No. 814,951. PATENTED MAR. 13, 1906.

R. A. FESSENDEN.

CAPACITY.

APPLICATION FILED DEC. 14, 1904.

2 SHEETS—SHEET 1.

Fig. 1.

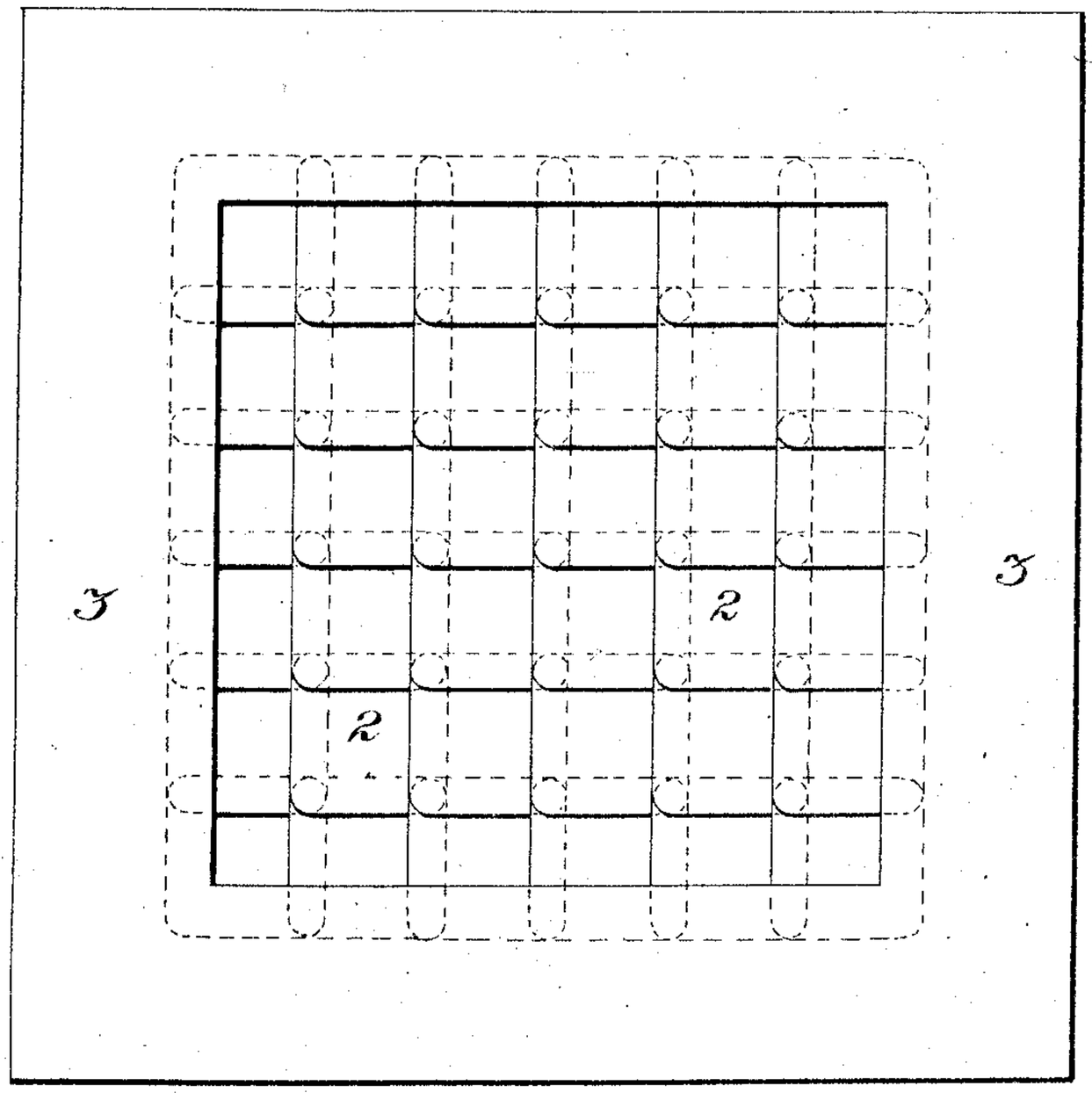
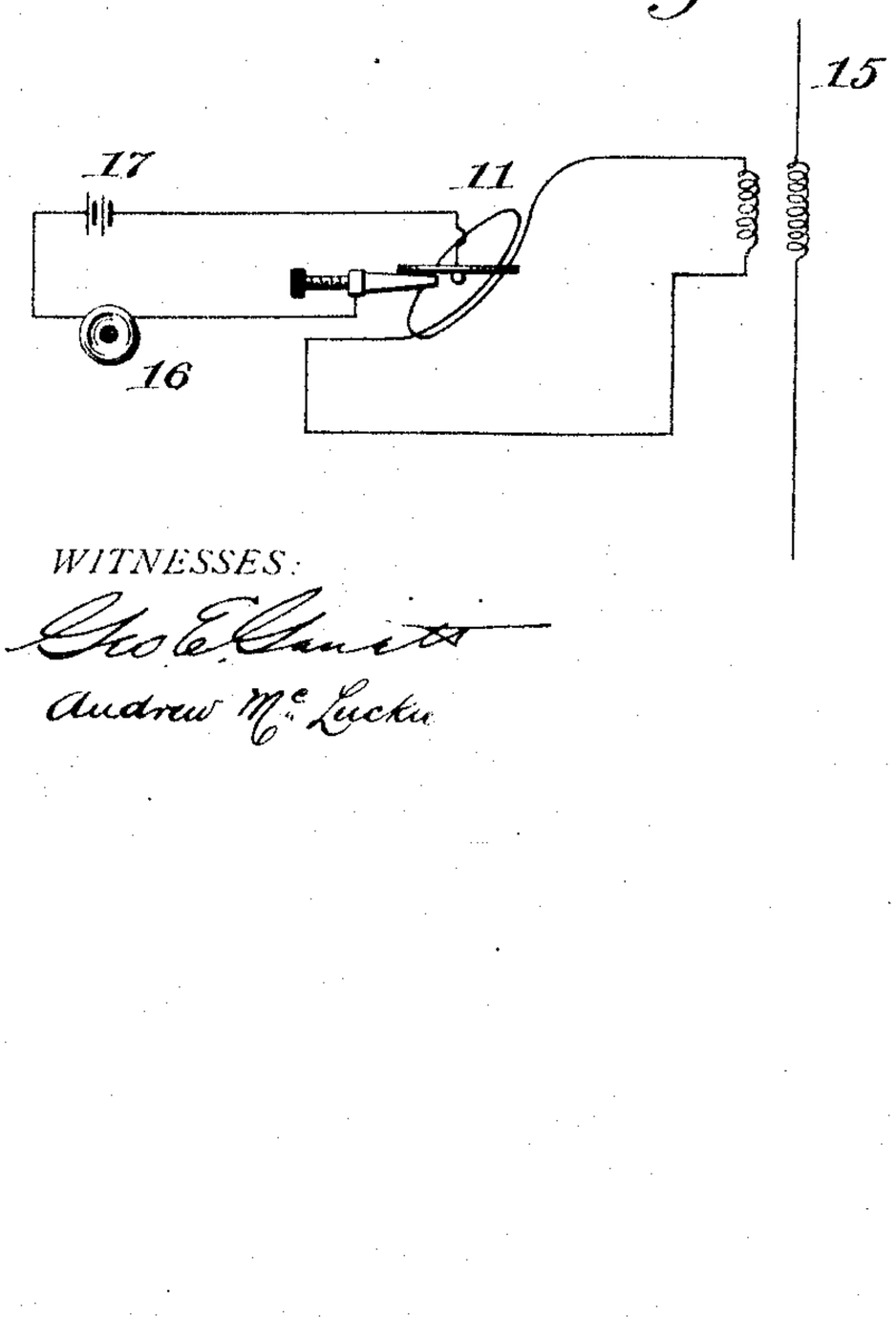
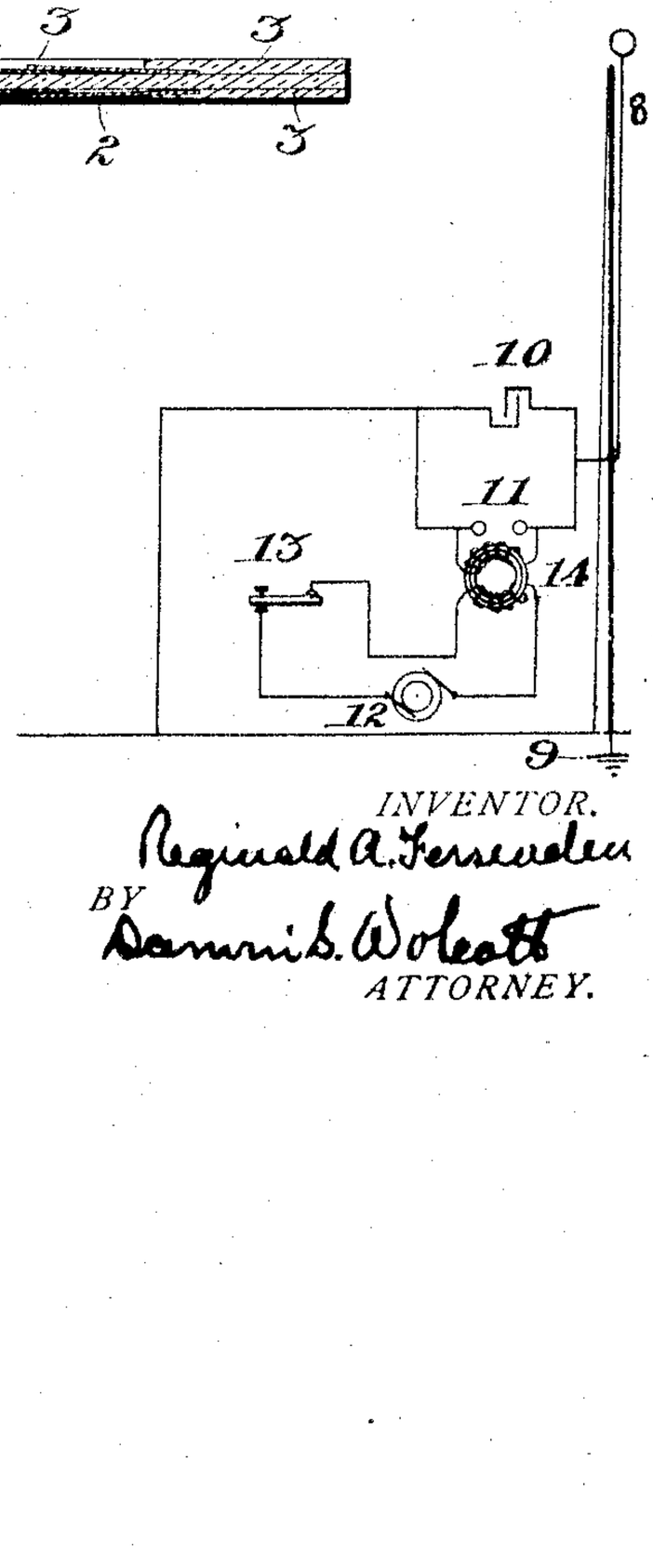


