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C. H. GAUNT.  
COMBINED TELEGRAPH AND TELEPHONE SYSTEM.

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NO MODEL.

Fig. 1.

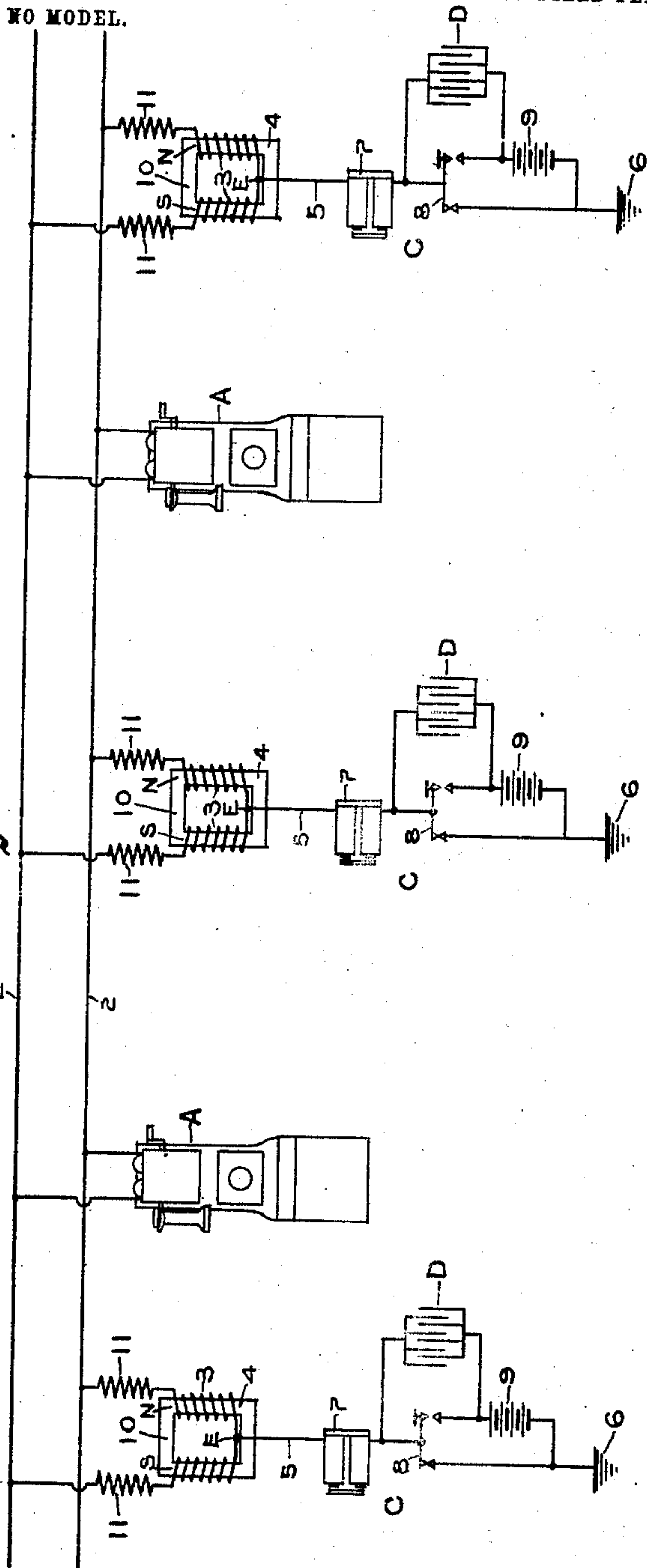
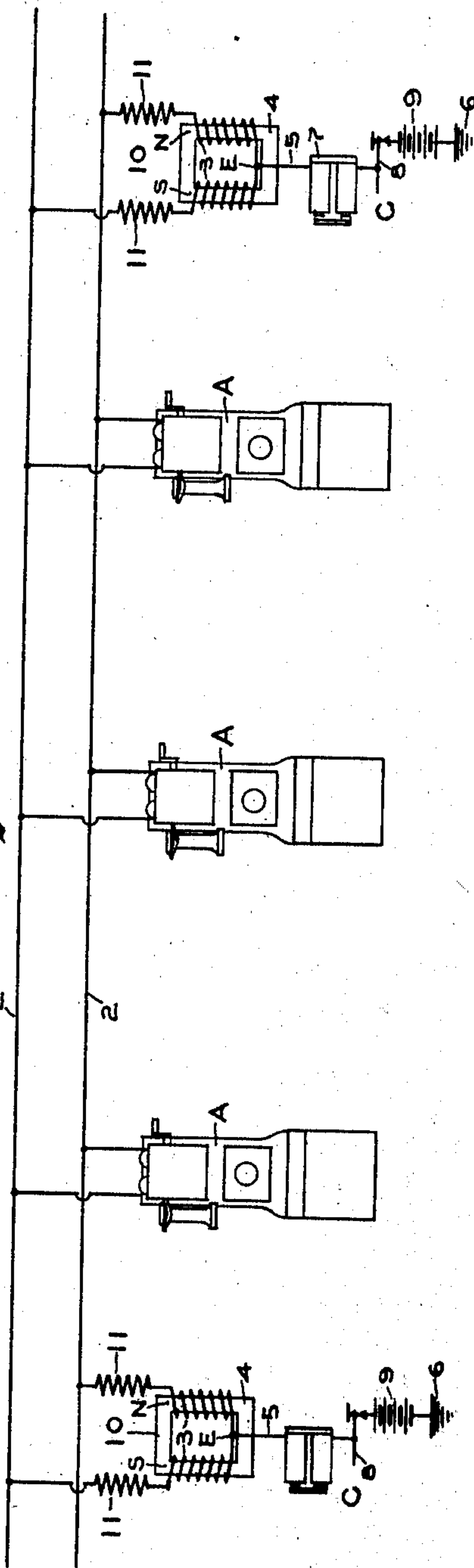


