128,624.

PATENT SPECIFICATION

Application Date, Aug. 14, 1917. No. 11,658/17.
Complete Accepted, July 3, 1919.

COMPLETE SPECIFICATION.

Apparatus for the Concentration of Electric Waves in a Single Direction or upon a Fixed Point.

We, LUIGI ROTA, of Clarence House, Park Road, Teddington, in the County of Middlesex, Professor, and ERNESTO BINETTI, of 132, Via del Tritone, Rome, in the Kingdom of Italy, Commendatore, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The objects of the present invention are to construct apparatus which will:—

1. Concentrate the wave or train of waves upon a desired point for whatever purpose the apparatus may be designed.

2. Assure the absolute secrecy of the communications, that is to say, each station may correspond at any distance by radio-telegraphy and radio-telephony as well as by radiotelemechanism, exclusively with the appointed station without the communications being intercepted or troubling or being received by other stations.

3. Enable several stations to be installed close together, each station not being disturbed or troubled by messages intended for other stations or by atmospheric waves, at the same time permitting a receiving station to determine the direction of the station from which it receives its messages and to put itself in communication with the sending station.

4. Suppress all dissipations or absorptions to which the waves are subject during their travel due to natural electrical disturbances produced by atmospheric electricity.

5. Permit all transmission and receiving stations to transmit or receive in all directions if the apparatus is put out of circuit.

6. Increase the capacity, determine the phases and intensity of the wave, making it possible to transmit electric power wirelessly to a distance, as for producing Joule's effect at a distance.

7. Transmit a wave having a force and such a constitution that it can indicate when a magnetic body has come between the transmitting and receiving stations, whether the body be upon the earth, upon water or under water.

The accompanying drawings show diagrammatically various examples of the methods of carrying the invention into effect, from which it will be observed that it may have various arrangements, forms and sizes, single or double, and may be arranged horizontally, vertically or inclined, and with respect to its cross sectional form it may be circular, square, rectangular, triangular or of other form. We will hereinafter, both in the description and claims, refer to these forms as cylinders, and they may be constructed of sheet metal or of wires or bands arranged parallel to each other, according to the work for which the

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apparatus is intended and the system and power of the station in which it is installed; the system may be direct coupled or indirect coupled, and the waves may be damped waves or undamped or continuous waves and of any length. The apparatus always remains the same in principle and in its foundamental basis and action, but, according to the work which it is intended to perform, it may be modified in various ways.

The apparatus consists of two, three or more cylinders united in series by means of a reciprocal induction and, further, each cylinder is in communication with a battery, accumulator or dynamo, and the said battery is common to all the cylinders but in a contrary direction for each alternate cylinder. Upon the principle of the action of transformers, one is able to obtain by the first transforming, the augmentation of intensity, in the second, the electromotive force, by means of the third, these two (intensity and electromotive force) may be made equal; or *vice versa*, if desired or necessary, all these effects in co-relation, the energy originally produced and its intensity, its electromotive force and its periods. The battery has for its object to reconstitute all the force lost by passive losses, resistances and otherwise, and further to give to the energy of the wave its constitutive and primitive property. The cylinders increase the capacity and diminish the resistance, and in union with the relative inductions and currents of the batteries, they define the energy of the wave with intensity and phase desired and determined.

As shown in Fig. 1, the cylinders A, A^1, A^2, are provided with the relative transformers a, a^1,—P, P^1, being the primaries and S, S^1, the secondaries; p is the battery of accumulators and r, r^1, the resistances; s, s^1, s^2 are coils to prevent the oscillation circulating in the battery circuit. By the first coil s the cylinder A is connected with the positive pole of the battery; by the second, s^1, the cylinder A^1 is connected with the negative pole of the battery, and by the third, s^2, the cylinder A^2 is connected with the positive pole of the battery. The production of the current in the battery of accumulators is suitable for the relative transformers of the cylinders and the energy produced by the exciting apparatus. In the receiving apparatus, P, P^1, are the primaries, and S, S^1, are the secondaries, p is the battery, r, r^1, are the resistances, s, s^1, s^2 are the coils to prevent the wave passing into the battery circuit. A^2 is a negative cylinder (the opposite to the last cylinder of the transmitting station), the second cylinder, A^1, is positive, and the third cylinder, A, is negative. The first cylinders are generally shorter and the last cylinders longer, and further this latter may sometimes terminate with a conical formation a^2 of larger diameter (of wire or bands) as shown in Fig. 7, which also represents a vertical arrangement. All the transformers may be fixed or adjustable, both in the transmission and receiving apparatuses. Also the resistances connected to the batteries may be fixed or variable. It is now easy to understand that we can diminish or increase the energy of the wave. It is possible to produce waves with definite phases and intensity and to receive a definite wave at a single receiving station, that is to say, a perfect syntony, and also to distinguish various waves different from one another, rendering it thus possible to communicate with or receive messages from various stations.

The apparatus shown in Fig. 2 is similar to that shown in Fig. 1 with this difference, that the first cylinder, A, has a second concentric cylinder A^{10} connected to it at A^{11} and with the wire at b.