Fig. 2.

Fig. 3.





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2 SHEETS—SHEET 2.

Fig. 4

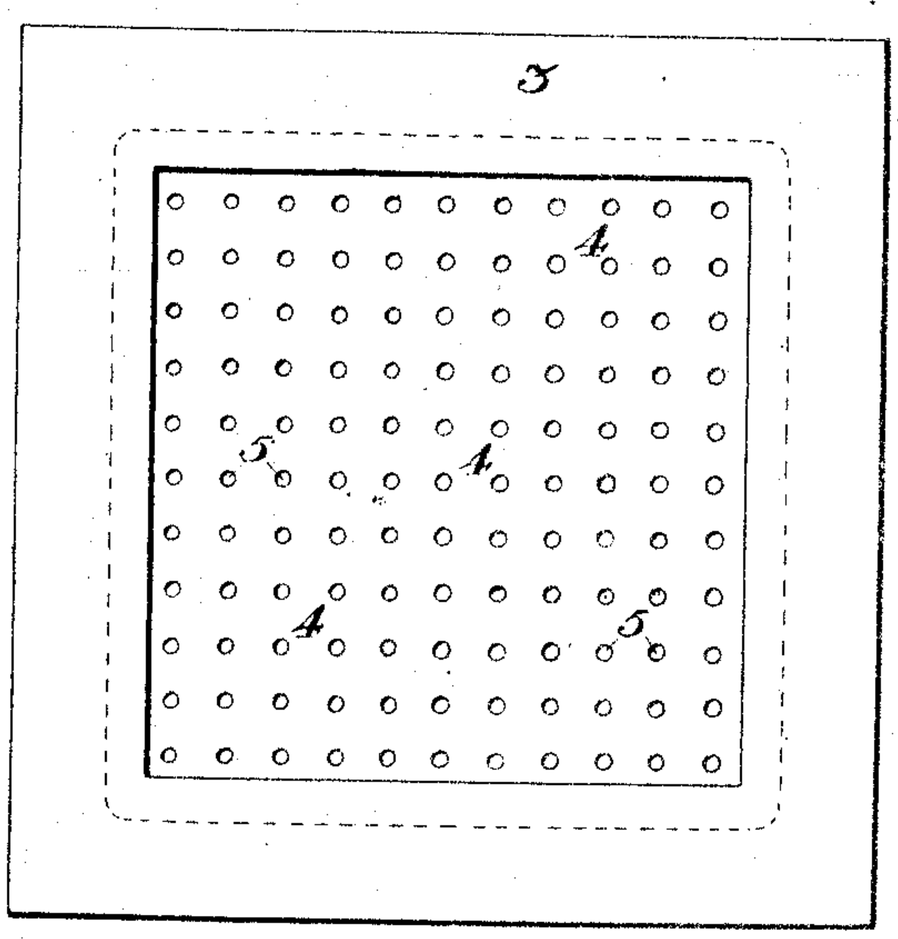


