Oct. 26, 1926. 1,604,129

A. MEISSNER

TRANSMITTING ARRANGEMENT FOR WIRELESS TELEGRAPHY AND TELEPHONY

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Fig. 1.

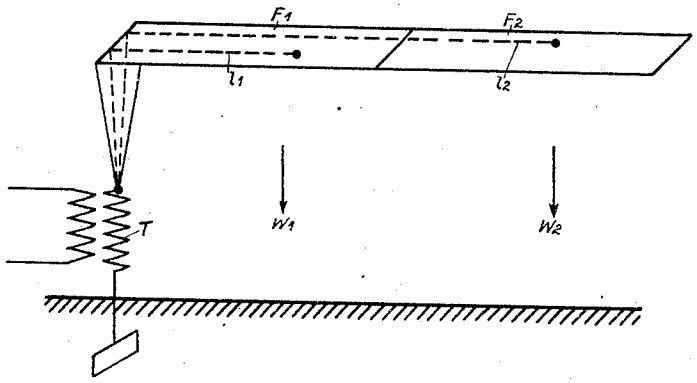


Fig. 2.

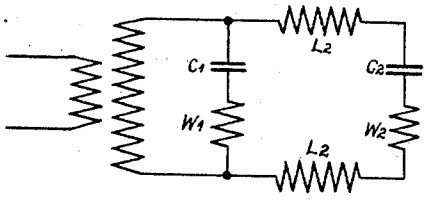
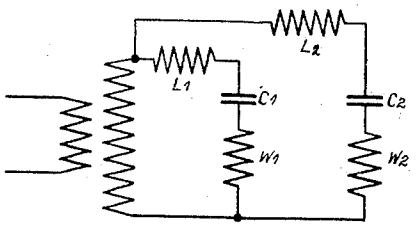


Fig. 3.



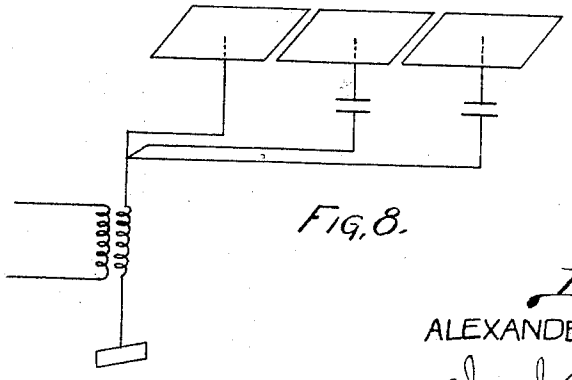


FIG. 8.

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Fig. 4.

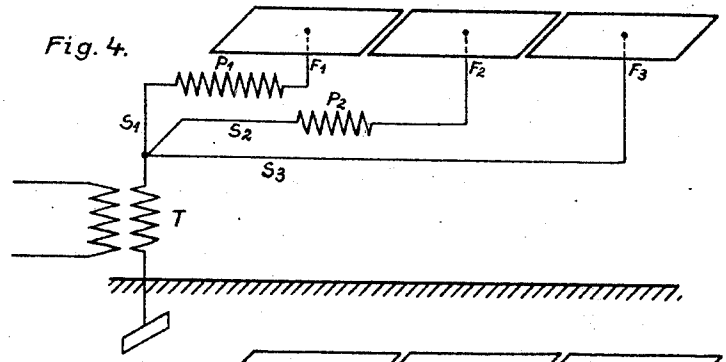


Fig. 5.