Fig. 3 shows other cylinders 3, 3^1, 3^2, in addition to the cylinders A, A^1, A^2. The cylinders 3, 3^1, 3^2, are insulated from each other at i, i^1, and they are united to the battery of accumulators and also with the cylinders A, A^1, A^2, by means of coils h, h^1, h^2, to prevent, by means of their inductance, the oscillations travelling into the circuit of the battery. This method gives the maximum intensity of the apparatus and prevents the radiating of the wave during its traverse of the cylinders A, A^1, A^2, which act as antennæ or transmitting points.

Fig. 4 is the same in principle as those previously described but with this

difference, that there is in the interior of the apparatus and concentric therewith, a complete cylinder A^{12}, connected to earth, further increasing the capacity of the apparatus.

This connection with the earth would be the same as in Fig. 5. In this figure n, n^1, n^2, n^3, are four cylinders arranged as previously described. The cylinder n is connected with the circuit by means of the wire m. There is in the same cylinder, n, another cylinder E, which is concentric therewith and which terminates at d in the second cylinder n^1. The said cylinder E is connected to earth by means of the wire m^1, which is generally smaller than the wire m, and further, in certain cases (due to a different system of excitation being used) there may be inserted at the point, K, a capacity or a self inductance, to make the wire m^1 agree with the arrangement and work of the wire m, producing in m^1, a retardation because the wire m^1 is united to the cylinder E, and this latter terminating in n^1, would otherwise have precedence of action with respect to the cylinder n (and to the wire m connected thereto).

Fig. 6 is similar to that described with respect to Fig. 1 with this difference, that the apparatus is doubled starting from the point b^1 and finishing with the last cylinders, which are parallel as shown in Fig. 6 or at an angle to each other as shown in, Fig. 6a. The two sets of cylinders A A^1 A^2 are connected by inductances h, h^1, h^2 acting as above described. Upon the principle of electrodynamics, two fluxes or currents parallel and in the same direction will attract each other. Due to the common attraction they will travel always uniting more and more, with the suppression of radiation or expansion. This apparatus shown in Fig. 6 is specially suitable for indicating a magnetic body which may happen to be between the two stations of transmission and reception, as hereinafter explained.

To obtain the desired information or indication, starting with the principle that currents magnetize magnetic bodies, for this reason, due to the improved apparatus by which we obtain a wave having the properties of a current and with a certain intensity, then, if this wave remains neutral to all the disturbances and currents of the atmosphere during its traverse, on encountering a magnetic body, it will magnetize it. The wave will then lose its original properties and it will no longer act (due to the loss or defect) at the receiving station in such a way as to do the desired work there. It will thus make known the presence of a body (or obstacle) according to its constitutive matter. Or, in other words, as it is a law of nature that to every action which seeks to exert itself upon matter, this latter opposes the same with a reaction equal and inverse, then the wave coming by means of this apparatus reproduces the same matter in the body which it encounters, it must be admitted that the body, as soon as it has received a part of the flux, causes a reaction upon a certain scale in such a way that it changes the whole of the original action, that is to say, it prevents a regular reception, which is immediately known or noticed at the receiving station, for the receiving apparatus is so constructed as not to be affected by all disturbances, thus effecting the desired work, that is to say, indicating the presence of a body.

The apparatus shown in Figs. 3 and 6 are specially useful for doing the work just described. The apparatus shown in Figs. 8 and 9 is specially suitable for signifying the presence of a magnetic body which may be upon or in the water (and it is the same with a magnetic body which may be upon the land), and this body we admit, for example, may be a submarine.

The idea will certainly occur that it is impossible to transmit through sea water as it is true that sea water absorbs very rapidly electric waves, but it must be remembered that known electric waves are simply a disturbance of the lines of magnetic force, instead of, as we obtain by the present invention, the production of a real current. For this reason the absorption is slower over the greater part of its travel and its production is dynamically stronger and more united. The wave therefore has the faculty of being perceived by the reception

apparatus, being signalled at the receiving station with very delicate apparatus, that is to say, by means of a telephone of the micro-ampere type or of the hundredth of a micro-ampere, or by means of a galvanometer, for example of the Nobili type, or the more delicate Deprez-D'Arsonval. Thus the apparatus will be able to determine very nearly all the evolutions of a submarine, it being well understood that it is necessary to ascertain all the losses due to resistance, absorption and other causes and the distances apart of the transmitting and receiving ships.

Fig. 8 shows the arrangement for the transmission as well as for the reception; Fig. 9 represents the double transmission which will be effected as described with respect to Fig. 6, that is to say, with a single transmission apparatus to which two apparatuses constructed according to the present invention have been applied working synchronously together.

In Fig. 8, 1 represents one transmission antenna independent of that which is to effect the desired object, 2 is the body of the vessel, and 3 is a cylinder closed by insulating material. 4 and 5 are the two cylinders forming part of the apparatus constructed according to the present invention, a part of the cylinder 5 protruding from the closed cylinder 3. For the reason that sea water destroys very rapidly the materials, and the search should be made at different depths as well as at the surface of the water, the two apparatuses will be made movable and will be plunged into the sea only at the desired time and in agreement both for transmission and receiving.