Fig. 6.

Fig. 5.

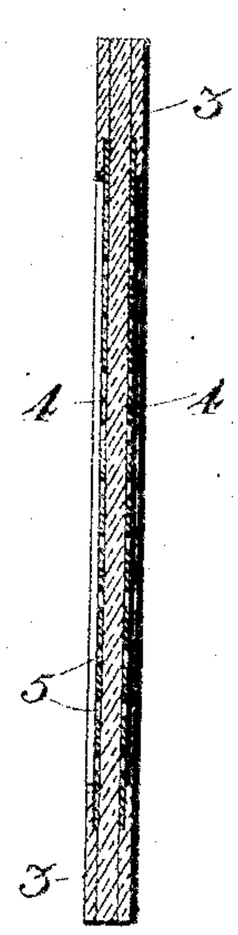
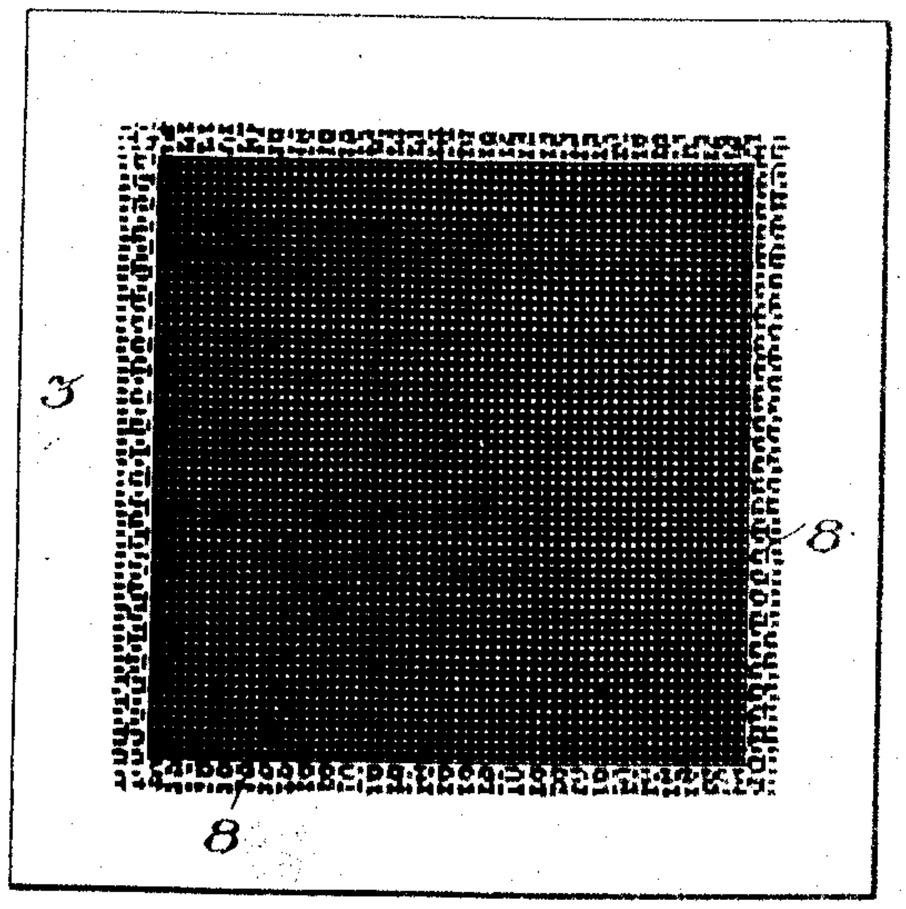
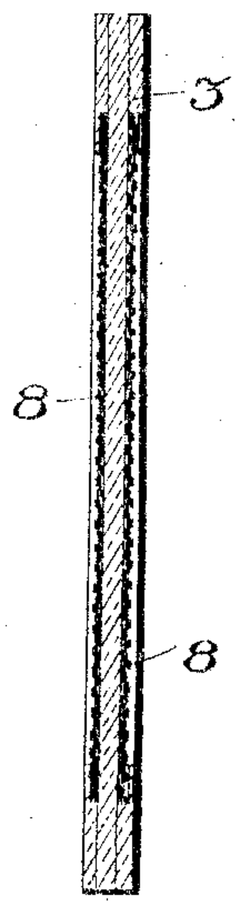