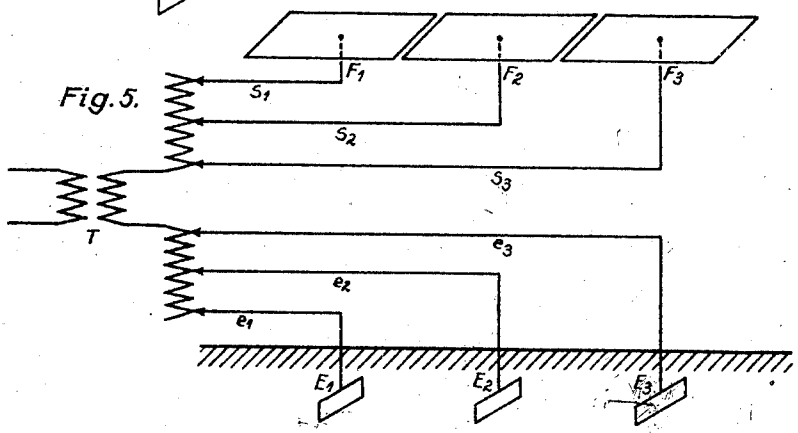


Fig. 6.

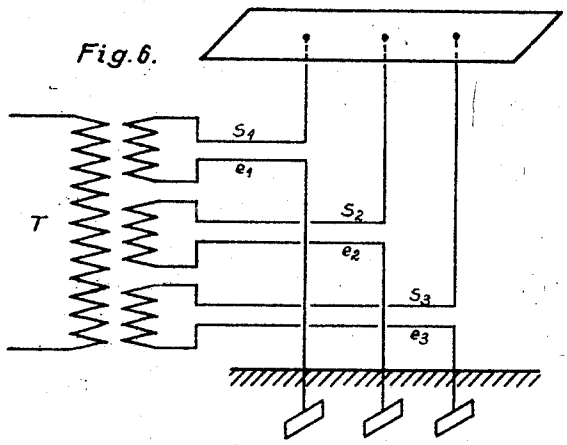
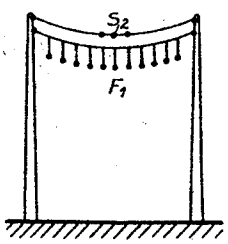


Fig. 7.



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UNITED STATES PATENT OFFICE.

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TRANSMITTING ARRANGEMENT FOR WIRELESS TELEGRAPHY AND TELEPHONY.

Application filed August 8, 1922, Serial No. 580,518, and in Germany May 27, 1921.

The invention relates to an arrangement by means of which the operation of large antennæ, such as antennæ of large area or great length is considerably improved. An important object of the invention is to provide means whereby uniform utilization of the elements of area of the antenna at varying distances from the feeding point is obtained. The utilization of the various elements of area of large antennæ has heretofore not been uniform, and the lack of uniformity has caused considerable loss in efficiency of the antenna as a whole.

The invention will be further explained by reference to the drawings the eight figures of which represent several embodiments of the invention, by way of example.

In Fig. 1 a long antenna is shown which is excited from one end in the usual manner by means of a transmitting transformer T. If, for instance, the antenna is considered as comprising two equal elements of area F_1 and F_2, the supply current for the surfaces F_1 and F_2 may be assumed to pass through distances corresponding to the lengths of the lines l_1 and l_2 respectively. Corresponding to these different supply lengths are different values of the self-inductive reactances L_1 and L_2 respectively in series with the equal capacities C_1 and C_2 respectively of the two elements of area. The two earth resistances for the elements of area F_1 and F_2 are also equal to each other. The conditions here are analogous to those in a branched and closed system such as is shown in Fig. 2, wherein one branch contains a capacity C_1 and a resistance W_1 and another a capacity C_2 and a resistance W_2, a self inductance L_2 being placed in series with the second branch. If C_1 and C_2, and W_1 and W_2 respectively are equal to each other, then if L_2 did not exist, the resistance losses in the system as a whole would be half the losses due to the resistance of one of the branches. Since, however, L_2 lies in front of the second branch, the high frequency impedance of the first branch is greater than that of the second branch and increases as L_2 is increased. This may be explained as follows: Since C_1 and C_2 are equal to each other, the capacitive reactances of the two branches are equal to each other. The high frequency impedance of the first branch is, on the whole, equal to this capacitive reactance W_{C_1}. The high frequency impedance of the second branch, however, is equal to $W_C - W_{L_2}$, as C and L_2 act oppositely to each other. The high frequency impedance of the second branch is therefore smaller by the self inductive reactance than that of the first branch and becomes smaller and smaller with an increasing self-inductance placed in series. Applied to the antenna according to Fig. 1, this amounts to the following: If both elements of area F_1 and F_2 have the same earth resistance, for instance, 5 ohms, the most favourable condition would be that the resulting resistance of the antenna as a whole would be half of 5 ohms, viz, 2,5 ohms. If, however, as may be the case in reality with an antenna having a length of 1200 meters, a self-inductance of 70,000 cm. is placed in series with F_2, the unequal self inductances of the area F_1 and F_2 of the antenna cause correspondingly unequal frequency impedances and distributions of current, that is to say from 50 to 80% more current will flow through F_2 than through F_1. F_1 does not come into full effect and is no longer arranged in parallel with regard to F_2.