Fig. 10 shows the arrangement given to the apparatus to obtain Joule's effect at a distance, that is to say, a spark at a predetermined point by means of electric waves produced by the apparatus herein described. Fig. 10 represents three apparatuses, I, II, III, each having its own excitation apparatus; all three working together and in accordance with the principle stated above of the common attraction of the fluxes, they unite in Q at the point E to obtain the desired effect at P. Q, Q^1, may be two complete cylinders insulated from each other or as described with respect to Figs. 11 and 12.

In Fig. 11 the cylinders 4, 5, are made with parallel wires with an intermediate inductance.

The apparatus shown in Fig. 12 is very similar to that shown in Fig. 3, the outer cylinders 4 and 5 being similar to those marked z and z^1 in Fig. 3, and the inner cylinders A, A^1, corresponding with two of the inner cylinders A, A^1, shown in Fig. 3. The inductances h, h^1, act in similar manner to those shown in Fig. 3.

It is necessary to state that the number of apparatuses such as I, II, III, is not limited but is always in accordance with the work desired to be done. The arrangement of the apparatus I is generally at an angle of 45 degrees to the apparatus III or the last of the series.

It may be stated that the various modifications of the apparatus herein represented are those forms which in experiments have given the best practical results, are simple and work perfectly.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. Apparatus for transmitting and receiving elecric waves, consisting of a series of cylinders united by means of reciprocal transformers and connected to a battery, accumulator or dynamo, the connection between the cylinders being so made that each cylinder is connected to the opposite pole to that to which the next adjacent cylinder is connected, the connection being made by coils having such an inductance as to prevent the wave circulating in the battery circuit, substantially as shown and described.

2. Apparatus as claimed in Claim 1, in which the inductances of the transformer of each cylinder and the resistances of the batteries may be fixed or variable, substantially as described.

3. Apparatus as claimed in Claim 1, in which the end cylinder is provided with an internal cylinder, both cylinders being connected to the same wire, substantially as described and shown in Fig. 2.

4. Apparatus as claimed in Claim 1, in which the cylinders are surrounded by other cylinders insulated from each other, each of these latter cylinders being connected to one of the internal cylinders by means of inductance coils and being connected to the battery, substantially as described with respect to Fig. 3.

5. Apparatus as claimed in Claim 1, having an internal concentric cylinder which is connected to earth, substantially as shown and described with respect to Fig. 4.

6. Apparatus as claimed in Claim 1, having a cylinder which is concentric with the first cylinder and passes therethrough and is connected with the second cylinder, substantially as shown and described with respect to Fig. 5.

7. The combination of a plurality of apparatuses as claimed in Claim 1 arranged parallel to each other or in which the end cylinders are at an angle to each other, substantially as shown and described with respect to Figs. 6 and 6^a.

8. Apparatus as claimed in Claim 1, which is located within a closed cylinder and is movable in combination with an independent transmission antenna, substantially as shown and described with respect to Fig. 8.

9. The combination of a plurality of apparatuses as claimed in Claim 1, in which the fluxes unite at a point within cylinders insulated from one another with the object of obtaining Joule's effect, substantially as shown and described with respect to Figs. 10, 11 and 12.

Dated this 14th day of August, 1917.

HARRIS & MILLS,
Chartered Patent Agents,
34—35, High Holborn, London, W.C. 1.

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SHEET 1.

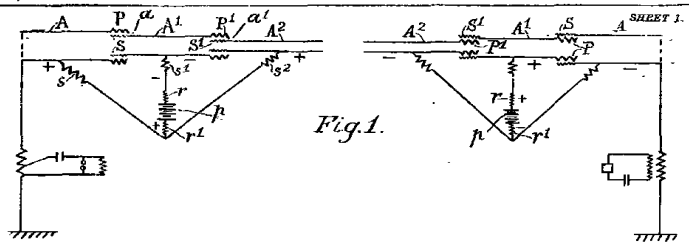

Fig. 1.

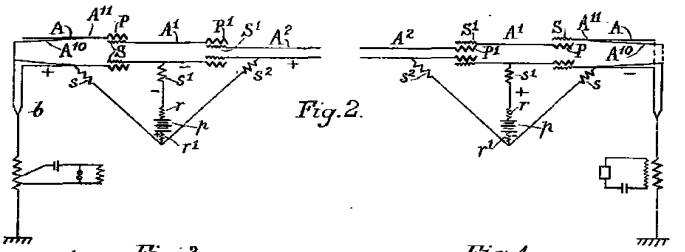

Fig. 2.

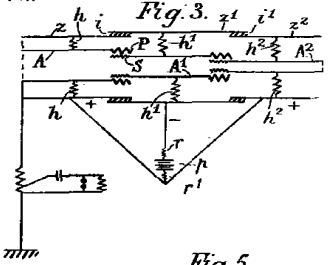

Fig. 3.

