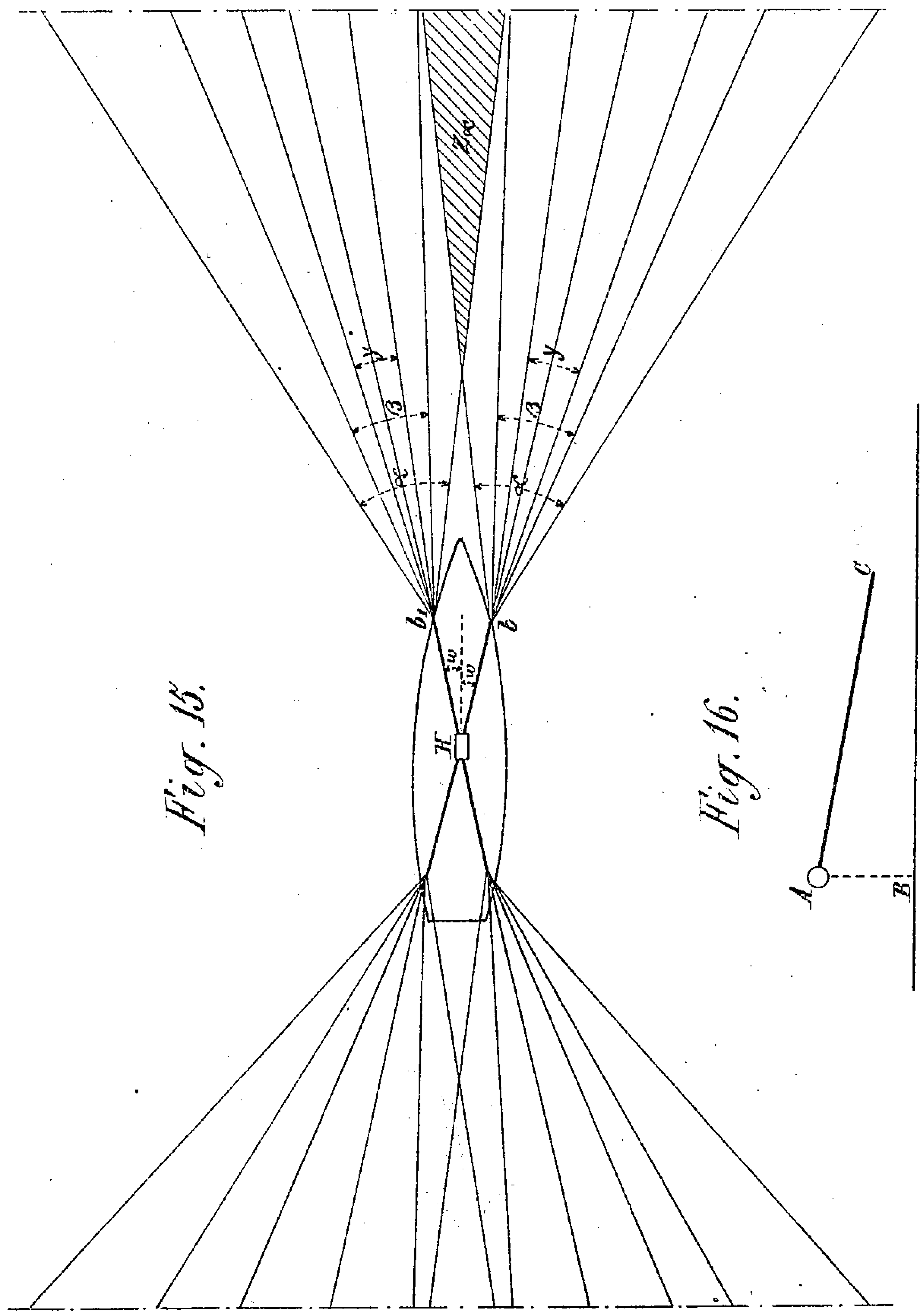

Fig. 15.

Fig. 16.

Witnesses

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UNITED STATES PATENT OFFICE.

MANUEL RODRIGUEZ GARCIA, OF PARIS, FRANCE.

WIRELESS TELEGRAPHY.

No. 795,762. Specification of Letters Patent. Patented July 25, 1895.

Application filed January 10, 1901. Serial No. 42,726.

