

No. 657,305.

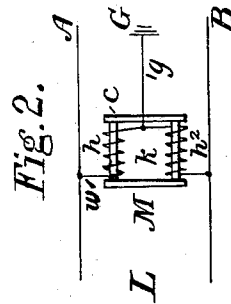
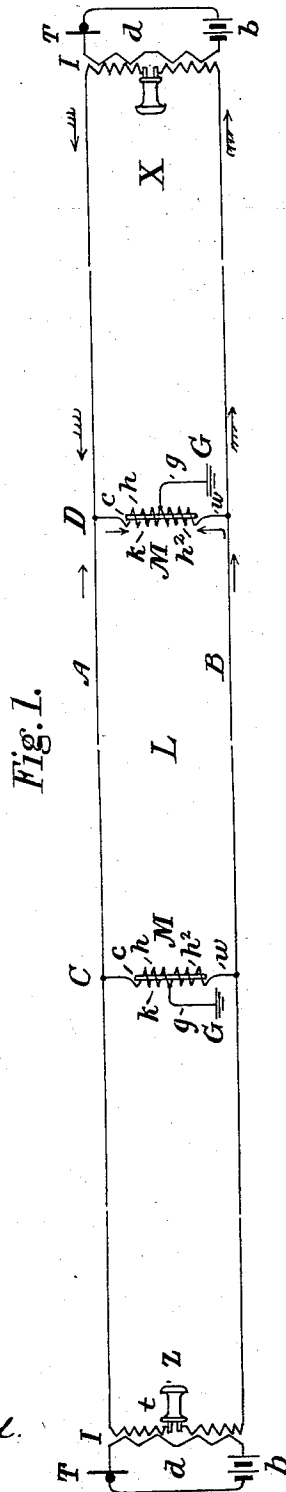
Patented Sept. 4, 1900.

C. H. ARNOLD.

MEANS FOR RELIEVING TELEPHONE LINES FROM DELETERIOUS ELECTRICAL CHARGES.

(Application filed Dec. 22, 1899.)

(No Model.)



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MEANS FOR RELIEVING TELEPHONE-LINES FROM DELETERIOUS ELECTRICAL CHARGES.

SPECIFICATION forming part of Letters Patent No. 657,305, dated September 4, 1900.

Application filed December 22, 1899. Serial No. 741,269. (No model.)

To all whom it may concern:

Be it known that I, CHESTER H. ARNOLD, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Means for Freeing Telephone-Lines from Deleterious Electrical Charges, of which the following is a specification.

This invention relates to metallic-circuit telephone-lines, and especially to such as extend between stations a considerable distance apart, and more particularly concerns the application to such lines of means for freeing them from intrusive and undesired electrical charges.

Telephone-lines are liable to receive high-potential charges in several ways—for instance, from blowing snow or escaping steam, or more frequently, since the widespread introduction of lighting and power circuits, from high-potential mains employed in other electrical installations. Such charges may fluctuate rapidly and widely in amount and yet at any moment may be of the same sign and of substantially the same amount on both conductors of the metallic telephone-circuit, and though they do not in all cases interfere seriously with telephonic communication they are always in the highest degree undesirable, since by reason of their presence users of the telephone and employees are exposed to unpleasant and possibly dangerous shocks, while their discharge, if unprovided for, is likely to be detrimental to apparatus, such as space cut-outs and protective appliances, which are subject to injury from incessant sparking due to these charges and their disruptive escape.

The object of this invention, stated in a general way, is to reduce the potential of the line conductors to approximately that of the earth, and thereby to remedy these and other harmful results incident to the presence of excessive potentials on telephone-circuits, or, in other words, it is to provide a simple means for clearing the line conductors of these intrusive and detrimental charges without at the same time diminishing the volume of the legitimate working current or involving any material escape thereof. In the invention a metallic-circuit or double-wire telephone-line is provided at one or more points be-

tween its end stations with an electromagnetic coil or helix wound on a normally-unmagnetized single or homogeneous iron core preferably of the closed magnetic-circuit type in such a way that if a direct current be passed from one of its ends to the other a magnetizing effect on the said core will be exercised. The said electromagnetic coil is connected in a bridge or cross conductor of the metallic telephone-circuit extending between and uniting the two conductors thereof, and a resistanceless earth conductor is attached to its center, thus providing a dead ground conductor connection at the middle of the coil. The device as a whole when thus connected constitutes a leak from both line conductors at the same point to earth, the discharge of each conductor passing by way of its own half of the electromagnetic winding, while with respect to the said two line conductors considered as the two sides of the telephone-circuit it constitutes merely a bridge containing the whole of the electromagnetic winding, the ground connection from this point of view being functionless. The intrusive charge passing from both conductors simultaneously traverses the two halves of the coil in opposite directions and discharges to earth at the middle thereof, acting to maintain absolute magnetic neutrality in the normally-unmagnetized core; but the voice-currents or other legitimate working currents of the telephone cannot pass from one side of the circuit to the other through the discharging device without traversing the whole of the winding around the core at any given moment in the same direction, thus tending to set up N polarity at one end of the normally-unmagnetized core and S polarity at the other end thereof, and therefore producing maximum impedance to the passage of the voice or working currents. Hence the said device while having a low impedance to the detrimental charges infesting the line has a high impedance as regards the working current, so that while the passage of the said undesired charges from both line conductors is greatly facilitated (the said conductors being practically at all times freed therefrom) there is no material loss of working current.