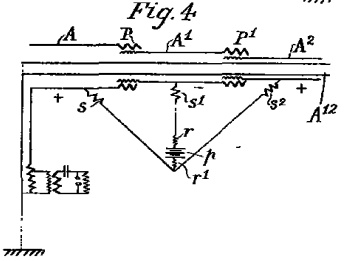

Fig. 4.

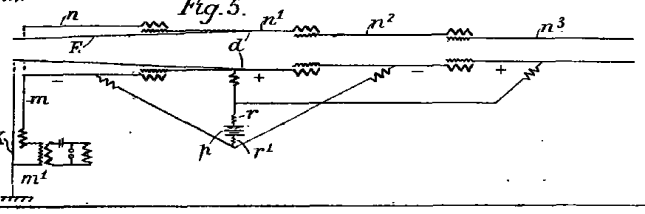

Fig. 5.

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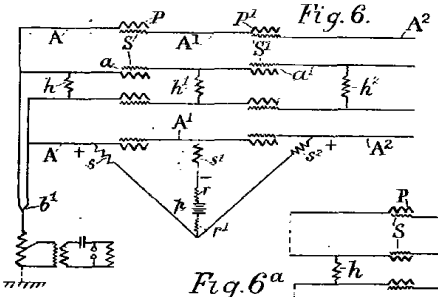

Fig. 6.

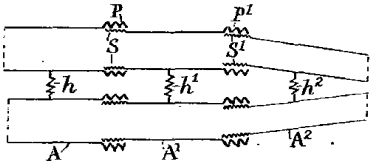

Fig. 6a

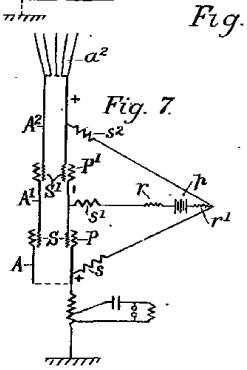

Fig. 7.

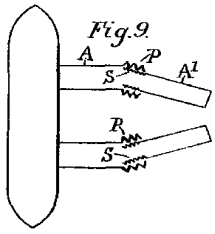

Fig. 9.

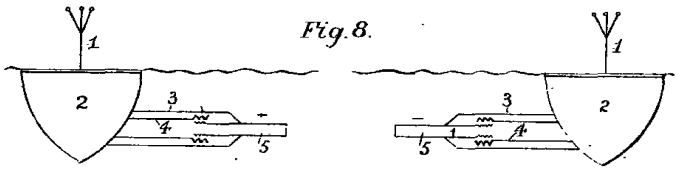

Fig. 8.

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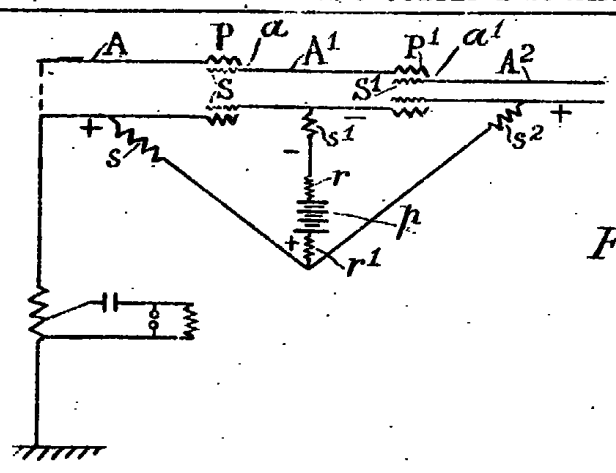
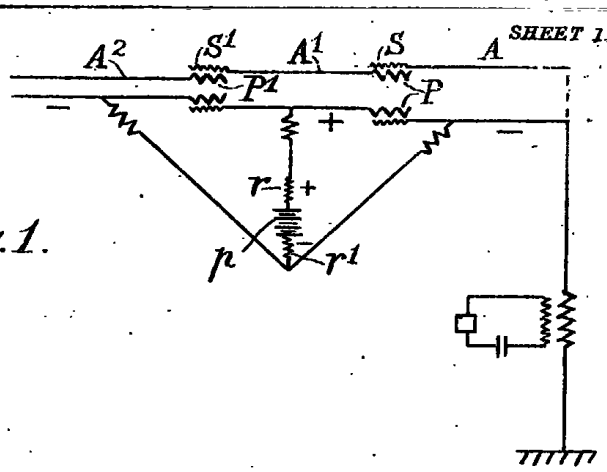


Fig. 1.



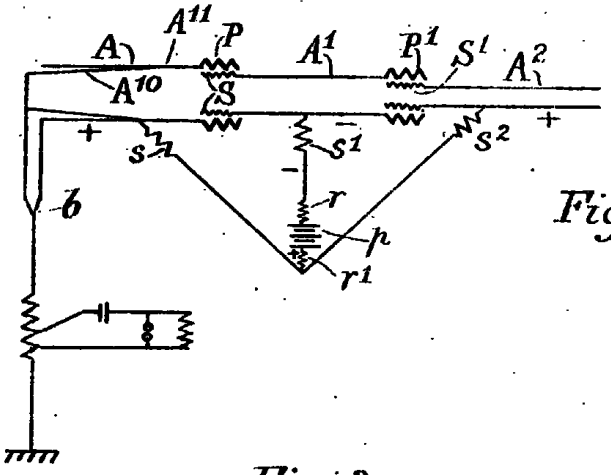


Fig. 2.

