(No Model.)

J. S. STONE.

TELEPHONE TRANSMITTER CIRCUIT AND APPARATUS.

No. 507,694. Patented Oct. 31, 1893.

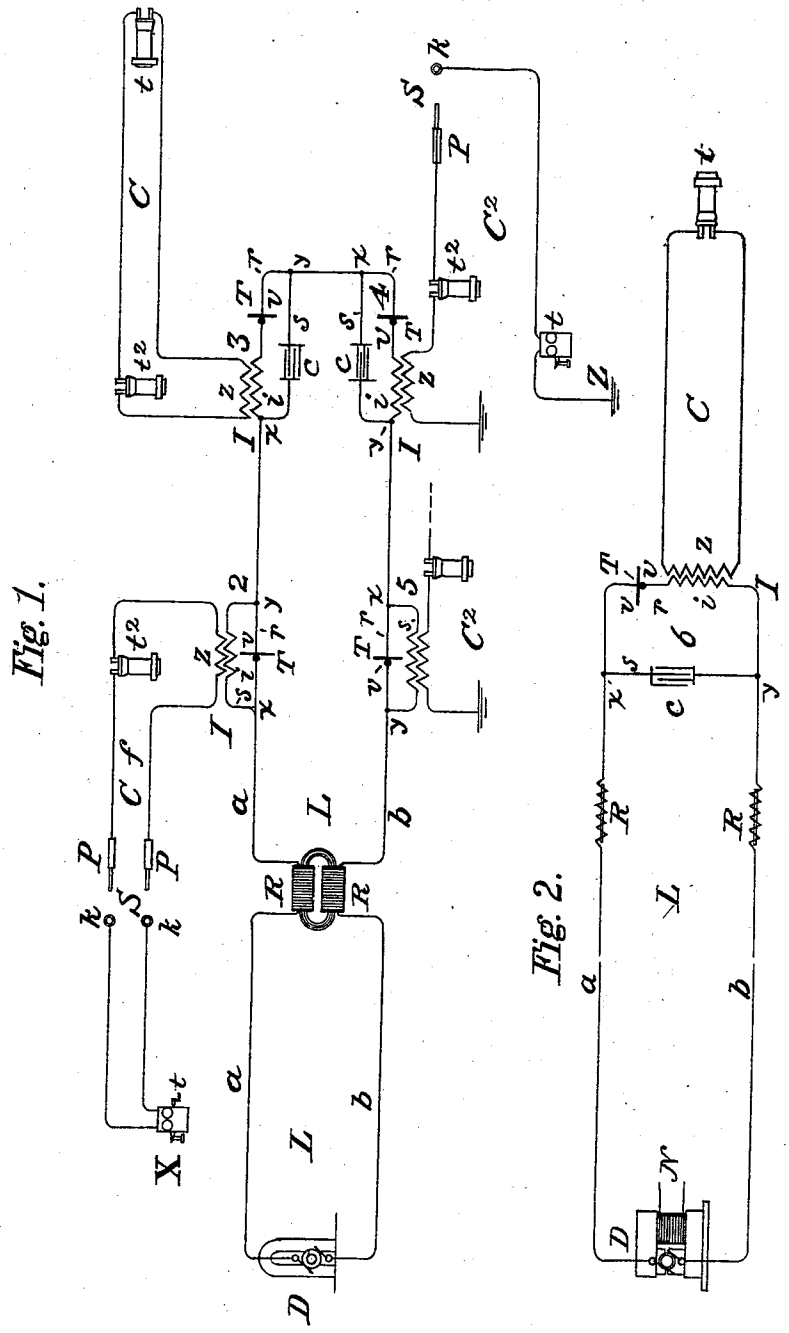

Fig. 1.

Fig. 2.

Attest.

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TELEPHONE-TRANSMITTER CIRCUIT AND APPARATUS.

SPECIFICATION forming part of Letters Patent No. 507,694, dated October 31, 1893.

Application filed May 22, 1893. Serial No. 475,112. (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 Telephone-Transmitter Circuits and Apparatus, 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; and these systems mainly 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, and to use 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 described in this specification excellent results are obtained when the common centralized source of current and a current steadying or regulating appliance having great electro-magnetic inertia are connected in series with several variable resistance transmitters of relatively low resistance; the said variable resistances in series with the primary helices of their associated induction coils, being each shunted or bridged by a condenser; or when the said primary helices are arranged to shunt or bridge their several transmitters, and thus in either case to form electro-static or conductive local circuits of small impedence to vibratory currents, there being in each case one such branch or local circuit for each transmitter.

