E. J. PRATT.

INDUCTION COIL.

APPLICATION FILED NOV. 15, 1917.

**1,362,138.** **Patented Dec. 14, 1920.**

Fig. 1.

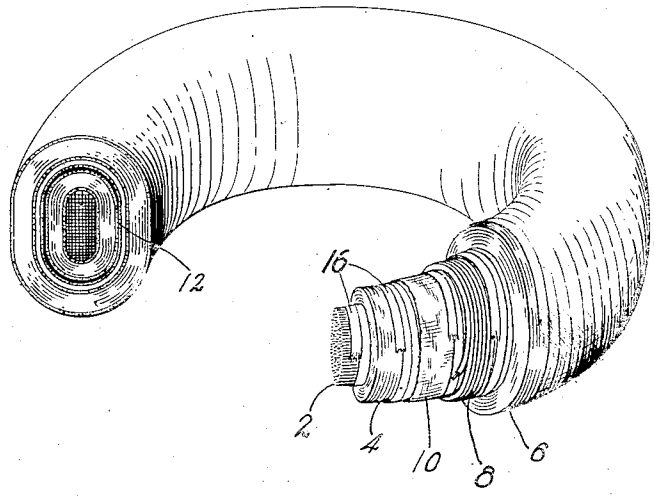



Fig. 3.

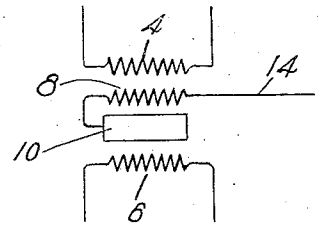
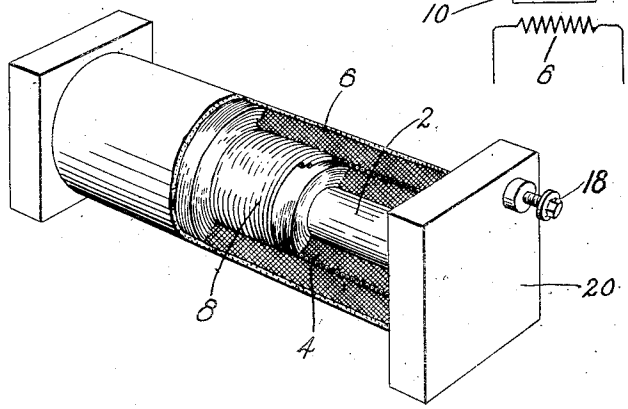



Fig. 2.




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# UNITED STATES PATENT OFFICE.

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## INDUCTION-COIL.

1,362,138. Specification of Letters Patent. Patented Dec. 14, 1920.

Application filed November 15, 1917. Serial No. 202,186.

*To all whom it may concern:*

Be it known that I, EDWARD J. PRATT, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Induction-Coils, of which the following is a full, clear, concise, and exact description.

This invention relates to devices for inductively connecting two electrical circuits and more particularly to repeating coils for telephone lines.

Although the common practice of dividing a telephone line into several sections inductively connected by repeating coils counteracts to a considerable extent the disturbing effects from the unbalancing of a portion of the line and thus reduces the undesirable sounds in the receivers, such an arrangement does not ordinarily get rid of the noises due to static disturbances, as the coil itself, acting as a condenser whose plates are the two windings of the coil, repeats static disturbances from one circuit into the other to such an extent as often to interfere seriously with the response of the telephone apparatus to talking currents.

It has been proposed to insert a metal sleeve between the inner and outer windings of the repeating coil to act as an electrostatic shield between the two windings, the accumulation of a charge on either winding of the coil inducing a charge on the sleeve instead of on the other winding. However, if this sleeve extends entirely around the inner coil it acts as a closed circuit winding and interferes with the repetition across the coil of the talking current variations; moreover, when such a shield is used the inner winding must be dried and impregnated before the sleeve is fitted in place, and a second drying and impregnating is necessary after the outer winding is in place. The longitudinal slitting of the sleeve will avoid this difficulty, but if the slit is wide the shielding effect is greatly reduced, while the employment of a sleeve with a slit whose edges are close together and yet not in conductive relation involves a high manufacturing cost on account of the skill and time required to insure that the sleeve in the completed coil is properly arranged. Coils in which each winding is completely surrounded by a metal casing are so expensive to produce in an efficient form that their use is necessarily limited.

It is an object of this invention to provide means of low cost but high efficiency for preventing electrostatic induction between the windings of repeating and other induction coils by electrostatically shielding the windings from each other, this result being preferably accomplished by interposing between the windings, a shielding winding of insulating conductive wire with or without a supplementary sleeve of thin metal.

Further objects and advantages of this invention will appear from the following detailed description, taken in connection with the accompanying drawings, in which Figure 1 is a view, partly in section, of a toroidal induction coil, equipped with a shielding winding and metal sleeve; Fig. 2 is a view, partly in section, of a straight or cylindrical induction coil in which the metal sleeve is omitted from the electrostatic shield; and Fig. 3 is a diagram indicating the relation of the parts of the coil shown in Fig. 1.