To all whom it may concern:

Be it known that I, MANUEL RODRIGUEZ GARCIA, a citizen of the Republic of France, residing at Paris, France, have invented certain new and useful Improvements in or Relating to Wireless Telegraphy, (for which I have obtained Letters Patent of France No. 301,264, dated June 14, 1900,) of which the following is a specification.

The present invention relates to wireless telegraphy by means of Hertzian waves, involving: first, a special arrangement, at each station, of a group or number of aerial conductors or antennæ at varying inclinations; second, a special group of electric capacities, arranged in such a manner that they can be, at will, connected, one by one, with the corresponding primary receiver; third, two systems of contact-breakers with handles, one of which is conjointly employed with a special shunt system. The combination of these various modifications is involved in the new arrangement of a station for purposes of wireless telegraphy, and the object of this new arrangement consists in the following application: The solving of the problem according to which a given vessel will receive information as to the direction and distance of a source of waves emanating from another vessel, thereby avoiding the risk of collision when direct vision is interfered with, as at night-time or owing to a perturbed state of the atmosphere, from whatever cause it may arise. But such arrangement in a station naturally implies all the conditions necessary for the two following applications, which, consequently, are also covered in the claims, viz: first, the emission of waves in one direction only in such a manner, that any receiver stationed outside a certain zone of the horizon, is not influenced thereby; second, the substitution of the usual vertical conductors or antennæ by a more suitable and easier arrangement.

In the accompanying drawings, Figure 1 gives a sketch of the arrangement of a post showing the principal angular positions which the aerial antennæ can occupy. Fig. 2 shows a plan of the arrangement giving the various effective and non-effective zones with regard to a given antenna A C. Figs. 3, 4, and 5 show positions of the antennæ of two stations corresponding to diminishing range of communication. Fig. 6 shows a sketch in elevation of a post placed on a vessel. Fig. 7 is a plan of the same. Fig. 8 is a plan showing details of a transmitting and receiving apparatus constituting the station of a vessel. Fig. 9 is a plan of the receiving apparatus. Fig. 10 is a plan of a commutator arranged to put two receiving apparatus successively in communication with several series of symmetrical antennæ. Fig. 11 is a vertical section of the same commutator with a symmetrical interrupter L at the end. Fig. 12 is a horizontal section of the interrupter. Fig. 13 is a vertical section of a commutator which serves to successively connect the various receiving antennæ with condensers of determined capacities. Fig. 14 is a plan of the same commutator.

In order to facilitate the understanding of the following description, it is necessary first to explain the method of communication according to the new system on which are based the arrangements described.

Let A represent the transmitting and receiving apparatus of a station, Fig. 1. This apparatus A is placed at a height above the ground, on an insulated support, represented by the dotted line A B while A C', A C and A C'' represent various aerial antennæ terminating in the station A. The two inclined antennæ A C' and A C'', are so arranged on either side of the horizontal antenna A C that they form with the latter two equal angles, and it is assumed here, that these angles have a certain limit or extreme value α. The characteristic phenomenon of this arrangement is as follows: It will be observed that every aerial antenna, whether horizontal like A C, or inclined like A C', or A C'', or occupying any intermediate position between the extreme positions as marked by A C' and A C'', and whether used for the emission or reception of waves presents the following phenomenon: at each end of such an antenna there is a zone of effective influence both as regards emission or collection of waves. Each of these zones forms a zone of the horizon, the apex of the angle of which is at the corresponding end of the antenna. The angle which limits this zone is divided into two equal parts by the projection of the antenna on the ground, and the opening of the angle increases in proportion as the distance from the transmitter grows less, and decreases as such distance increases. The two zones thus defined are separated by two lateral zones within which there is no appreciable effect observable.

It may be remarked here, that the height of the support A B (Fig. 1) will be less than that which determines the formula: $H = \alpha \sqrt{D}$, used in the case of communications between parallel horizontal antennæ, with a view of avoiding the effects of transmission which characterize this kind of communication. In the formula $H = \alpha \sqrt{D}$, the value H represents the height of the horizontal antenna above the ground, α is an empirical coefficient depending on the capacity, on the self-induction of the station and on the length of the antenna. D represents the distance separating the two corresponding stations. This formula is well known but can only be expressed in numbers if the empirical values α and D are given. The height of this support A B may be even reduced to zero, so that a horizontal antenna like A C, may lie on the surface of the ground, without any appreciable decrease as regards the effect produced.

Fig. 2 represents a schematic view of a horizontal projection of these diverse zones: α, α marking the two effective zones at the ends of an antenna A C, while β, β mark the two lateral zones where no appreciable effect is produced.

