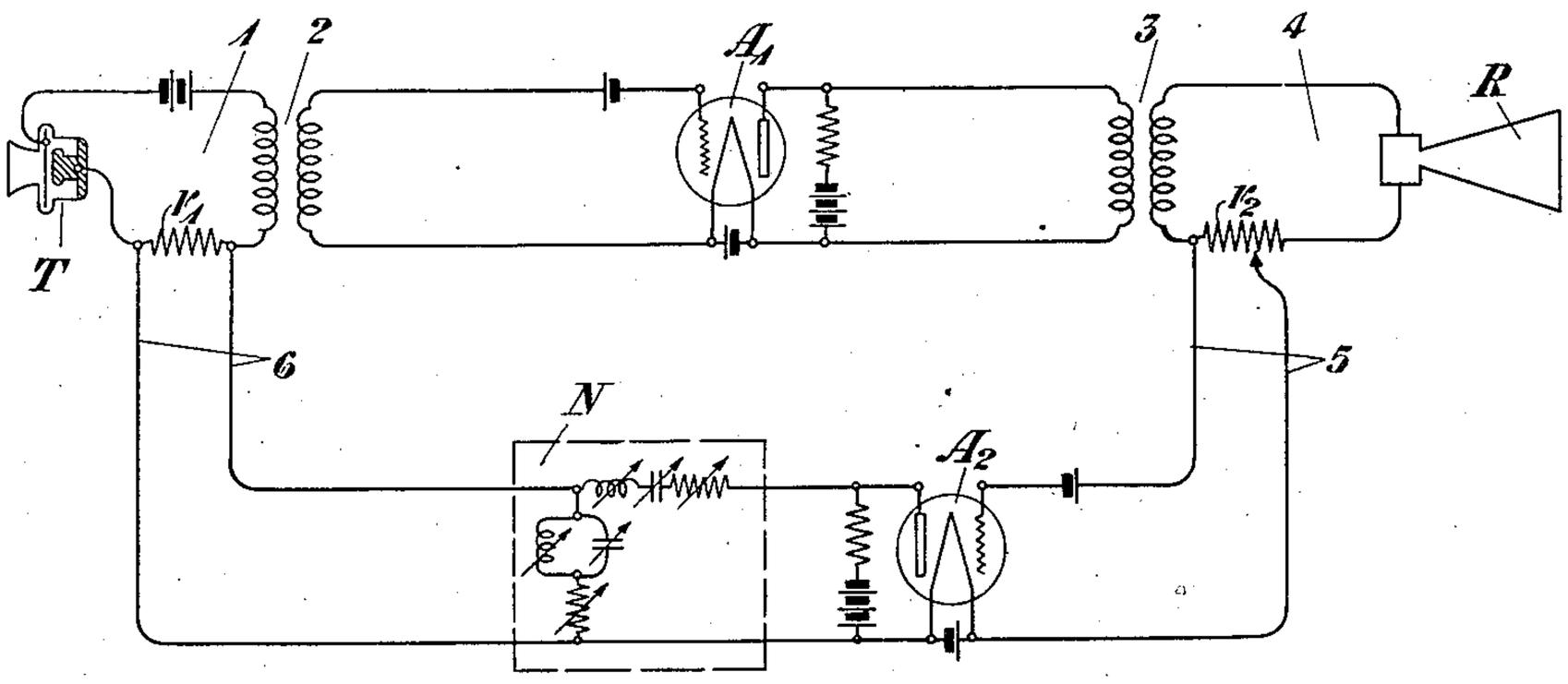
Dec. 16, 1924. 1,519,211

W. H. MARTIN

LOUD SPEAKER CIRCUITS

Filed June 17, 1922



INVENTOR.
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UNITED STATES PATENT OFFICE.

WILLIAM H. MARTIN, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

LOUD-SPEAKER CIRCUITS.

Application filed June 17, 1922. Serial No. 568,947.

To all whom it may concern:

Be it known that I, WILLIAM H. MARTIN, residing at New York, in the county of Bronx and State of New York, have invented certain Improvements in Loud-Speaker Circuits, of which the following is a specification.

This invention relates to improvements in telephone circuits and particularly to the types of circuits suitable for use with loud speaker apparatus.