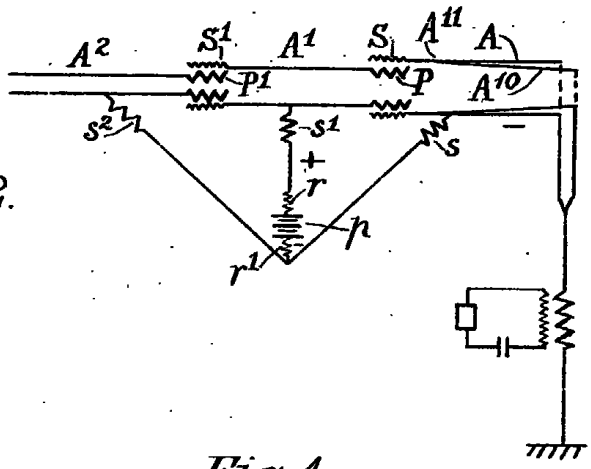


Fig. 3.

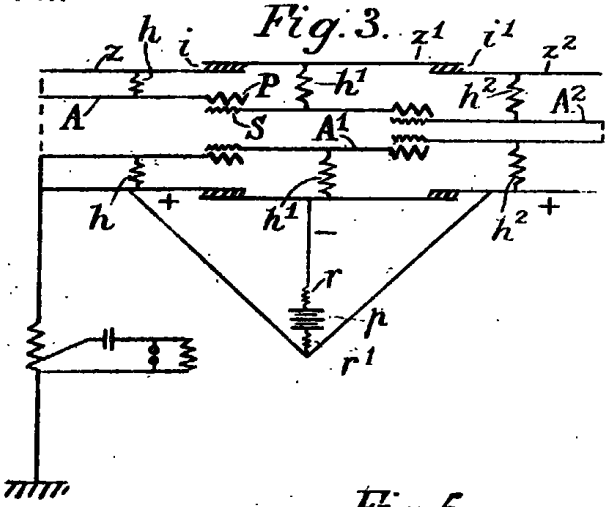


Fig. 4.

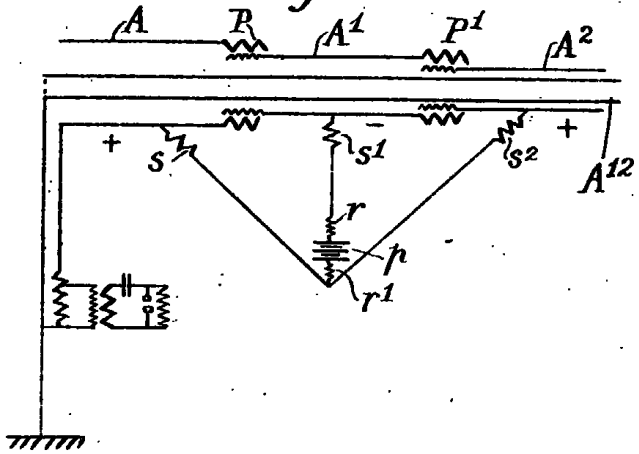


Fig. 5.

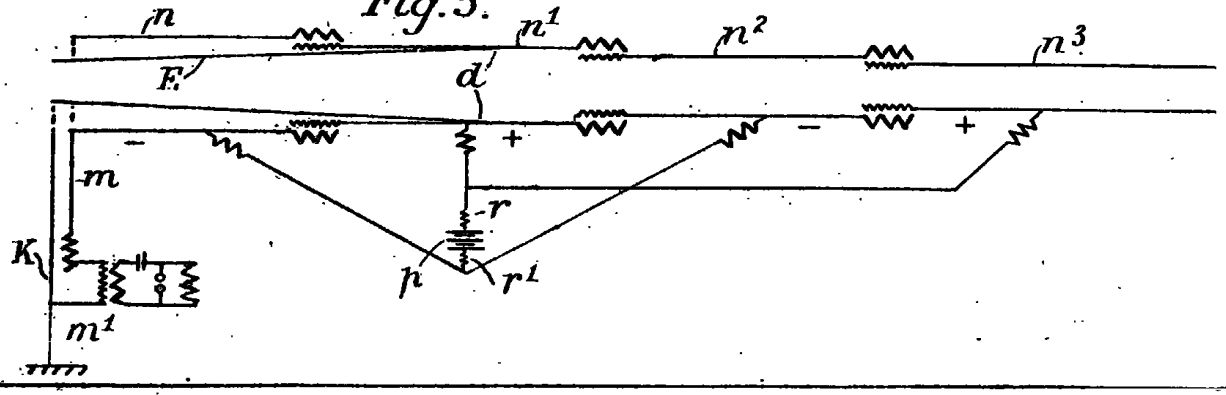


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Fig. 6.