Fig. 2.



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# UNITED STATES PATENT OFFICE.

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## COMBINED TELEGRAPH AND TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 719,458, dated February 3, 1903.

Application filed February 15, 1902. Serial No. 94,315. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES H. GAUNT, a citizen of the United States, residing at St. Paul, in the county of Ramsey and State of Minnesota, have invented certain new and useful Improvements in a Combined Telegraph and Telephone System, of which the following is a specification.

My invention relates to improvements in a combined telegraph and telephone system wherein a metallic circuit is used for the telephone-line, and has for its object to provide a system of that kind wherein telephone and telegraph messages may be transmitted simultaneously without interference one with the other.

My invention consists more specifically in the construction, combination, and arrangement of parts hereinafter described, and particularly pointed out in the claims.

In the accompanying drawings, forming part of this specification, Figure 1 is a diagrammatic view of my invention as applied to an open-circuit telegraph system, and Fig. 2 is a similar view of the invention as applied to a closed-circuit telegraph system.

In the drawings, 2 2 represent the wires comprising a metallic-circuit telephone-line over which both telegraph and telephone messages are to be transmitted. One of the wires constitutes the outgoing and the other the return conductor of the telephone-circuit, while they are at the same time used in parallel as one side of the telegraph-circuit, the other side being the earth. Bridged across these wires at any desired places are telephone apparatus A. Also bridged across the telephone-wires at any point where telegraphic communication is desired is an electromagnetic retardation-coil 3, the two halves or members of which are oppositely wound with an equal number of turns upon the opposite arms of the core 4. From a point E, which is preferably the middle point between the windings of this coil, a branch circuit 5 leads to the ground 6 through the telegraph apparatus C, which comprises a relay or sounder 7 and a key 8, so arranged as to cut the battery 9 into or out of the telegraph-circuit somewhere between the middle point E of the winding of

the retardation-coil 3 and the ground and preferably between the relay and the ground.