The field of use for the loud speaking telephone is found to extend, among other things, to announcing systems, phonograph reproduction, intercommunication, and the giving of public address or other performance. It often happens that in circuits designed for the above purposes, and particularly for the purposes of public address or announcing, that the loud speaking receiver will be located in relatively close proximity to the transmitter and as a result an acoustic coupling may exist between the receiver and transmitter, which may impress sufficient energy upon the transmitter to cause "singing" to take place in the circuit. In general it is the object of this invention to prevent such "singing" in loud speaker circuits by providing an additional electric coupling between receiver and transmitter which is adjusted to neutralize the effect of any acoustic coupling which may exist between them. Other features of the invention will appear more fully from the detailed description hereinafter given.

The invention may be more fully understood from the following description together with the accompanying drawing in the figure of which is illustrated a circuit diagram of a loud speaker system embodying the invention.

In the drawing is shown a transmitter T. The condenser type of transmitter, or any other desired type, may be used. The transmitter T is included in a transmitter circuit 1 which includes a battery, a winding of transformer 1, and a series resistance r_1. The other winding of transformer 2 is connected to an amplifier circuit, which includes the vacuum tube amplifier A_1. The output of the amplifier is connected through a transformer 3 to a receiver circuit 4, which includes the series resistance r_2 and the loud speaking receiver R which is illustrated schematically as it is of a well known type. If, as often may be the case, the receiver R is sufficiently close to the transmitter T, it may cause the voice waves to be impressed through the air upon the transmitter T and thus cause "singing" to take place in the circuit. In other words the acoustic coupling between the receiver and transmitter may be sufficiently great so that, when operating through the amplification in the electrical circuit between the transmitter and the receiver, a flow of energy is sustained around the circuit and "singing" results. In order to neutralize the effect of this acoustic coupling an electrical coupling is provided in accordance with this invention between the receiver circuit 4 and the transmitter circuit 1. This electrical coupling consists of a circuit 5 connected to the terminals of the series resistance r_2. Circuit 5 is connected to the input of a vacuum tube amplifier A_2. The output of amplifier A_2 is connected to a distortion network N. The distortion network N is connected to circuit 6 which is bridged across the terminals of resistance r_1 in the transmitter circuit 1. The distortion network N comprises a series and shunt combination of resistance, inductance and capacity, the elements of which may be varied. With this arrangement the original energy from the transmitter will be transmitted through the amplifier A_1 to the receiver circuit 4 and will actuate the loud speaker R. A portion of the sound from the loud speaker R may affect the transmitter T and tend to cause a circulation of energy, or "singing". However, at the same time a portion of the energy from the receiver circuit will be transmitted over circuit 5, through amplifier A_2 and distortion network N, and over circuit 6 to the transmitter circuit 1. This energy can be made to neutralize the effect of the energy transmitted acoustically and will prevent "singing" from taking place. The amplifier A_2 and distortion network N obviously must be adjusted differently to meet different acoustic conditions. The distortion network N needs to be adjusted for both variation of efficiency with frequency and phase relation with frequency.

While the arrangements of the invention have been disclosed as embodied in certain specific arrangements which are deemed desirable, they are capable of embodiment in

many other types of circuit arrangements without departing from the spirit of the invention as defined by the appended claims.

What is claimed is:

1. A circuit including a transmitter and a receiver so arranged that an acoustic coupling exists between said receiver and transmitter, and an electric coupling associated with said circuit adapted to neutralize the effect of said coupling, said electric coupling comprising an amplifier and a distortion network and means for adjusting the same.

2. A loud speaker system comprising a transmitter circuit and a receiver circuit, an amplifier circuit interconnecting said circuits, a series resistance in said receiver circuit, a series resistance in said transmitter circuit, an input circuit associated by a variable connection with first said mentioned resistance, an amplifier in said input circuit, a variable distortion network associated with the output of said amplifier, and a circuit connecting said distortion network to said second mentioned resistance.

3. A circuit including a transmitter and a receiver so arranged that an acoustic coupling exists between said receiver and transmitter, an electric coupling associated with said circuit between said receiver and transmitter, said electric coupling including amplifying arrangements, and means for adjusting said amplifying arrangements so that they will impress on said transmitter circuit energy to neutralize the effect thereon of said acoustic coupling.

In testimony whereof, I have signed my name to this specification this 16th day of June, 1922.

WILLIAM H. MARTIN.