According to the invention the most favourable conditions are established by the use of balancing means. In a system according to Fig. 2, the two branches may, for instance, be made equivalent by placing in series with them equal self inductances L_1 and L_2 (Fig. 3). The impedance of the system is thus made equal to half the impedance of each of the branches.

In an antenna, equal self-inductance values for the current supply paths of elements of area which are at varying distances from the source of current may be obtained by providing the elements of area with separate feed lines and inserting balancing coils of different sizes in the feed lines. Fig. 4 is a diagram of such an arrangement. The three elements of area F_1, F_2, F_3 of the antenna, which, as usual, may be electrically connected with each other are provided with three feed lines S_1, S_2, S_3 respectively from the transmitting transformer T. The shortest line S_1 has inserted therein a relatively large coil P_1, the middle line S_2 contains a smaller coil P_2, and the longest line S_3 has no coil. The values of the coils P_1 and

P_2 are so chosen that the self-inductances of all three lines are made equal. The charges of the three elements of area F_1, F_2, F_3 are thereby caused to be also equal to each other, with the result that every element of area has an equal share in the operation of the antenna and the impedance of the antenna as a whole has the smallest possible value.

The balancing coils need not be inserted in the feed lines themselves, but may be placed so to speak in the transformer T, by branching off the lines S_1, S_2, S_3 as shown in Fig. 5, from various points of the secondary winding of the transformer. In order to arrive in such a case at the correct distribution of voltage and current for the various elements of area of the antenna, the transformer, as may be seen from Fig. 5, is preferably so arranged that the part of the secondary coil which takes up the voltage of the primary coil, is separated from the part from which the feed lines are branched off. The latter part is thus caused to serve chiefly as a loading coil. Therefore, by tapping several different turns of this part by the lines S_1, S_2, S_3, the currents in the latter can be adjusted as desired. The improved antenna can also, according to the invention, be constructed so that every element of area provided with a feed line is earthed below its capacity centre, i. e. the point at which the capacity of the area may be assumed to be concentrated without changing the constants of the area. Fig. 5 shows three earth connections E_1, E_2, E_3 corresponding to the elements of area F_1, F_2, F_3. The arrangement of the earth connecting lines e_1, e_2, e_3 with relation to the secondary of the transformer T is similar to that of the feed lines S_1, S_2, S_3. In this manner a transmitting installation is obtained having an antenna which operates with great efficiency and hardly any losses.

With this construction, it is particularly advantageous to arrange the feed and ground lines for the antenna as shown in Fig. 6, that is, as separate lines S_1 e_1, S_2 e_2 and S_3 e_3, which are placed as close to each other as possible so that their lines of force are not dissipated in the ground.

The balancing of the areas of the antenna according to the invention can also be effected by reducing the relatively large self-inductances of the longer feed lines by condensers, Fig. 8, instead of supplementing the relatively small self-inductances of the shorter feed lines by the use of additional coils.

In erecting an antenna according to the invention, it will in many cases be preferable to carry the current supply to the more distant areas over those lying closer to the transmitting transformer. Fig. 7 shows such an arrangement, in which the part of the antenna corresponding to F_1 is suspended between suitably erected poles, and the supply lines S_2 for the more remote area or areas are supported by a carrying rope at a short distance above the area F_1.