The arrangement of the former case, constitutes the characteristic feature of the present invention, and it will be seen not only that by it the supply circuit is split at each transmitter into two parallel branches, one of which contains the transmitter itself and the primary helix of its associated coil, and the other a condenser, but that an organization is thereby constituted at each transmitting apparatus which comprehends three branch circuits meeting at two points, and including respectively the generator and the regulating appliance; the transmitter and its induction coil primary; and the condenser; while in both cases the main telephone or conversation circuit is joined up with the secondary helix of the induction coil. 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 the said transmitter and the condenser are included, and the rise and fall of current in the primary helix brought about by the operation of the transmitter, and governed by the consequent rise and fall of the condenser charge, 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 illustrate this specification, Figure 1 is a conventional diagram of an organization of circuits and appliances comprehending the invention, and Fig. 2 is a detail diagram representing the special characteristic feature of the invention specified herein.

A suitable dynamo machine D which may be a motor generator receiving power from an independent power circuit N, or an ordinary dynamo or magneto machine driven by

any convenient power, is placed in a supply circuit L in which are connected in series at a number of different stations 2, 3, 4, 5, a number of transmitters T. The said dynamo generates in the supply circuit L and electrical current which traverses the transmitters, and each of the said transmitters is adapted when operated, to vary a localized portion of such current, and thereby to generate voice currents in direct or main telephone circuits C and C^2 connecting with distant telephone stations; those marked C, being shown as double conductor or metallic, and those indicated by C^2, as single wire or earth completed circuits. A shunt wound dynamo having thirty six commutator bars and capable of developing twelve volts, when the machine was run at a speed of twelve hundred revolutions per minute, has been used for this purpose and has given excellent results. In each of the conductors *a 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. 2 these are indicated as being helices of insulated wire, wound round iron bar shaped cores. They may be placed in either or both of the said conductors, but the most advantageous arrangement is to have one coil in each conductor; and it is convenient and useful to construct the induction coils as shown in Fig. 1, 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 points *x* and *y* into two parallel branches *s* and *r*, the variable resistance or operative electrodes *v* of the transmitter T, being contained in the branch *r*, while a condenser of electricity or a resistance coil, inductive or non-conductive is contained in the branch *s*.

In Fig. 2 which illustrates the connection of a single station with the supply circuit, and at the stations or locations 3 and 4 of Fig. 1,—the variable resistance T, and the primary helix *i* of its associated induction coil I, are both serially arranged in the branch *r* and are paralleled by the branch *s* and the condenser *c* included therein, constituting an electrostatic shunt round the said transmitter and primary.

At stations 2 and 5, Fig. 1, the primary helix *i* of the associated transmitter induction coil I is contained in the said branch *s*, and an electro-magnetic shunt circuit in this case is formed round the variable resistance.

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 *i* is arranged in series with the variable resistance or transmitter proper T, as at stations 3, 4 and 6, it is preferably wound with a lesser number of convolutions and to a lower resistance than when used to shunt the said transmitter as at points 2 and 5. In the latter 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. But in the former 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. The condensers *c* of the branch *s* at stations 3, 4, and 6 may satisfactorily have a capacity of six microfarads. 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 also included in one or more telephone receivers *t*, t^2. That is to say a telephone, if desired, may be included therein, at the home as well as at the distant station.

The arrangements described are well adapted for use as a system of current supply for operators' transmitters in the central stations of exchanges; and such an adaptation is indicated in Fig. 1.

Two of the transmitters on the supply circuit, viz: 2 and 4, 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 substation 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 conducting cords *f*, which terminate in plugs P adapted for insertion in the sockets *k*. The plugs can of course be 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. It must however be understood that the transmitter supply circuit L is not in its operation restricted to supply current to central station transmitters, and that, if desired, it may connect with any number of substations in like

manner, to supply the transmitters of such stations also.

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 current.

I make no claim herein for a transmitting apparatus which has its variable resistance or electrodes shunted by the primary helix of its own associated induction coil, the secondary helix of 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; but

What I do claim as my invention is—

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

2. The combination in a telephone system, of three branch circuits converging at two points, one containing a source of current, and an electromagnetic regulating or steadying device; and the other two containing respectively, a condenser, and a variable resistance transmitter in series with the primary helix of its associated induction coil; with a direct or conversation circuit including the secondary helix of said induction coil substantially as specified.

3. The combination, substantially as hereinbefore described, of a variable resistance transmitter; a current supply circuit therefor including in series the said transmitter and the primary helix of its associated induction coil; and an electro-static shunt circuit around the said transmitter and primary helix; with a direct or conversation circuit including the secondary helix of said induction coil, and a speaking telephone.

4. The combination of a common current supply circuit including a generator, and an electro-magnetic current regulating device; a series of direct telephone or conversation circuits, extending to receiving telephones; a number of variable resistance transmitters, each having an associated induction coil, the said transmitters and the primary helices of their respective induction coils being serially connected in the common supply circuit, and the secondary helices of the said coils being included in the said telephone circuits respectively; and a condenser for each transmitter shunting the said transmitter, and its associated primary helix; substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 15th day of May, 1893.

JOHN S. STONE.

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