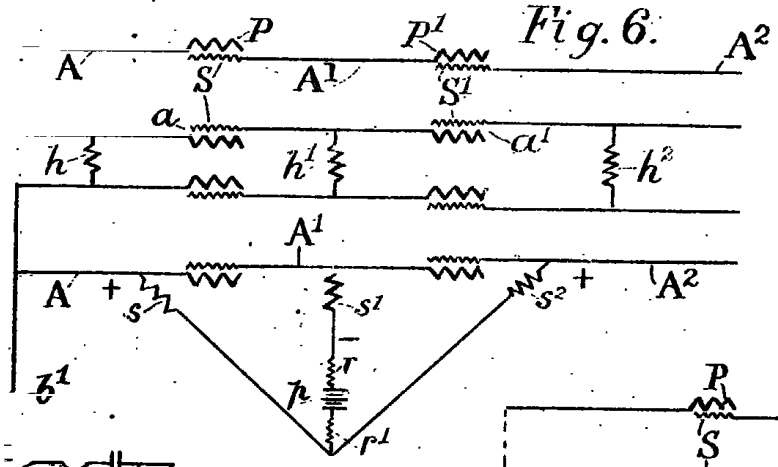
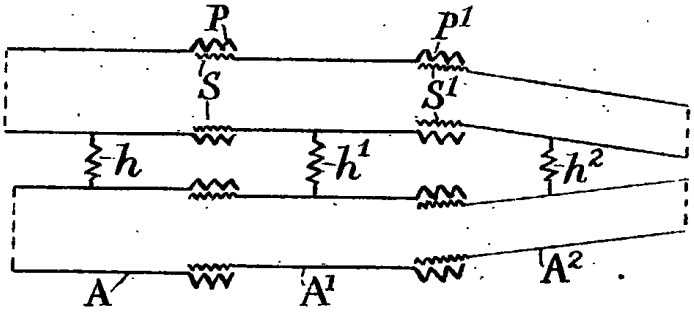


Fig. 6a



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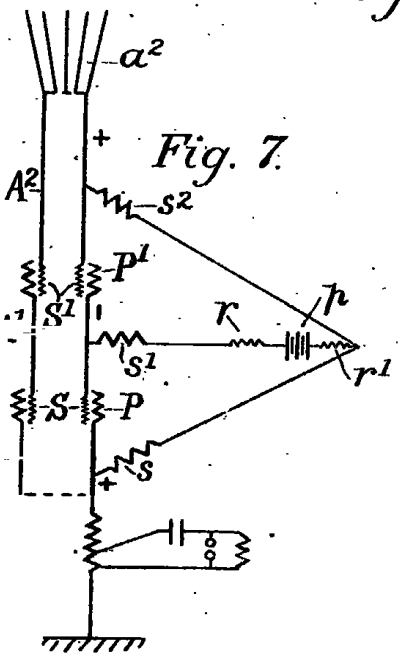


Fig. 9.

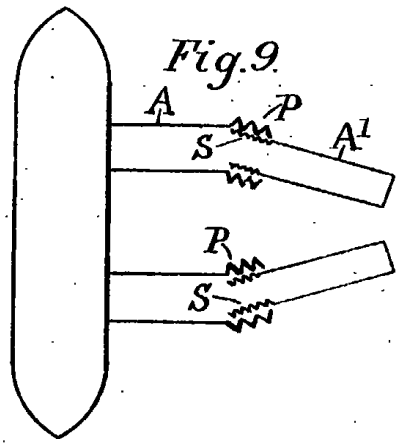


Fig. 8.

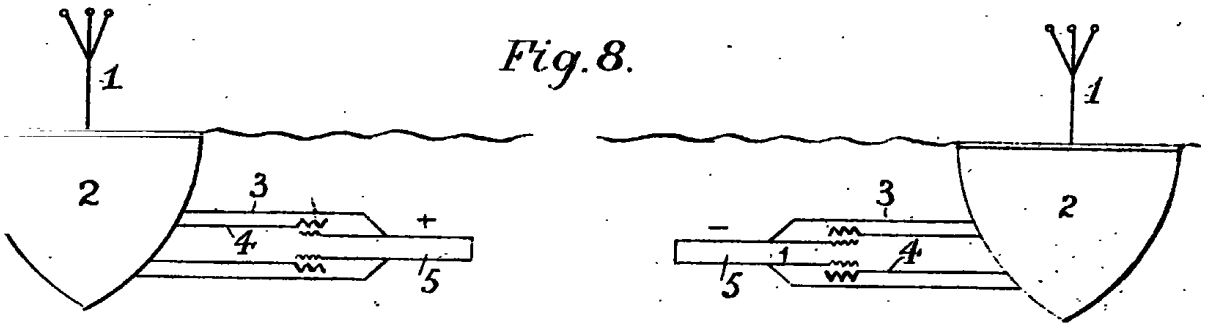


Fig. 11.