I claim as my invention:

1. A transmitting arrangement for wireless telegraphy and telephony comprising a source of high frequency energy, an antenna and separate paths for supplying current from said source to different areas of the antenna, said areas being at successively increasing distances from said source, said paths having substantially uniform impedances so as to cause current to be supplied to the respective areas of the antenna in substantially equal amounts.

2. A transmitting arrangement for wireless telegraphy and telephony comprising a source of high frequency energy, an antenna, and individual lines for feeding current from said source to different areas of the antenna, said areas being at successively increasing distances from said source, said feed lines having substantially uniform impedances.

3. A transmitting arrangement for wireless telegraphy and telephony comprising a source of high frequency energy, an antenna and individual means for supplying current from said source to different areas of the antenna said areas being at successively increasing distances from said source.

4. A transmitting arrangement for wireless telegraphy and telephony comprising a source of high frequency energy, an antenna, separate feed lines for supplying current to different areas of the antenna from said source of energy, said areas being at successively increasing distances from said source, and inductance coils in the feed lines for the areas of the antenna in closest proximity to said source of energy, so as to provide current supply paths of substantially equal impedances for the areas of the antenna.

5. A transmitting arrangement for wireless telegraphy and telephony comprising a source of high frequency energy, an antenna, individual feed lines for different areas of the antenna, comprising inductances of varying values, the inductances in the feed lines for the areas in closest proximity to said source of energy being greater than those in the feed lines for the areas most remote from the source of energy, an individual ground for each area, connecting lines between said source of energy and said grounds, and inductances in said connecting lines corresponding in value respectively to the inductances in the feed lines for said areas.

6. A transmitting arrangement for wireless telegraphy and telephony comprising a transformer acting as a source of high frequency energy, an antenna including a plurality of areas electrically connected to-

gether, feed lines for said areas including a loading coil connected with the secondary winding of the transformer, a ground for each of said areas, and connections between the secondary winding of the transformer and said grounds including inductances corresponding respectively to the inductances in the feed lines.

7. An antenna system comprising an antenna, signal responsive apparatus, separate paths connecting said apparatus to different areas of said antenna, said areas being at successively increasing distances from said apparatus.

8. An antenna system comprising an antenna, signal responsive apparatus, separate paths connecting said apparatus with different areas of said antenna, said areas being at successively increasing distances from said apparatus and said paths having equal impedances.

9. An antenna system comprising an antenna, signal responsive apparatus, a plurality of individual grounds for said antenna, each located under a particular capacity area of said antenna and cooperating therewith, individual conductors connecting said apparatus to said capacity areas and grounds.

10. An antenna system comprising an antenna, signal responsive apparatus, a plurality of individual grounds, each located under a particular capacity area of said antenna and cooperative therewith, individual pairs of conductors, the conductors of each pair being closely related to each other, one conductor of each pair connecting said apparatus to a capacity area and the other conductor of said pair connecting said apparatus to the ground under said capacity area.

11. An antenna system comprising an antenna, signal responsive apparatus, a plurality of individual grounds, each located under a particular capacity area of said antenna and cooperating therewith, pairs of conductors, one conductor of each pair connecting said apparatus with a capacity area and the other conductor of each pair connecting said apparatus with a ground under the particular capacity area, the combined impedances of the conductors of each pair being equal.

12. An antenna system comprising an antenna, signal responsive apparatus, said antenna comprising a progressively laterally extending continuous conducting element and individual conductors connecting said apparatus to different points on said element.

13. An antenna system comprising an antenna, signal responsive apparatus, said antenna comprising a progressively laterally extending continuous conducting element, individual lines for connecting said apparatus to different points on said element, said lines having substantially equal impedances.

14. An antenna system comprising an antenna, signal responsive apparatus, individual conductors connecting said apparatus to different points on said antenna, said conductors being of substantially equal impedance and lying above said antenna.

In testimony whereof I have signed my name to this specification.

DR. ALEXANDER MEISSNER.