By winding the two halves or members of the coil 3 oppositely—that is to say, one half dextrorsally and the other half sinistrorsally—the telegraph-current entering at the point E and traversing the coil members in parallel would, if the yoke 10 of the core were removed, produce opposite magnetic poles at points N and S of the core, so that with the yoke in place a magnetic flux will circulate through the arms and yokes of the core of the retardation-coil, and a change of this flux due to an increase, diminution, or discontinuance of the telegraph-current will act in opposite directions in the oppositely-wound coil members to graduate or modify the suddenness with which the telegraph-currents are impressed upon or withdrawn from the telephone-circuit.

In order that there may be no difference of induced potential between the points S and N of the windings, and consequently no difference of induced potential between the two wires comprising the telephone-circuit, the two halves of the retardation-coil 3 are balanced inductively by being wound each with the same number of turns, whereby the inductive impulses produced in the coil members at the instant of change of magnetism of the core, due to the commencement, increase, diminution, or discontinuance of the telegraph-current, will be made exactly equal upon the telephone-wires.

To balance ohmically the two halves of the divided telegraph-circuit, so that the divided telegraph-currents may enter the telephone-wires with equal degrees of strength, two non-inductive resistance-coils 11, whose difference in resistance is exactly equal to the difference in ohmic resistance of the two parts of the divided retardation-coils, are interposed in the divided telegraph-circuits at some point between the point E and the telephone-wires 2 2, so that the sum of the resistances in each branch of the divided telegraph-current shall be as nearly the same as possible.

It will be observed that while in the telegraph-circuit the oppositely-wound members of the retardation-coil 3 act in parallel, so that



a magnetic flux is produced in the arms and yokes of the core, in the telephone-circuit they act in series, and as they are wound with an equal number of turns of wire no magnetic flux or self-induction will be produced when the telephone-current passes through them. Owing to this absence of impedance in the coil, it will have a tendency to short-circuit the telephone pair. To overcome this, the coils 3 and 11 are both made of high ohmic resistance as compared with that of the telephone apparatus.

From the foregoing description it will be seen that one of the essential features of my invention is that I accomplish the non-interference between the telegraph and telephone currents by the interposition in the telephone-circuit of a merely ohmic resistance and the interposition in the divided telegraph-circuit of a self-inductive resistance—that is to say, by so winding and connecting the members of the retardation-coil that the coil constitutes an ohmic resistance only in the telephone-circuit, but a self-inductive resistance in the divided telegraph-circuit, so that the counter electromotive force of the inductive coil will serve to modify the suddenness with which the telegraph-currents are impressed upon or withdrawn from the telephone-wires, thus reducing to a minimum the clicking in the telephone apparatus and enabling me to dispense with the use of a condenser for that purpose, although, if desired, a condenser may also be interposed in the branch telegraph-circuit, as shown in Fig. 1, where the condenser D is arranged between the relay and the battery in parallel with the key 8.

Another important feature of my invention is the provision of means to balance the difference in ohmic resistance between the two halves of the retardation-coil, so that the divided telegraph-currents may enter the telephone-wires with equal degrees of strength. It is well known that owing to variations in the wire affecting its resistivity and variations in the tightness and regularity of winding there is always in practice a marked difference in ohmic resistance between the windings on the two arms of an induction-coil, even when the number of convolutions on each is the same.

It is assumed in this specification that the main-line conductors used in parallel as one side of the telegraph-circuit are themselves substantially balanced ohmically or have been put into a state of such balance by any suitable means.

Various modifications may be made in the structure, form, and arrangement of the parts shown and described without departing from the principle of my invention, the scope of which is defined in the claims.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a combined telegraph and telephone system, the combination, with a metallic-cir-

cuit telephone-line, of an electromagnetic retardation-coil bridged across the same and comprising two coil members, each wound with the same number of turns, and a branch telegraph-circuit leading from the retardation-coil at a point between the coil members thereof to the ground, said coil members being so wound and connected as to constitute an ohmic resistance merely in the telephone-circuit, but a self-inductive resistance in the telegraph-circuit.