Fig. 7.





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UNITED STATES PATENT OFFICE.

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CAPACITY.

No. 814,951. Specification of Letters Patent. Patented March 13, 1906.

Application filed December 14, 1904. Serial No. 236,858.

To all whom it may concern:

Be it known that I, REGINALD A. FESSENDEN, a citizen of the United States, and a resident of Washington, District of Columbia, have invented certain new and useful Improvements in Capacities, of which the following is a specification.

The invention herein described relates to improvements in condensers, especially condensers for use with alternating currents of high frequencies, and still more especially to condensers for use in wireless telegraphy.

The invention is hereinafter more fully described and claimed.

In the accompanying drawings, forming a part of this specification, Figures 1, 4, and 6 show views of condensers embodying my improvement. Figs. 2, 5, and 7 show sections of the same, and Fig. 3 shows an arrangement of circuits for use in connection with my invention.

Heretofore there has been great difficulty in obtaining condensers for use with alternating currents of high potential, and more especially high potential and high frequency such as are used in wireless telegraphy.

For low potentials specially-prepared paraffin condensers have been used; but they are objectionable in many cases on account of the paraffin becoming chemically changed under the action of the high potentials and because the paraffin becomes soft at comparatively low temperatures, such as are met with in summer. Oil condensers have been used, but are bulky and heavy. Glass has been very generally used for this work; but I have found that the use of glass condensers as ordinarily constructed is objectionable on account of the presence of very heavy losses and objectionable heating.

In applying comparatively large metallic sheets to the surface of a dielectric it is practically impossible to prevent the formation of minute pockets between the metallic sheets and the dielectric. These pockets contain fluids which cannot be removed and the presence of which give rise to large losses.

I have discovered that one of the chief difficulties is due to the irregular or non-continuous contact between the metallic coatings of the condenser and the dielectric material between the coatings and have given a mathematical explanation of this effect in a paper on insulation and conduction. (*American Institute Electrican Engineers*, 1898.)

As the result of numerous experiments I have found that this difficulty can be overcome by making the metallic coatings in such manner that they are non-integral—*i. e.*, are formed of a large number of small areas arranged in such relation to each other that while currents can freely pass from one area to the next there will be openings of spaces between adjacent areas permitting the removal or escape of fluids from between the metallic sheets and the dielectric. By reason of the small extent of the areas the formation of continuous contact between the areas and the surface of the dielectric can be easily and surely attained. As the areas are small, the openings or spaces between adjacent areas are numerous, (permitting the free evaporation or extraction of the solvents which may be used in the cement or of air or gases which would otherwise remain between the metallic coating and the dielectric.) As a further improvement I have found it advantageous to cover the edges of the coatings by an additional layer of insulating material, preferably of the same character as the dielectric lying between the coatings.

