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J. S. STONE.

METHOD OF PROTECTING TELEPHONE CIRCUITS FROM THE ACTION OF ELECTROMAGNETIC WAVES.

APPLICATION FILED JUNE 29, 1904.

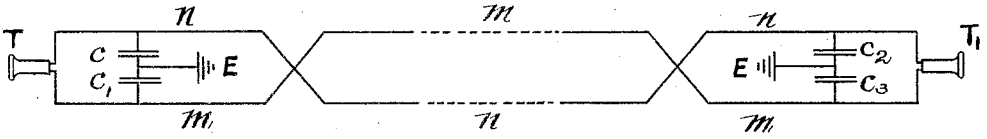


Fig. 1.

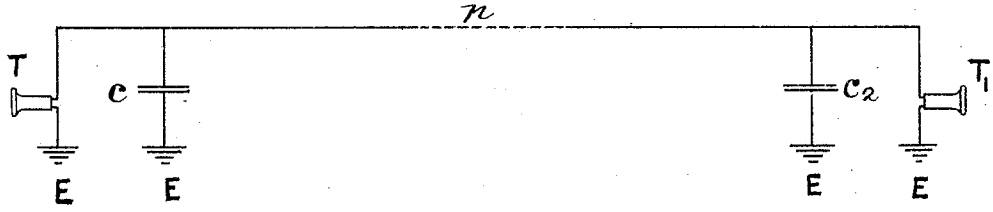


Fig. 2.

WITNESSES.
Braincard T. Judkins
Gladside Higgins.

INVENTOR.
John S. Stone

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UNITED STATES PATENT OFFICE.

JOHN STONE STONE, OF CAMBRIDGE, MASSACHUSETTS.

METHOD OF PROTECTING TELEPHONE-CIRCUITS FROM THE ACTION OF ELECTROMAGNETIC WAVES.

SPECIFICATION forming part of Letters Patent No. 781,625, dated January 31, 1905.

Application filed June 29, 1904. Serial No. 214,590.

To all whom it may concern:

Be it known that I, JOHN STONE STONE, a citizen of the United States, residing at Cambridge, in the county of Middlesex and State of Massachusetts, have invented a certain new and useful Improvement in Methods of Protecting Telephone-Circuits from the Action of Electromagnetic Waves, of which the following is a specification.

My invention relates to the art of telephony, and it relates more particularly to the protection of telephone apparatus and lines from disturbance by electromagnetic waves of the nature of those employed in wireless or space telegraphy and telephony.

Electromagnetic waves employed in wireless or space telegraphy and telephony, ordinarily consist of horizontally polarized electromagnetic waves of a frequency of the order of 10^5 or 10^6. These waves in general, therefore, have no electric component parallel to the earth's surface and no magnetic component normal to the earth's surface, and are of an order 10^2 or 10^3 greater in frequency than those employed in telephony.

Properly constructed subterranean telephone wires can in no wise be affected by the electromagnetic waves of wireless telegraph or telephone systems, which owing to their high frequency, can produce no disturbance at appreciable distances below the surface of the ground.

Properly constructed overhead transposed metallic telephone circuits cannot in general be affected by the electromagnetic waves of wireless telegraph or telephone systems, save in one particular which will hereinafter be more fully described, owing to the fact that these waves being horizontally polarized have no magnetic component normal to the earth and to said circuits, and no electric component parallel to the earth and to said circuits.

If a telephone circuit be a grounded circuit, or if it be an untransposed metallic circuit the wires of which are in a vertical plane, electromagnetic waves of wireless systems may develop high frequency alternating currents in said circuits; but owing to the high frequency of said electromagnetic waves, said high frequency currents will be ineffective in producing audible sounds in a telephone receiver connected with said circuit, the frequency of such currents being above the limits of audibility. Again, if the metallic circuit aforesaid be suitably transposed, the electromagnetic waves of a wireless system will be ineffective to produce high frequency electric currents in said circuit.

