(No Model.)

J. S. STONE.

TELEPHONIC TRANSMISSION.

No. 509,965. Patented Dec. 5, 1893.

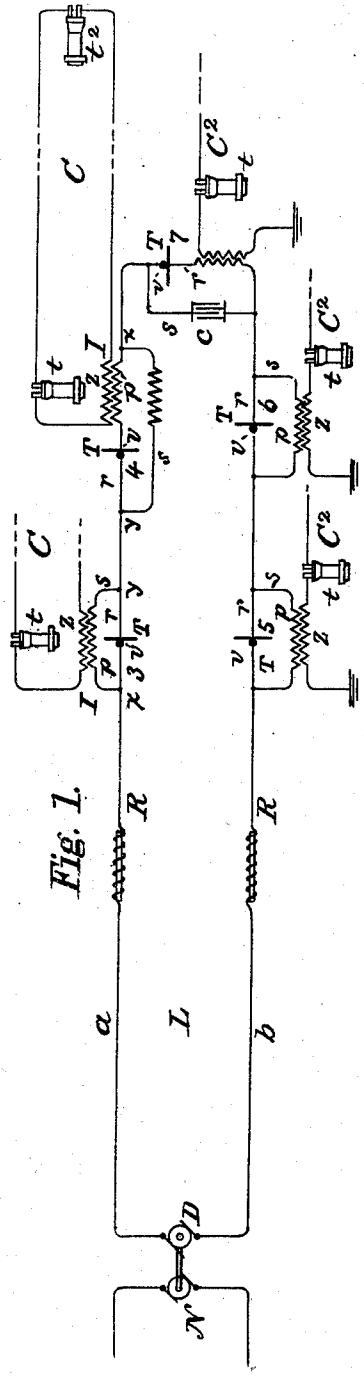

Fig. 1.

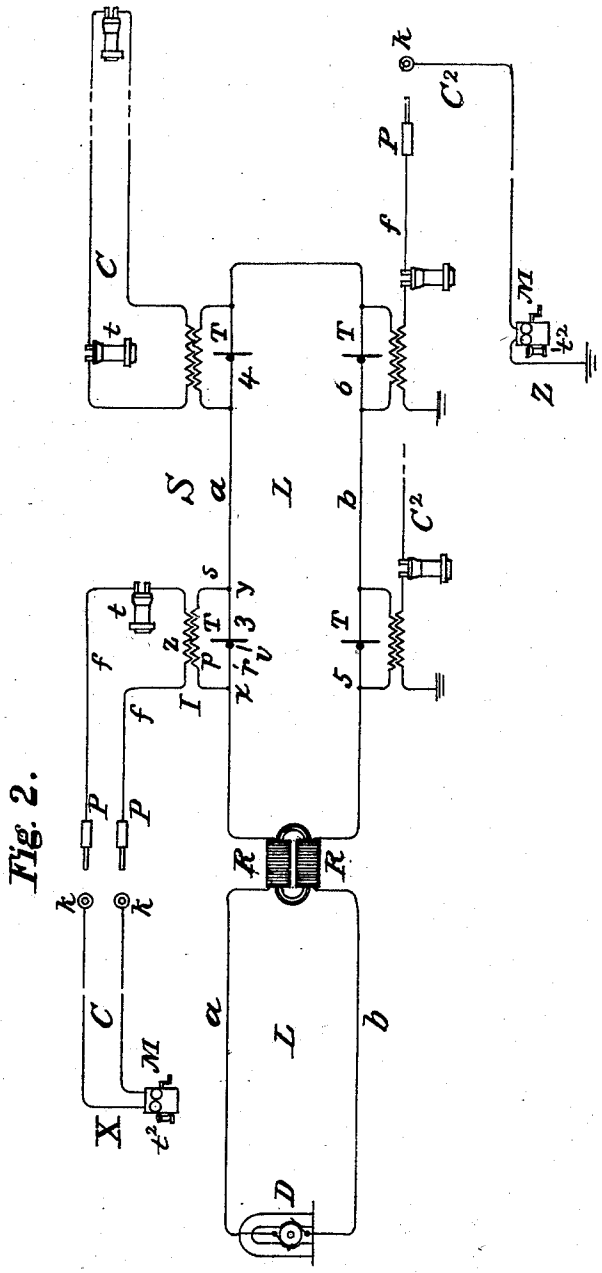

Fig. 2.

Attest.
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TELEPHONIC TRANSMISSION.

SPECIFICATION forming part of Letters Patent No. 509,965, dated December 5, 1893.

Application filed May 22, 1893. Serial No. 475,111. (No model.)

To all whom it may concern:

Be it known that I, JOHN S. STONE, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Telephonic Transmission, of which the following is a specification.