In Fig. 1, 1 is a plate which may be of mica, and 2 represents small areas of tin-foil applied so as to be in continuous contact. A conducting-plate from one area to another is formed by causing adjacent areas to overlap to a certain extent. In applying these areas to the dielectric openings or spaces should be left for the escape or removal of fluids, &c. Fig. 2 is a sectional view of the same, showing the mica plate 1, the tin-foil coating 2, and a protecting layer of mica 3 covering the edges of the tin-foil coatings, so as to prevent discharges from the edges of the coatings.

In the construction shown in Figs. 4 and 5 a large sheet of metal, as tin-foil, is divided up into small connected areas 4, forming holes or openings 5 through the sheet, said holes or openings being sufficiently numerous and so distributed as to afford ample opportunity for the escape of or removal of fluids, &c., from between the metallic coating and the surface of the dielectric.

Fig. 6 shows still another form in which a plate metallic coating consists of areas formed by flattening a sheet of wire-gauze, as

by passing it between rolls, and causing it to present an almost perfectly continuous surface, with, however, small interstices to permit of the evaporation, removal, or renewal by a vacuum-pump of objectionable fluids or gases which might otherwise exist between the coatings and the dielectric.

As illustrating the improved results obtained by this novel method of construction two condensers were taken, both having similar plates of mica, but the metallic coatings of one formed of two single pieces of tin-foil, while the metallic coatings of the other were formed of a number of small areas arranged as described. Both condensers were tested with the same alternating-current voltage, and whereas the one whose coatings were formed of large pieces of tin-foil became very hot and broke down in a few minutes at twelve thousand five hundred volts, the one whose coatings were formed of a number of small areas of tin-foil in continuous contact with the dielectric at the end of one hour had not only not broken down, but was so cool that a piece of parallin placed upon it was not softened.

I do not limit myself to any particular kind of dielectric or to any particular kind of metallic coatings, as I have found this method applicable to many types of condensers. Instead of mica, hard rubber or even in some cases glass may be used, and the coatings may be applied directly, as in the case of gold-leaf, or may be applied with suitable cement—as, for example, a solution of shellac—or may be vulcanized in position.

The solvent and gases may be removed by baking under heat with or without pressure or by a vacuum with or without pressure. In all cases, however, the conducting-coatings should be so arranged as to make good continuous contact with the dielectric and to avoid the retention or entrance of objectionable fluids or gases between the metallic coatings and the dielectric.

Fig. 3 shows sending and receiving stations embodying the invention herein described. 8 is a sending-conductor grounded at 9. 10 is a condenser of the form herein described. 11 is a spark-gap. 12 is a source of alternating current; 13, a signal-key; 14, a transformer. On depression of the key 13 the condenser 10 is charged and discharged across the gap, thereby emitting the waves which are received upon the receiving-conductor 15, which is operatively connected to the receiver 11 of the type described in United States Patent No. 706,735, said receiver being arranged in a closed tuned circuit which is preferably tuned to the same frequency as the receiving-conductor 15, sending-conductor 1, and the local sending-circuit, containing the condenser 10 and spark-gap 11. 16 is an indicating instrument, and 17 is a local battery.

I claim herein as my invention—

1. A condenser having in combination a dielectric and metallic coatings composed of a number of small areas electrically connected.

2. A condenser having in combination a dielectric and metallic coatings in continuous contact with the dielectric except at such portions as the areas contact with each other.

3. A condenser having in combination a dielectric and metallic coatings composed of a number of small areas electrically connected and in continuous contact with the dielectric.

4. A condenser having in combination a solid dielectric and metallic coatings in continuous contact with the dielectric and having their edges protected by solid insulating material.

5. A condenser having in combination a dielectric and non-integral metallic coatings in electrical contact.

6. A condenser having in combination a dielectric and non-integral metallic coatings in electrical contact with one another and in continuous contact except at such portions as the areas contact with each other with the dielectric.

Signed at Washington, District of Columbia, this 14th day of December, A. D. 1904.

REGINALD A. FESSENDEN.

Witnesses:
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JESSIE E. BENT.