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S. F. NELSON

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OPERATOR'S TELEPHONE CIRCUIT

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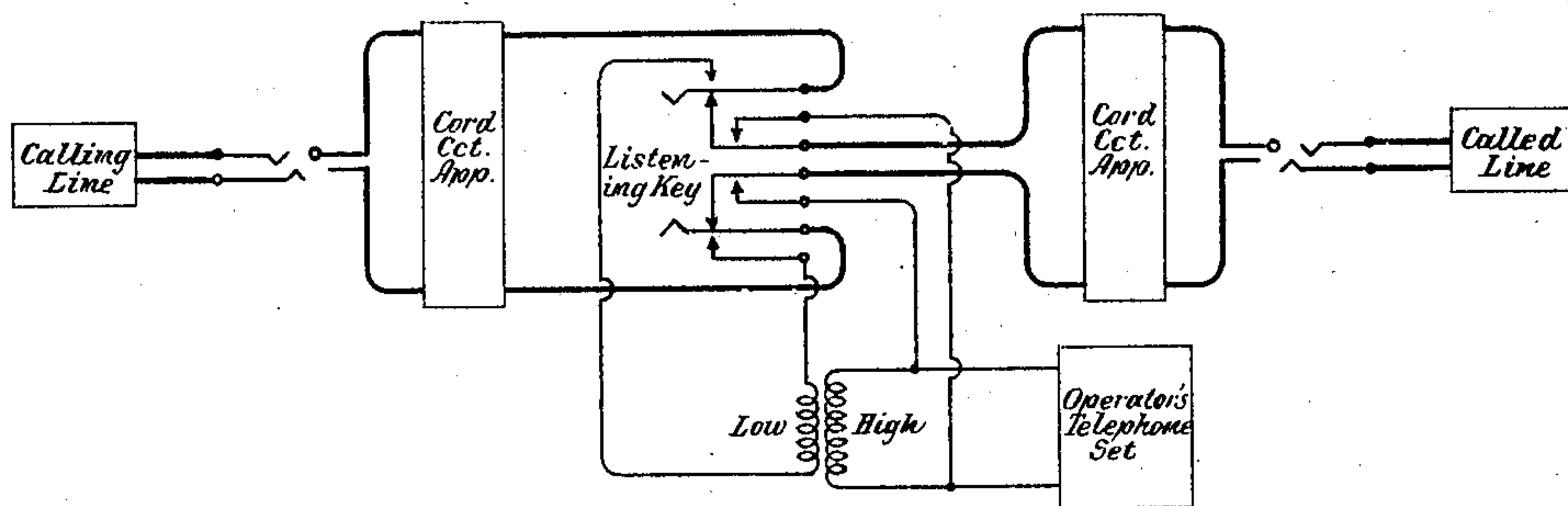