In the operation of variable resistance telephonic transmitters, it has, until recently, been an almost uniform practice to provide for each instrument an independent local battery, placed adjacent to the instrument, and included electrically in a local circuit which contained also the electrodes or variable resistance of the transmitter, and the primary helix of an induction coil, whose secondary helix was connected with the main circuit. Methods have, however, been devised, which have demonstrated the possibility and practicability of employing a centralized source of current supply, which, with or without the intermediation of induction coils, is capable of being used in common by a considerable number of transmitters, without detriment to their independence of operation. These systems depend upon the principle, that when the resistance of the source of current is small compared to that of each of a number of branch circuits connected in parallel, the currents in the various branches are proportionately independent of each other.

It has also been proposed by me, to employ some form of magneto or dynamo generator as a source of current and to employ self-induction or electro-magnetic resistances instead of simple resistances, in the branch circuits, for the purpose of preventing mutual interference between the transmitter circuits, and also any disturbance attributable to the current generator itself.

In the system which it is the object of this specification to describe, excellent results have been obtained, when the common centralized source of current and a current steadying or regulating device having great electro-magnetic inertia are connected in series with several variable resistance transmitters of relatively low resistance, the primary helices of the associated transmitter induction coils being connected in local circuits of small impedence to vibratory currents, formed by bridging the transmitters by the primary circuits of their respective coils, or by bridging the transmitters and primary circuits of their respective coils by condensers, there being in each case one branch circuit for each transmitter. The current remains constant in such a circuit, as a whole, and the variations produced by each individual transmitter only affect the current flowing in such portion of the circuit as is bounded by the two junction points of the two parallel branches of the supply circuit within which the variable resistance and primary helix of said transmitter are included. Since the resistance of one branch is stable, and the resistance of the other is variable, it follows, that when in the operation of the transmitter by vocal or other sounds produced in its vicinity, the latter branch is varied, a greater or less amount of the total current is shunted through the former branch; and that the rise and fall of current in the primary helix of the induction coil so produced, develops corresponding induced currents in the secondary helix of the said induction coil, which passing over the direct or conversation circuit, act upon the receiving telephone included therein, causing it to reproduce the original sounds.

In the drawings which accompany and form a part of this specification: Figure 1 is a conventional diagram of an arrangement of appliances and circuits representing the invention, and Fig. 2 represents a slight modification and extension of Fig. 1—illustrative of the application of the invention to central station transmitter work.

A suitable dynamo machine D which may be a motor generator receiving power from an independent lighting or power circuit N, as in Fig. 1, or any ordinary dynamo driven by any convenient independent power, as in Fig. 2, generates a constant current, which flows in the supply circuit L, to a number of telephone transmitters T, located in series on such circuits at different points 3, 4, 5, 6 and 7; each of these transmitters being adapted by their operation to generate voice currents in independent, or conversation circuits C and C^2; those marked C, being shown as double wire or metallic circuits, and those indicated by C^2, as single wire or earth com-

pleted circuits. Excellent results have been obtained with a shunt wound dynamo capable of developing twelve volts, and having thirty-six commutator bars, when the machine was running at a speed of twelve hundred revolutions per minute.

In each of the conductors *a* and *b* of the supply circuit L, at points between the generator and the nearest transmitter locations, are connected current regulating devices consisting of retardation or self-induction coils or electro-magnetic resistances R. In Fig. 1, these are conventionally indicated as being helices wound upon bar cores. These may be placed in either or both of said conductors, but the most advantageous arrangement is to have one coil in each conductor, and it is convenient and useful to construct the two coils as shown in Fig. 2, in the form of a single appliance, having a single iron core constituting a closed magnetic circuit.

The retardation coils may be made in any well known way, and I have attained good results with a pair of coils whose resistance measured in series amounted to sixty seven ohms; while the impedence required, need only be sufficiently high to prevent disturbance due to irregularities in the delivery of the dynamo or from other transmitters. Both properties, however, may be varied within wide limits, without materially affecting the operation of the system.

At each transmitting apparatus on the circuit, the supply circuit conductor is split between the point *x* and *y* into two parallel branches *s* and *r*, the variable resistance or electrodes *v*, of the transmitter T, being contained in the branch *r*, while a resistance coil, inductive or non-inductive, or a condenser of electricity is contained in the branch *s*. In Fig. 1 at the points 3, 5, and 6, the primary helix *p* of the associated transmitter induction coil I, is contained in said branch *s*, which in these cases may be regarded as an electro-magnetic shunt around the variable resistance.

At 4, the primary helix *p* of the induction coil is contained together with the variable resistance, in the branch *r;* and both are shunted by the branch *s*, which, in this case includes a simple or non-inductive resistance; and at 7, the variable resistance and primary helix are also serially arranged in the branch *r*, and are shunted by the branch *s*, which in this instance, includes the condenser *c*. The induction coils employed may be of standard mechanical dimensions, and coils of one-half inch in diameter and three and one half inches in length have been used with advantage.