There are several other points yet to be indicated to render the invention perfectly clear: These points are:

First. In the case of every inclined antenna such as the one marked A C″, Fig. 1, the free end of which is directed toward the ground, the effective zone at the free end C″ extends to a greater distance than that which characterizes the length of the second effective zone at the other end A of the said antenna A C″.

Second. The arrangement as illustrated by A C″ is the one which insures the greatest range of communication for an antenna of a given length.

Third. For a certain distance between two stations, the angle of the effective zones of the respective antennæ becomes larger as the effective extent of the corresponding antenna increases. This range varies by reason of two known factors, viz: the amount of inclination and the length of the antennæ.

Fourth. Assuming that A A′ are two posts acting as transmitters and receivers, and each provided, with an inclined antenna, the free end of which is inclined toward the ground and so placed that the horizontal projections of the antennæ coincide with the same straight line, it will be understood that the maximum distance of their communication will decrease as they are successively placed in the relative positions indicated, in their order, in Figs. 3, 4, and 5. The difference is evident from the difference of position as indicated in Figs. 3 and 4, and still more marked, when passing from the relative position indicated in Fig. 4 to that indicated in Fig. 5, in which latter position communication is only possible within a very short distance.

These principles having been explained, the arrangement of the apparatus will now be described.

Let H indicate a top placed over the bridge O P (Fig. 6) of a vessel, at a height less than that given by the formula $H = \alpha \sqrt{D}$, from the surface of the bridge, and a, a', a'', b, b' b'' represent horizontal and inclined antennæ of equal length and arranged on both sides of the top in the manner as illustrated in Fig. 1. Thus there are four groups of antennæ radiating from the top, each containing three antennæ, such as a a' a''. In each group the variously-inclined antennæ lie in the same vertical plane, the direction of which planes on the bridge are marked by Ha_1 Hb_1 Ha Hb, Fig. 7. The groups Hb_1 Hb on one side, and Ha_1 Ha on the other, inclose between their respective vertical planes, the greatest angle compatible with the size of the ship. An insulated antenna H E is provided in the axial plane of the vessel, with its free end inclined toward the bridge and toward the bow of the vessel.

The groups of antennæ Ha Ha_1 Hb Hb_1 correspond with as many distinct receivers and each antenna can be connected, separately and at will, with the receiver of its group, while the median antenna H E is permanently connected with the exciter of the station.

The general arrangement of the station in the interior of the top H is schematically represented in Fig. 8.

The conductors b' b'' b''', b_1 b_2 b_3, a' a'' a''', a_1, a_2 a_3 represent the various groups of receiving-antennæ referred to above.

For the purpose of description the figure represents the antennæ as arranged in parallel vertical planes in each of the groups. Rb Rb' Ra Ra' indicate four receiving apparatus, each corresponding to a group of antennæ and marked by the same letter as the index of the latter. These apparatus are hermetically inclosed in metal cases F, F′, F″, F‴.

Each receiver-circuit consists of two coherer-tubes r r connected in parallel, to obtain greater reliance as regards effect on the receiver. Each primary receiver-circuit actuates, by means of a relay, a bell, the bells of the four receivers being each of a different pitch. The arrangement of the relay, of the primary and secondary circuits of each receiver involves no new features and is not represented in the drawings.

Each bell or signaling device is so arranged as to start sounding when the receiver is influenced or energized, and to continue to do so, until it is stopped by decohering the coherer affected. For this purpose the following system is employed, which also permits of the hermetic closure of the metallic case inclosing the receiver.

Let $p\ p$ (Fig. 9) be a surface, taken on one of the sides of the case F. This surface $p\ p$ corresponds with a spot where the side of the case is very thin. The metal diaphragm which forms this surface, is flexible and forms a concavity toward the interior of the case F. This plate or surface can be pushed inward by pressure applied from the outside, and afterward returns to its first shape and place, when such pressure ceases, owing to the elasticity of its material.

A contact-block b is fixed to the inner side of the surface $p\ p$ by means of an intermediate disk of insulating material. Facing the contact b is arranged a second contact b' fixed in a similar manner on a support t. A small, independent battery s actuates a little hammer acting as a trembler, at D, and which, by striking against an armature or covering $a\ a$ common to both coherers $r\ r$, causes them to decohere. The circuit of the battery s terminates at one end in the contact b and at the other in the contact b'. A simple pressure on the surface $p\ p$, therefore, will effect contact between b and b', and by closing the circuit, decohere the coherer-tubes. Two condensers $c\ c'$ placed in shunt in this circuit s, tend to prevent or lessen the break-spark.