Fig. 1

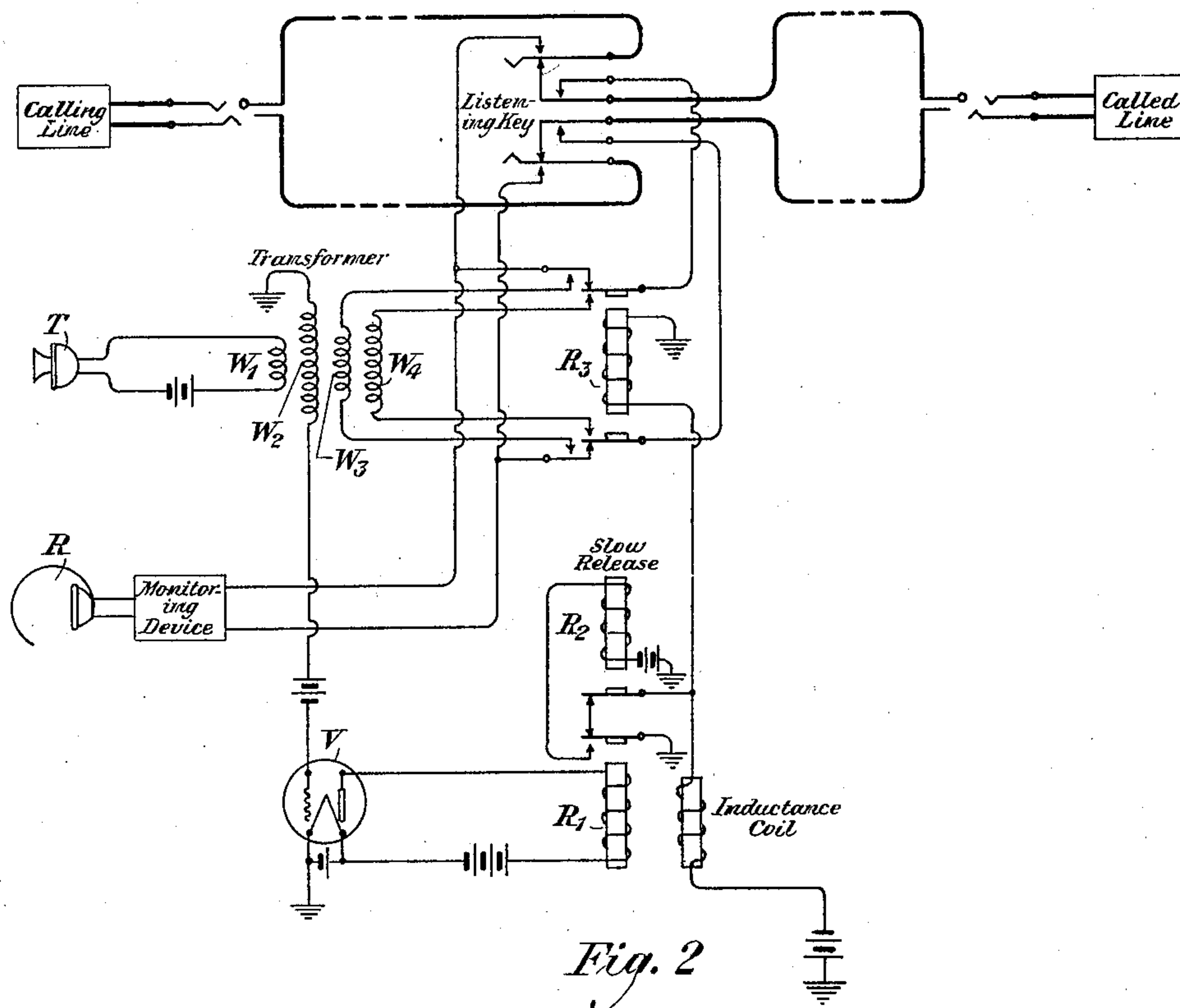


Fig. 2

INVENTOR.
S. F. Nelson
BY *gr 402*
ATTORNEY

UNITED STATES PATENT OFFICE.

STANLEY F. NELSON, OF BROOKLYN, NEW YORK, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

OPERATOR'S TELEPHONE CIRCUIT.

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This invention relates to telephone systems, and more particularly to operators' telephone circuits.

In telephone systems in which two subscribers' lines are linked together through an intermediate circuit across which there is bridged an operator's telephone set, it is important, particularly in cases of long distance transmission, that there be provided transmission of a high grade for the operator. In one or more of the modern methods of toll line transmission a toll operator talks forward while the calling subscriber is connected to the line. With the arrangements employed at the present time, the transmission from the operator to the distant operator and to the called subscriber is impaired by the shunting effect of the calling subscriber's line. Furthermore, while the operator is lining up the subscribers so that they may talk to each other, the transmission between the subscribers is impaired by the shunt of the operator's telephone set. With the present type of operators' circuit, half of the output energy of the operator's transmitter is absorbed in a balancing network; of the remaining half of the energy which reaches the transmission line, approximately one-half goes to the calling subscriber and one-half towards the distant operator and the called subscriber. Thus, it is seen that only about one-quarter of the energy from the operator's transmitter is projected towards the distant point, a serious transmission loss being involved.

The principal object of this invention is an improved distribution in systems such as that discussed above of the output energy from the operator's transmitter.

A further object of the invention is an improvement of the transmission between the operator and the called line without an accompanying impairment of the transmission over the calling line.

In accomplishing the first object stated above, the applicant introduces into the operator's telephone circuit an inequality transformer, arranged as will be more fully described below.

In accomplishing the second object stated above, the applicant introduces an additional feature into the operator's circuit whereby the operator's transmitting circuit is connected to the line only while the operator is

talking, as will be more fully disclosed below.

The invention will be better understood when the following detailed description is read with reference to the accompanying drawing.

Figure 1 of the drawing shows diagrammatically, and in part schematically, the applicant's arrangement whereby a large portion of the operator's transmitter energy goes to the toll line and the called subscriber while only a small portion of the energy goes to the calling subscriber.

Fig. 2 of the drawing shows diagrammatically a modified arrangement whereby the operator's transmitting circuit is connected to the line only while the operator is talking.