When the primary induction coil helix *p* is used to shunt the variable resistance as at points 3, 5 and 6, it is wound with a greater number of convolutions, and to a higher resistance than when arranged in series therewith as at points 4 and 7. In the former case, an induction coil has been satisfactorily employed in which the ratio of the number of convolutions of the primary to those of the secondary is that of two to three; while the primary resistance has been as high as fifty ohms. In the latter case the primary resistance may be from five to ten ohms, the size of wire employed in all cases being in conformity with the well established principles of construction; they are so made however, as to have a high impedence to voice currents, and in that respect may offer an apparent resistance of about five hundred ohms. For the transmitter apparatus at the point 7 in which the condenser shunts the transmitter, a condenser having a capacity of six microfarads answers well. The induction coil I in each case has its secondary helix *z* included, or adapted to be included, as usual in the main, direct, or conversation circuit; in which, as shown, is included one or more telephone receivers *t* and t^2. That is to say, a telephone, if desired, may be included therein at the home as well as at the distant station. This arrangement is well adapted for use as a system of current supply for operators' transmitters in the central station of exchanges, and such an adaptation is indicated in Fig. 2.

At all the transmitters of Fig. 2, the variable resistance of the transmitter is shunted by the induction coil primary. Two of these transmitters, 3 and 6, are shown as being operated in association with switchboard apparatus and connecting cords. The direct circuit C, so fitted, is a double wire circuit and extends from a sub-station X where it is provided with a regular call apparatus and telephone to the central station S, where it terminates in plug sockets *k*. The operator's transmitting apparatus has its induction coil secondary *z* in the circuit of flexible connecting cords *f*, which terminate in plugs P, adapted for insertion in the sockets *k*. The plugs may be of course inserted in the sockets of any conversation circuit. The arrangement of circuit C^2 leading to station Z is closely similar, differing only in that the said circuit is shown as being one of the earth return class.

Transmitters can be connected serially, as shown and described herein, in the circuit of a suitable dynamo generator, and receive current therefrom without any interference such as cross-talk, and without disturbance arising from inequalities in the dynamo currents. It must however be understood that the transmitter supply circuit, L, is not in its operation in any sense restricted to supply current to central station transmitters, and that, if desired, it may connect with any number of substations to supply in like manner, the transmitters of such stations also.

I make no claim herein for a transmitting apparatus which has its variable resistance, and the primary helix of its associated induction coil serially connected and together shunted by a condenser; the secondary helix

of the said coil being connected in a main telephone circuit; or to the combination of such an apparatus with a supply circuit including a generator and electro-magnetic current regulating devices; these organizations being claimed in a separate application for Letters Patent, filed contemporaneously herewith.

Having now fully described my invention, I claim—

1. The combination in a telephone transmitting apparatus of a variable resistance telephone transmitter, and an induction coil therefor; a current supply circuit divided into two parallel branches containing respectively the said transmitter and the primary helix of the said induction coil the branch including said primary being conductively continuous; and a direct or conversation circuit extending to a receiving telephone, and including the secondary helix of the said induction coil.

2. The combination of a plurality of variable resistance telephone transmitters in series with each other, each provided with an associated induction coil; a current supply circuit extending from a suitable source of electrical energy to the said transmitters and divided at each into two parallel branches, containing respectively the variable resistance of the transmitter, and the primary helix of its associated induction coil; and a direct or conversation circuit for each of the said transmitters connected with or adapted to be connected with the secondary helix of the said induction coil and extending to a receiving telephone whereby a suitably located common source of electricity may be common to a number of transmitters without any interference with their independence of operation, substantially as described.

3. The combination with a current supply circuit containing a suitable source of current; and a current regulating device substantially as described; of a plurality of variable resistance transmitters in series with each other, with said current regulating device and with said source of current; and of a series of branch circuits, each bridging one of said transmitters; thereby forming local circuits, substantially as hereinbefore shown, in which are included the primary helices of induction coils, the secondary circuits of which are, or are adapted to be connected with, or operated in, main circuits extending to receiving telephones whereby a suitably located common source of current may be common to a number of transmitters without any interference with their independence of operation, substantially as described.

4. The combination substantially as hereinbefore described, of a magneto or dynamo machine constituting a source of transmitter currents; a current supply circuit extending therefrom and excited thereby; a number of variable resistance telephone transmitters having associated induction coils connected in series in the said supply circuit; a shunt or branch circuit including the primary helix of its associated induction coil connected round each transmitter; self induction coils included in the supply circuit mains between the said dynamo machine and the transmitter nearest thereto; and a series of direct telephone or conversation circuits extending to receiving telephones, and including the secondary helices of the said transmitters respectively, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 2d day of May, 1893.

JOHN S. STONE.

Witnesses:
GEO. WILLIS PIERCE,
FRANK C. LOCKWOOD.