Now though in the instance of well constructed and transposed overhead metallic circuit telephone circuits whether the wires of said circuits be as usual included in a horizontal plane, or whether they be, as is sometimes the practice, included in a vertical plane, the electromagnetic waves of wireless systems will be ineffective to produce currents in said circuits; nevertheless said electromagnetic waves will in each instance tend to cause a difference of potential to exist between the two wires of the circuit and the earth, the two wires remaining at substantially the same potential relative to each other. Such an effect would not tend to develop any current in a receiving telephone included in the line, and would therefore not tend to disturb the telephone line in its normal functions. It is customary, however, in telephone practice to include at every terminal of every line what is termed a carbon plate arrester, which electrically connects each wire of the metallic circuit to a carbon plate separated from a ground connection by an excessively small air space of the order of 15-1000 of an inch. As a consequence of the use of these carbon plate arresters, it follows that if the electromagnetic waves be sufficiently powerful the potential to which they may raise the two wires may become sufficient to spark across these narrow air spaces thus momentarily short-circuiting and grounding the telephone circuit. Such momentarily short-circuiting and grounding of the circuit may in case of what is known as the common battery or central current supply telephone system, cause a sound in the telephone receiver.

The object of the present invention is to completely remove the disturbance of the normal function of telephone lines by electromagnetic waves of wireless systems. This I accomplish in the case of a metallic circuit by

providing a shunt circuit of low impedance between the wires of the telephone circuit and also from the wire of the circuit to ground. In the case of grounded telephone circuits, I accomplish the purpose of this invention by shunting the line to ground through a circuit of low impedance.

In using the expression "low impedance," I have reference to a circuit whose impedance is low for currents of the frequency of the electromagnetic waves ordinarily employed in wireless telegraphy, that is to say, of a frequency of the order of 10^5 to 10^6.

In order that the shunt circuits herein referred to may not operate to shunt the telephone currents from wire to wire in case of metallic circuits, and from wire to ground in case of grounded circuits, I construct these shunt circuits so that they shall have relatively large impedance to currents in the frequencies employed in telephony, that is to say, of frequencies of the order of 10^2 to 10^3.

In order that said shunt circuits may not unbalance well-balanced metallic circuits to which they are applied, I construct said shunt circuits in such a way that the impedance of each wire to ground is the same.

The apparatus and mode of its operation may be further explained by having reference to the drawings which accompany and form a part of this specification.

Fig. 1 is a diagrammatic illustration of my invention applied to a metallic circuit telephone line.

Fig. 2 is a diagram illustrating my invention applied to a grounded telephone line.

In these figures,

T T_1 are telephones.

C C_1 C_2 C_3 are condensers.

E is an earth connection.

m and *n* are telephone wires.

If the telephone circuit shown in Fig. 1 is well balanced, then the capacity of the condenser C must equal that of the condenser C_1, and that of the condenser C_2 must equal that of the condenser C_3 in order that the balance of the line may be preserved. If, however, the balance of the metallic circuit shown in Fig. 1 be not perfect, said defect may be remedied by adjusting the capacity of C with respect to C_1 and of C_2 with respect to C_3. Such adjustment will not only carry out the purposes of the present invention, but will operate to improve the telephone circuit in its normal function. Referring still to Fig. 1, it may be sufficient to add that the shunt circuit C C_1 and the shunt circuit C_2 C_3 may be placed either between the carbon plate arrester and the metallic circuit, or between the carbon plate arrester or other protective devices, and the telephone apparatus, but should preferably not be placed between what is known as the sneak current arrester and the telephone instruments proper. The same remarks apply to the shunt circuit C and C_2 of Fig. 2.

Having fully described the apparatus of this invention and its mode of operation, I claim—

The method of protecting telephone circuits against the effects of the electromagnetic waves developed by wireless telegraph and telephone systems which consists in diverting the currents induced in said telephone circuit by said electromagnetic waves to earth through a circuit or circuits of impedance low for said induced currents, but high for currents of the frequencies employed in telephony.

In testimony whereof I have hereunto subscribed my name this 27th day of June, 1904.

JOHN STONE STONE.

Witnesses:

BRAINARD T. JUDKINS,

G. ADELAIDE HIGGINS.