A table T (Fig. 8) supports a switch or contact-breaker device, provided with a handle and is intended simultaneously to put in communication with the corresponding receivers, two symmetrical antennæ or antennæ of the same inclination, of each of the groups b' and b_1. On a second table T_1 is arranged a second switch device of almost similar construction, which serves the following purpose: Suppose two symmetrical antennæ of any kind have been connected with the corresponding receivers by means of switch T. It will now be possible, by means of the switch T, to connect these two antennæ, respectively, with two capacities of the same surface, from the two groups of capacities marked C_1, C_2, C_3, and $C'_1\ C'_2\ C'_3$. These capacities are placed on supports of insulating material. The connections to the several condensers $C'\ C^2\ C^3$ in Fig. 14 have not been shown in order to simplify the figure. A reference-letter has been placed on each condenser, indicating the connections. Two switches T′ and T'_1 similar to those marked T T_1, respectively are provided similarly for the receivers Ra' and Ra_1.

Figs. 10, 11, and 12 refer to details of the switch device T.

Each of the antennæ b', b'', b''', and b_1, b_2, b_3, is connected with a contact-stud g' (Fig. 10,) while two other studs $n\ n$ are insulated from every conductor. Two arc-shaped contacts M N are connected with the terminals, each to each, of the coherers of the receivers Rb_1 Rb'. The cross-bar switch K O I, revoluble around its center o can be turned round in any direction by means of a handle P.

Each end of the cross-bar K I is provided with a spring brass blade, intended to establish communication between one of the contacts g' with one of the segmental contacts M or N. The contact-studs g' are so arranged that the ends K, I, of the cross-bar cannot simultaneously put in communication the segmental contacts M N, with the studs except wh[illegible] is on two contact-studs g' connected with two symmetrical antennæ, one in each group. When the ends K, I are in contact with the studs $n\ n$, there is no communication between the receivers Rb_1, Rb' and their respective antennæ.

Fig. 11 is a vertical section of the switch device. The segmental contacts M N and the studs g' pass through the table being insulated therefrom by gutta-percha sleeves as represented in thick lines. The ends K, I, are provided with brass spring-blades each having two arms A A, and A′ A′, the ends of which press simultaneously on one of the segmental contacts and on one of the studs g'. The ends K, I, of the cross-bar are of ebony in order to insulate the springs A A and A′ A′ from each other. A rod V, which serves as the axis of rotation for the cross-bar, is continued below the table T and is provided at L with a special circuit-breaker of cylindrical shape. This circuit-breaker L (Fig. 12) is provided on part of its circumference with two metallic surfaces $a\ b$ and $c\ d$ connected with each other by a central conductor m. These contact-surfaces $a\ b$, $c\ d$, are separated from each other by two similar insulating-surfaces $a\ c$, and $b\ d$. Two elastic brass blades A B, C D, press against the sides of the cylinder L.

According to the angular position of the contact-surfaces or the insulating-surfaces of the cylinder L, the two contact-blades are either in electrical communication with each other or insulated from each other. The first happens when the contact-surfaces $a\ b$ and $c\ d$ are in contact with the blade A B and C D, while no communication takes place when the blades A B, C D are in contact with the insulating portions of the cylinder. The contact-blades A B, C D are connected with two conductors, for a purpose which will be explained hereinafter.

Let B represent the coil of the oscillator of the post (Fig. 8) while S indicates a source of electricity of any kind—a battery of accumulators according to the figure—and let E represent the special antenna of the oscillator, which antenna is marked by the same letter in Fig. 7, and π a capacity connected with the pole of the exciter, which is opposite to the one at which the emission antenna terminates.