2. In a combined telegraph and telephone system, the combination, with a metallic-circuit telephone-line, of an electromagnetic retardation-coil bridged across the same, the two halves of said coil being oppositely wound with an equal number of turns, a telegraph-circuit leading from the retardation-coil at a point between the opposite windings thereof to the ground, and telegraph apparatus suitably connected with the telegraph-circuit, said retardation-coil constituting a self-inductive resistance in the telegraph-circuit, and an ohmic resistance, only, in the telephone-circuit.

3. In a combined telegraph and telephone system, the combination, with a metallic-circuit telephone-line, and its telephone apparatus, of an electromagnetic retardation-coil bridged across the telephone-circuit, the two halves of said coil being oppositely wound and having each the same number of turns, a grounded telegraph-circuit connected with the retardation-coil at a point between the opposite windings thereof, and an ohmic resistance interposed between such point of connection with the retardation-coil and the wires of the telephone-circuit, said retardation-coil constituting a self-inductive resistance in the telegraph-circuit.

4. In a combined telegraph and telephone system, the combination, with a metallic-circuit telephone-line and its telephone apparatus, of an electromagnetic retardation-coil comprising two oppositely-wound and inductively-balanced coil members, a telegraph-circuit connected with said coil at a point between the oppositely-wound members thereof, and an ohmic resistance interposed between such point of connection and one or both of the wires of the telephone-circuit, said retardation-coil constituting a self-inductive resistance in the telegraph-circuit and an ohmic resistance, only, in the telephone-circuit.

5. In a combined telegraph and telephone system, the combination, with a metallic-circuit telephone-line and its telephone apparatus, of an electromagnetic retardation-coil bridged across the wires of said circuit and comprising two oppositely-wound and inductively-balanced coil members, a telegraph-circuit connected with said coil at a point between the coil members thereof, and means for balancing the ohmic resistances between such point of connection and each of the wires of the telephone-circuit, said retardation-coil



constituting a self-inductive resistance in the telegraph-circuit.

5 6. In a combined telegraph and telephone system, the combination, with a metallic-circuit telephone-line and telephone apparatus carried thereby, of an electromagnetic retardation-coil bridged across the same and having oppositely-wound coil members, a telegraph-circuit leading from said coil at a point  
10 between the oppositely-wound coil members thereof to the ground, telegraph apparatus comprising a relay and a key interposed in said telegraph-circuit, a battery also interposed in said circuit, and a condenser arranged  
15 in parallel with said key between the relay and the battery, said retardation-coil constituting a self-inductive resistance in the telegraph-circuit.

20 7. In a combined telegraph and telephone system, the combination, with a metallic-circuit telephone-line and its telephone apparatus, of an electromagnetic retardation-coil bridged across the wires of said circuit and comprising two oppositely-wound coil members, a branch telegraph-circuit leading from  
25 said coil at a point between the coil members thereof, and means for balancing the ohmic resistances between such point of connection and each of the wires of the telephone-circuit, said retardation-coil constituting a self-inductive resistance in the telegraph-circuit,  
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but an ohmic resistance, only, in the telephone-circuit.

8. In a combined telegraph and telephone system, the combination, with a metallic-circuit telephone-line, of an electromagnetic retardation-coil bridged across the same and comprising two coil members, each wound with the same number of turns, and a branch telegraph-circuit leading from the retardation-coil at the middle point of the windings thereof to the ground, said coil members being so wound and connected as to constitute a self-inductive resistance in the telegraph-circuit.  
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9. In a combined telegraph and telephone system, the combination, with a metallic-circuit telephone-line, of an electromagnetic retardation-coil bridged across the same and comprising two coil members, each wound with the same number of turns, a branch telegraph-circuit leading from the retardation-coil at substantially the middle point between said coil members to the ground, and means to balance ohmically the difference in ohmic resistance between said coil members.  
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In testimony whereof I affix my signature in presence of two witnesses.

CHARLES H. GAUNT.

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