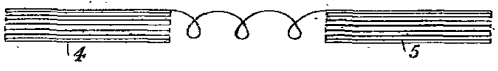
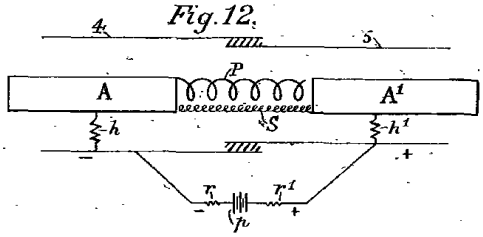


Fig. 12.



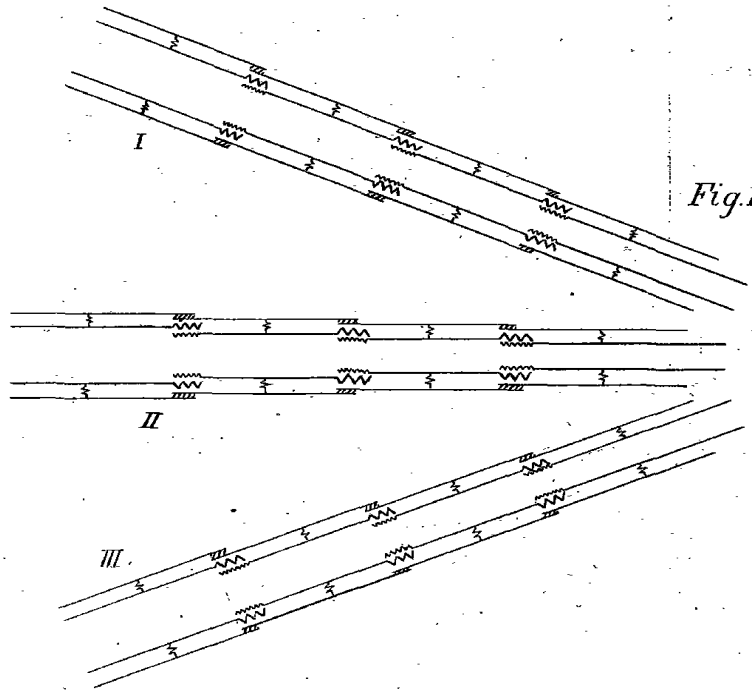


Fig. 10.

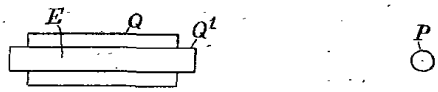


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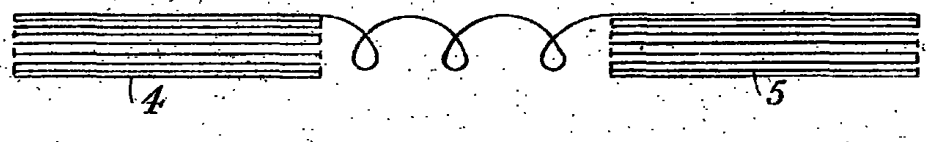
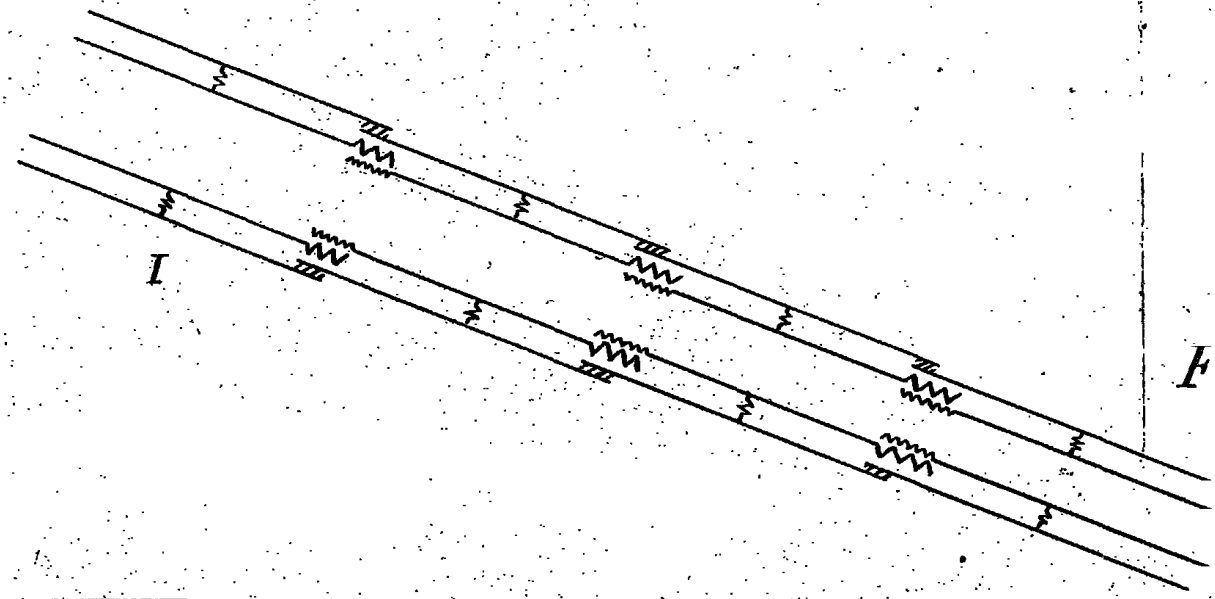
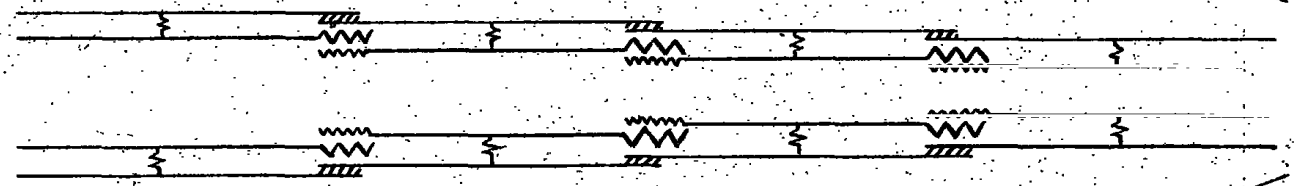
Fig. 11.