With reference, first, to the details of Fig. 1 of the drawing, a calling line at the left may be connected to a called line at the right through an intermediate circuit including a so-called listening key. This listening key is designed to connect across the transmission line the operator's telephone apparatus, which may take the form of any suitable operator's telephone set. The applicant provides an inequality transformer, as shown, having its low winding adapted to be connected to the calling line when the listening key is operated, and its high winding, which is directly in circuit with the operator's telephone set, connected to the called line. With this arrangement, when the operator operates the listening key and talks, a large portion of the energy from her transmitter will go to the called line, where it is needed, and only a small portion of this energy will go to the calling line, this low energy being sufficient since the line loss between the operator and the calling subscriber is, of course, quite small. The distribution of energy is, of course, determined by the impedance ratio of the transformer windings, and accordingly, may be adjusted as is desired.

With the arrangement shown in Fig. 1 and described above, the transmission between the operator and the called line is materially improved; the calling line transmission, however, as will be readily understood, is somewhat impaired. If it is desired to overcome the disadvantage of low transmission efficiency for the calling line, the ar-

arrangement shown in Fig. 2 of the drawing may be employed. The principal feature which is added in this arrangement of Fig. 2 consists of a voice operated switching device which connects the operator's transmitting circuit to the transmission line only while the operator is talking, the transmitting circuit being disconnected from the transmission line at all other times.

Fig. 2, like Fig. 1, shows a calling line, a called line, an intermediate circuit designed to be connected to the calling line and the called line to link them together, and a listening key associated with the intermediate circuit. The operator's telephone apparatus includes the transmitter T and the receiver R. When the listening key is operated, the receiver R is bridged directly across the intermediate circuit. If a high impedance receiver is used, no other apparatus will be required in the receiving circuit. If, however, the receiver R is not of the high impedance type, it may be necessary to include a monitoring device, as indicated in the drawing, this device taking the form, for instance, of a repeater.

Associated with the transmitter T is an inequality transformer having four windings W_1 , W_2 , W_3 and W_4 . The winding W_1 is in circuit with the transmitter. The windings W_3 and W_4 are designed to be connected across the calling line and the called line, respectively. Winding W_3 has a relatively low number of turns, and winding W_4 has a relatively high number of turns.

The winding W_2 of the transformer is connected in circuit with a battery and the grid of a vacuum tube V, which is designed to function as a detector. In the plate circuit of the vacuum tube is the winding of a relay R_1 . When the operator talks into the transmitter T, the grid of the tube V is made sufficiently positive to permit a flow of current in the plate circuit through the winding of relay R_1 . A relay R_2 has its winding adapted to be connected through an inductance coil and a battery. This inductance coil, however, is normally short-circuited. Upon operation of relay R_1 , the short-circuit of the inductance coil is removed and the coil is connected to the winding of relay R_3 , causing the operation of that relay. Also, a relay R_4 , which is slow releasing, operates in response to the operation of relay R_1 and serves to prevent the replacing of the short-circuit around the inductance coil until a suitable time has elapsed.

The operation of relay R_3 connects the winding W_3 of the transformer across the calling line and the winding W_4 across the

called line. Thus, the transformer T, which is normally disconnected from the transmission line, is connected in response to the operator's speech to the calling line through a transformer winding which is relatively low and to the called line through a winding which is relatively high. The inductance coil described above functions to produce a speedy operation of relay R_3 , and the slow release feature of relay R_4 serves to maintain this operated condition temporarily.

With the arrangement just described, it will readily be understood that the operator's receiving circuit introduces only a negligible loss in the transmission circuit, and that normally the operator's transmitting circuit cannot introduce any loss since it is disconnected from the transmission line. While the operator is lining up the two subscribers or is connected to the line for any other purpose, the transmission between the calling line and the called line is not appreciably impaired.

While the invention has been described specifically for the purpose of illustration, it is to be understood that it is capable of embodiment in other forms different from that disclosed within the true scope of the invention as defined in the appended claims.

What is claimed is:

1. In a telephone system, a calling line, a called line, an intermediate circuit adapted to be connected to said lines to link them together, operator's telephone apparatus, a transformer having a relatively low winding and a relatively high winding, and a switch in said intermediate circuit for connecting the low winding of said transformer to said calling line and the high winding of said transformer to said called line and said operator's telephone apparatus.

2. In a telephone system, a calling line, a called line, an intermediate circuit adapted to be connected to said lines to link them together, an operator's telephone receiver, an operator's telephone transmitter, means for connecting said receiver directly across said intermediate circuit, a transformer having a relatively low winding and a relatively high winding, and means operable only in response to the operation of said transmitter for connecting said transmitter to said calling line through the low winding of said transformer and to said called line through the high winding of said transformer.

In testimony whereof I have signed my name to this specification this 14th day of November, 1927.

STANLEY F. NELSON.