A special arrangement will have to be used in order to prevent the oscillator from being drawn into action in consequence of an oversight on the part of the operator when the receivers Rb_1 and Rb' are in connection with two antennæ of their groups. This arrangement is intended to prevent the working of the oscillator while the segmental contacts M N are in contact with one of the studs q' (Fig. 10) through the intermediate cross-bar K O I. The working of the oscillator is possible only at the moment when the ends K, I press against the contacts n n, which position corresponds with the insulation of all the antennæ. This result is obtained by the device represented in Fig. 12. Let D D′ (Fig. 8) represent two conductors of great capacity and high conductivity. These conductors are in shunt at t and t', on the circuit of the source of electricity S and terminate in the two contact-plates A B, C D which press against the circumference of the cylinder L (Fig. 12.) The rotation of the cross-bar involves that of the switch L which is rigidly connected with it, and is so arranged that there is communication established between the blades A B, C D for every position of the cross-bar corresponding to the connection of the receivers with any two antennæ, while such communication is broken by placing the ends K, I of the cross-bar on the contact-studs n n.

When there is communication between the contact-blades A B and C D (Fig. 12) the shunt-circuit D D′ (Fig. 8) is closed, and this circuit being of less resistance than the primary circuit of the coil B, the greater part of the current from the source S passes by way of the shunt D D′, in consequence of which the oscillator cannot be actuated. If, on the contrary, the contact-blades A B, C D are insulated from each other, the circuit D D′ is open and the shunt has no effect on the working of the oscillator.

An identical arrangement exists with regard to the shunt-circuit D″, D‴, which terminates in the system T′.

The apparatus is completed by the arrangement of two cross-bar switchboards T_1 and T'_1, the purpose of which has been explained above. One of the said devices, say T'_1, is arranged in the following manner: A cross-bar U O′ V revolubly mounted at O′, is provided at its ends with brass plate-springs h h', (see Fig. 13) similar to the springs A A′ represented in Fig. 11. Segmental contacts B′, B″ B‴ are connected with antennæ b' b'' b''', while other and similar contacts B_1 B_2 B_3 are connected with antennæ b_1 b_2 b_3 (Fig. 14). Facing each of the contacts B_1 B_2 B_3 are contact-studs c_1 c_2 c_3 which are connected respectively to capacities marked by the same letters. The same remarks apply to contact-studs C'_1 C'_2 C'_3 which are arranged before the contacts B′ B″ B‴. These contacts and studs are inserted in insulating-sleeves of gutta-percha, as represented in the drawing, Fig. 13, by thick lines. By means of the brass springs (these springs being insulated from each other as in the case of springs A A and A′ A′ Fig. 11), provided at the ends U and V of the cross-bar, (Fig. 13) it is possible to establish, at will, communication between one of the contacts B′, B″ B‴, and consequently one of the corresponding antannæ, with one of the capacities which are connected respectively with the three contact-studs c'_1 c'_2 c'_3, and simultaneously it is possible to establish relation between one of the three antennæ which terminate at the contacts B_1 B_2 B_3 with one of the capacities terminating at the studs c_1 c_2 c_3. These capacities are made of different dimensions in each group, and their importance increases with the increase of the index of the letter which refers to them, while on the other hand they are so constructed that it is possible to fix the following equivalents: $C'_1=C_1$, $C'_2=C_2$, $C'_3=C_3$.

According to the arrangement represented in Fig. 13 and the arrangement of the cross-bar U O′ V it is not possible to connect, by this system, more than two equivalent capacities with two symmetrical antennæ of the groups b' b'' b''' and b_1 b_2 b_3.

The contact-studs J J, without connections are so arranged that all the capacities are insulated when the ends U and V of the cross-bar press against them. Thus it will be seen that the purpose of the switch T turning with the circuit-breaker L, consists in effecting simultaneously a relation between two symmetrical antennæ of the groups b' b'' b''' and b_1 b_2 b_3 with the receivers, respectively, and at the same time protecting these two receivers against radiation from the neighboring oscillator.

The object of the switch device T_1 is to simultaneously connect the two receiving antennæ, between which connection has been established in the manner described, with any of the capacities between which equality exists.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a system of wireless telegraphy, a plurality of groups of antennæ, receivers therefor and a commutating-switch device arranged and adapted to establish simultaneous communication between two symmetrical antennæ and their corresponding receivers and to break connection between the antennæ and their receivers.

2. A commutating-switch device, a plurality of groups of antennæ, receivers for said groups of antennæ, and two capacities which are equivalent to each other, the said switch device being arranged and adapted to establish communication between two antennæ and said capacities, and to break all connections between the capacities and the antennæ.

3. The combination with a metal case and receivers therein, of a non-automatic device for decohering the receivers without breaking the continuity of the said metal case.

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

MANUEL RODRIGUEZ GARCIA.

Witnesses:
EDGAR P. MACLEAN,
LOUIS SULLIGER.