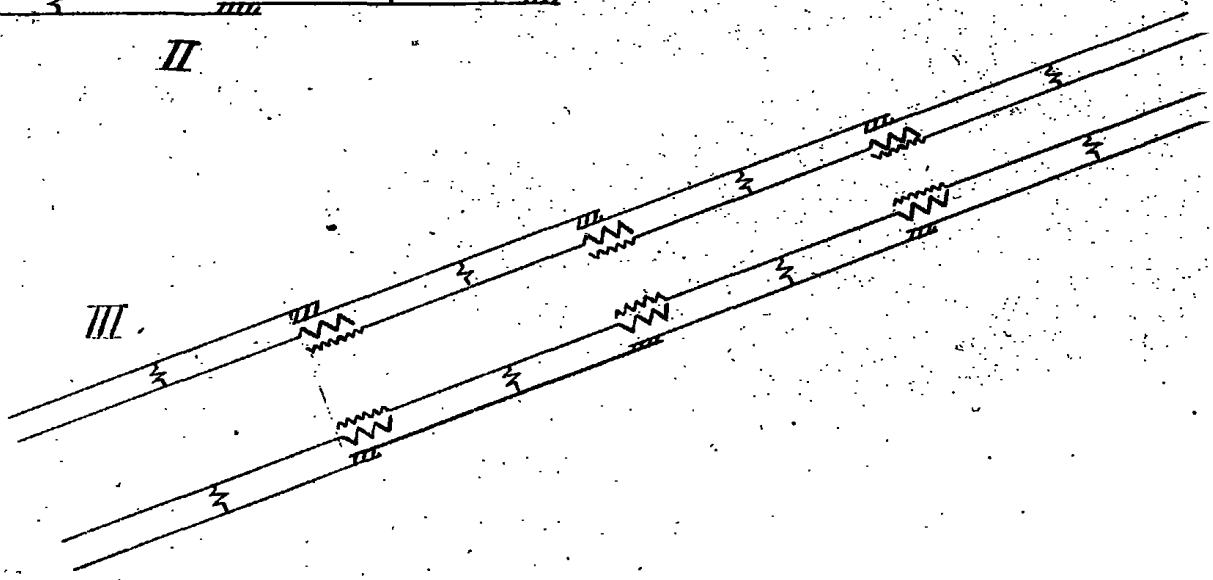
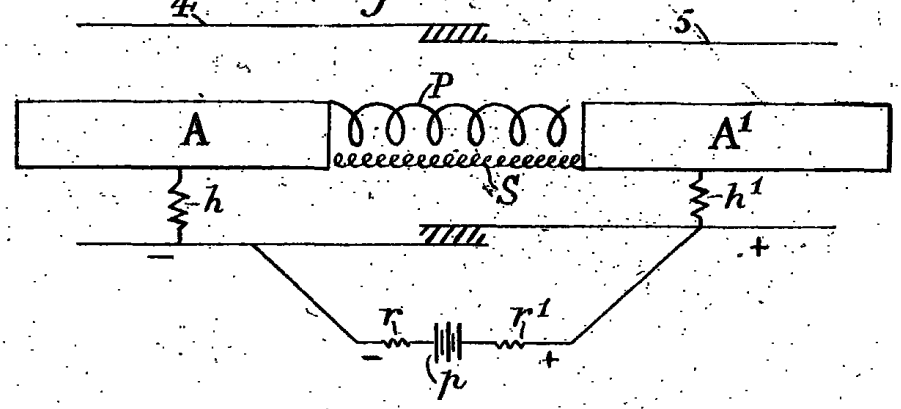


Fig. 12.



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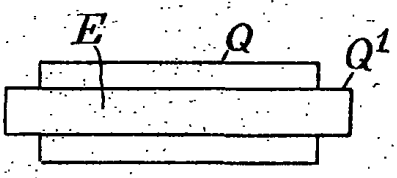

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