The toroidal coil shown in Fig. 1 comprises a wire or other suitable core 2, an inner winding 4 and an outer winding 6, windings 4 and 6 being arranged to form parts, respectively, of separate working circuits or sections thereof. Between windings 4 and 6 is a winding 8 comprising a single layer of insulated conductive wire. Because of the difference between lengths of the inner and outer peripheries of the toroid, the turns of winding 8, though contiguous along the inner periphery of the toroid, will elsewhere be more or less separated from each other. To prevent electrostatic leakage between these turns, a thin metal sleeve 10, which may comprise a layer of tin foil or other foil, is placed, preferably, between the shielding winding 8 and the inner winding 4. This sleeve does not extend over the inner periphery of the toroid, the gap 12 between its edges being slightly narrower than that portion of the winding 8 in which the turns are not separated from each other. As diagrammatically shown in Fig. 3, the winding 8 is conductively connected at one end to the sleeve 10 and has its other end brought out at 14 to be used as a terminal for the shield, by which it may be connected to a ground of selected potential, the sleeve 10 and the winding 8 being both conduc-

tively insulated from the windings 4 and 6. An insulating covering 16, such as tape, is applied in a well-known manner to each of the elements of the coil to assist in holding it in place and to aid in preventing short circuits between it and adjacent elements.

The wide gap between the edges of the sleeve 10 insures that the handling of the coil after the sleeve has been placed in position will not result in the bridging of the gap by the distortion of the sleeve or the breaking of the foil from its edges, while along the gap the windings 4 and 6 are electrostatically insulated from each other by the closely wound turns of the shielding winding 8. The insulation of the winding 8, though sufficient to prevent short circuits between adjacent turns, is not thick enough to separate adjacent turns such a distance as to interfere with their electrostatic screening function, it not being essential that an absolutely continuous screen of metal be provided. Along the exterior periphery of the winding 8, where the spaces between the turns are sufficient to appreciably decrease the efficiency of the winding as a shield, the sleeve 10 effectually supplements the shielding action of the metal turns of the winding 8. As will be clear from a consideration of Figs. 1 and 3, winding 8 and sleeve 10 do not form a closed circuit, since the former is of insulated wire and has its two terminals in non-conductive relation, but they constitute two sheaths for the inner winding, which, though each varying circumferentially of the coil as to its shielding efficiency, are so arranged that the less effective shielding portions of one are in registry with the more effective shielding portion of the other, so that the inner and outer windings 4 and 6 are electrostatically separated from each other throughout the length of the coil.

By this arrangement, an electrostatic charge on winding 4 or winding 6, instead of inducing a charge on the other windings 6 or 4, respectively, induces a charge on the shield composed of the winding 8 and sleeve 10, and electrostatic disturbances occurring in one of the working circuits are to a large extent prevented from reaching the other circuit, the effect of the shield being to reduce the electrostatic induction between the windings to so small a per cent. of its value in an unshielded coil as to be negligible.

Shields of this type can be incorporated in repeating and other induction coils at little added cost and without the employment of special skill or apparatus, one important advantage being that, on account of the wide gap in the sleeve 10, the shield does not interfere with the drying and impregnating of the completed coil, as the inner and outer windings may be treated at the same time.

In a straight coil the sleeve 10 is not required, as it is practicable to arrange the shielding winding so that there are no spaces between successive turns thereon. As shown in Fig. 2, one end of the wire forming the shield 8 is brought out and connected to the terminal 18 mounted in one of the end blocks 20.

In the straight coil, as well as in the toroidal coil, for the best results, the winding 8 should be so placed that it does not intermesh with either of the windings 4 or 6. A single layer in the shielding winding is then sufficient to reduce electrostatic induction across the repeating coil to the desired degree, and the coil leakage which would result from increasing the thickness of the shielding winding and therefore the space between the inner and outer windings of the coil, and which would reduce the efficiency of transmission of variations in the talking current, is avoided.

Coils, embodying this invention, are also useful as means for connecting testing and measuring instruments to a telephone line when the passage of a static charge between the line and instruments would interfere with the accuracy of the observations.

What is claimed is:

1. An induction coil having two windings adapted to form parts respectively of two working circuits, and an electrostatic shield between said windings comprising a sleeve of thin metal and a winding of conductive wire.

2. An induction coil having two windings adapted to form parts respectively of two working circuits, and an electrostatic shield between said windings comprising a sleeve of thin metal and a winding of conductive wire conductively connected to said sleeve.

3. An induction coil having an inner and an outer winding adapted to form parts respectively of two working circuits, and an electrostatic shield between said windings comprising a split sleeve of thin metal partially surrounding said inner winding and an intermediate shielding winding between said sleeve and one of said first named windings.

4. An induction coil comprising an inner and an outer winding adapted to form parts respectively of two working circuits, and an electrostatic shield between said windings comprising two sheaths for the inner winding, each sheath forming a complete shield between said windings on one side of said coil and an incomplete shield between said windings on the other side of said coil, said sheaths overlapping so that their incomplete shielding portions lie on opposite sides of said coil respectively.

5. An induction coil comprising an inner and an outer winding adapted to form parts respectively of two working circuits, and an electrostatic shield between said windings

comprising two sheaths for the inner winding, each sheath forming a complete shield between said windings on one side of said coil and an incomplete shield between said windings on the other side of said coil, said sheaths overlapping so that their incomplete shielding portions lie on opposite sides of said coil respectively, said sheaths being conductively connected to each other to form an open circuit insulated from said winding.

6. In a toroidal induction coil, an inner and an outer toroidal winding, said windings arranged to form parts respectively of two working circuits, a thin metal sleeve extending between said windings except along the internal periphery of the toroid, and an open circuit winding of insulated conductive wire between said first named windings, the turns of said open circuit winding being contiguous along the inner periphery of the toroid.

In witness whereof, I hereunto subscribe my name this 13th day of November, A. D. 1917.

EDWARD J. PRATT.