In the drawings which accompany this specification, Figure 1 is a diagram represent-

ing a metallic-circuit telephone-line extending between two stations and shown as being provided with the discharging device, which combined with the said line constitutes my invention. Fig. 2 represents a portion of such a telephone-circuit and a preferred form of electromagnetic coil associated therewith.

In the drawings, L is the metallic-circuit telephone-line having main conductors A and B and extending between stations X and Z, at each of which are placed the usual telephone-receiver *t* and transmitter T, the latter being included, with its battery *b*, in a local circuit *d*, associated with the main circuit by means of the induction-coil I in a manner well understood.

M is an electromagnetic coil consisting of a helix of insulated wire *k*, wound over a normally-unmagnetized single or homogeneous iron core *c*, preferably formed, as indicated in Fig. 2, with a closed magnetic circuit. In Fig. 2 the helix or core *k* is formed in two sections, together constituting a single coil wound continuously in one direction only on the core. The term "single electromagnetic coil" employed in the claims is to be understood as including such a coil. In Fig. 1 two coils are shown as being applied to the main-line circuit L at points C and D, respectively, and one, two, or more may be so employed; but in most cases a single coil applied as shown is sufficient.

The coil M is connected in the circuit of a bridge or cross wire *w*, extending between and uniting the two main-circuit conductors A and B and must be provided with an earth conductor or ground connection *g*, extending from the center *v* of its winding to earth at G. The working current of the circuit considered at any given moment traverses the two main conductors in opposite directions, as indicated by the feathered arrows, while the charges which are to be dissipated being at any given moment of the same sign in both conductors are indicated by the plain arrows. It is manifest that the working current or any portion thereof passing from the main conductor A to the other, B, or vice versa, by way of the bridge-wires *w* must necessarily traverse the entire coil *k* and that the impedance offered thereby will be high, the tendency being to set up N polarity at one end of the normally-unmagnetized core and S polarity at the other end thereof, and also that the dissipation of the deleterious charge of conductors A and B, respectively, at any bridge *w* will be oppositely directed within the coil-winding *k*, the discharge from *a* passing through the half *h* and that of B through the half *h*² of the winding to the central ground connection, thus acting to maintain absolute magnetic neutrality in the normally-unmagnetized core, the impedance of such a path being low. Good results have been attained with a coil containing as a whole two thousand turns of wire, forming a resistance for each half-coil between the line conductor with

which it connects and the ground of seventeen ohms.

I am aware that heretofore branches extending independently to earth from the two line conductors, respectively, of a metallic circuit and each containing an independent electromagnetic coil having a separate iron core of its own have been employed for the purpose of diminishing the static charge of the line. Such a coil so connected, however, has a high impedance for the dissipation of the deleterious charge, as well as for the working current, and is therefore not adapted for the purposes specified herein. My invention differs from such an arrangement both in structure and operation, since it comprehends a single split coil wound on a single core and provided with a centrally-connected earth branch and serves to clear both sides of the line at once, the discharge currents or impulses passing simultaneously through the two halves of the coil oppositely, the magnetic effect which each would tend to exercise on the common core being thus neutralized by the equal and opposing effect of the other. The impedance of the connection between the two line conductors as a unit and the earth is thus much less than if separate coils were used for each line conductor.

I claim as my invention—

1. The combination with a metallic-circuit telephone-line; of means for freeing the conductors of said line from intrusive and detrimental electrical charges, said means consisting of a bridge between the main conductors of said line containing only a single electromagnetic coil wound continuously in one direction, and a resistanceless ground connection centrally attached to the said coil; and constituting a leak to earth from both conductors at the same point, offering low impedance to the said charges, but high impedance to the working current; substantially as set forth.

2. In combination with a metallic-circuit or double-wire telephone-line; a bridge or cross conductor between the main conductors of said line; a single continuous electromagnetic coil or helix contained in the said bridge, and wound over a single or homogeneous iron core; and a resistanceless conductor extending between the center of said coil to earth; whereby the passage of detrimental charges from both line conductors is facilitated, without involving the escape of the working current, substantially as specified.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 9th day of December, 1899.

CHESTER H. ARNOLD.

Witnesses:

GEO. WILLIS PIERCE,
JOSEPH A. GATELY.