

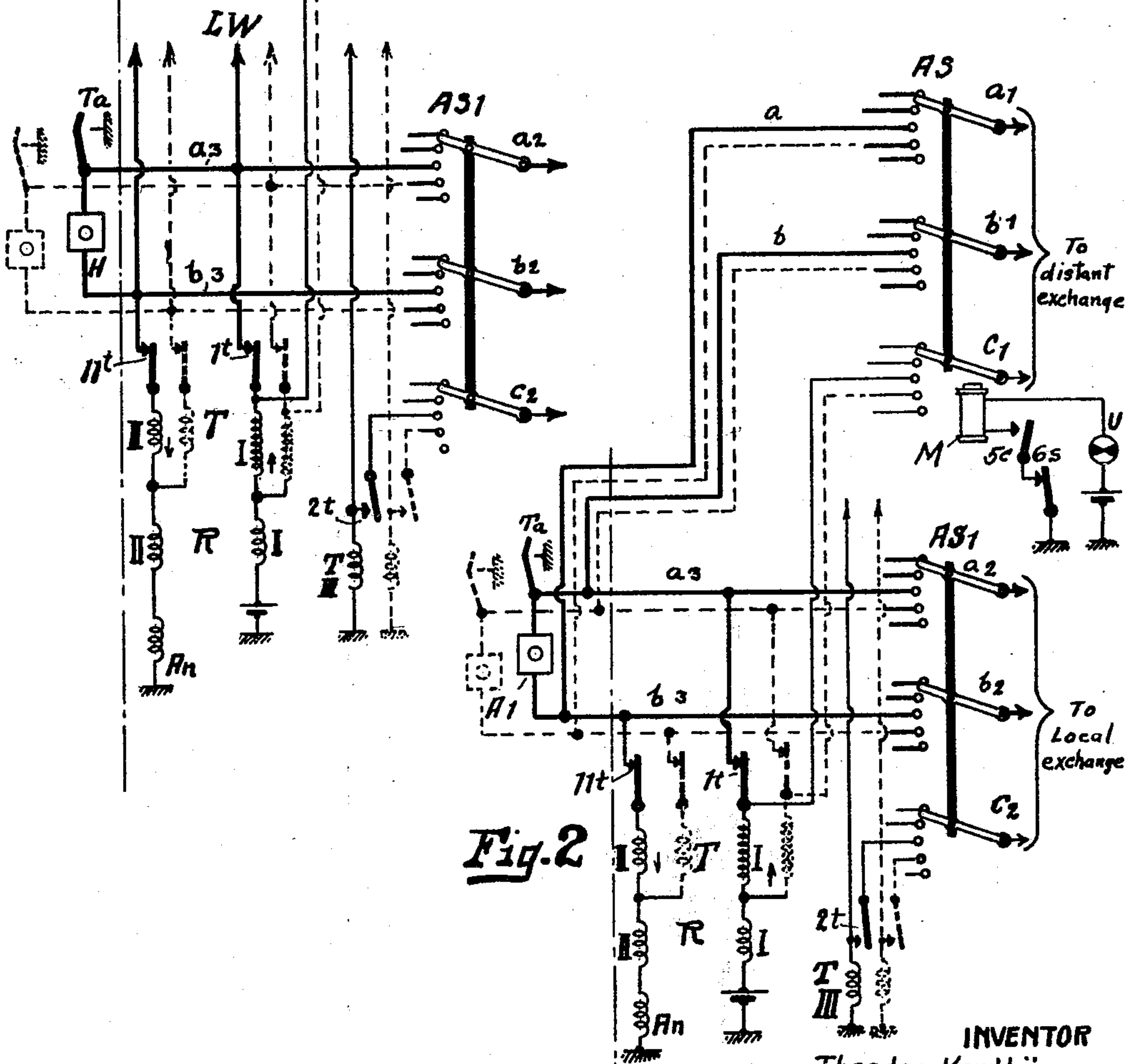
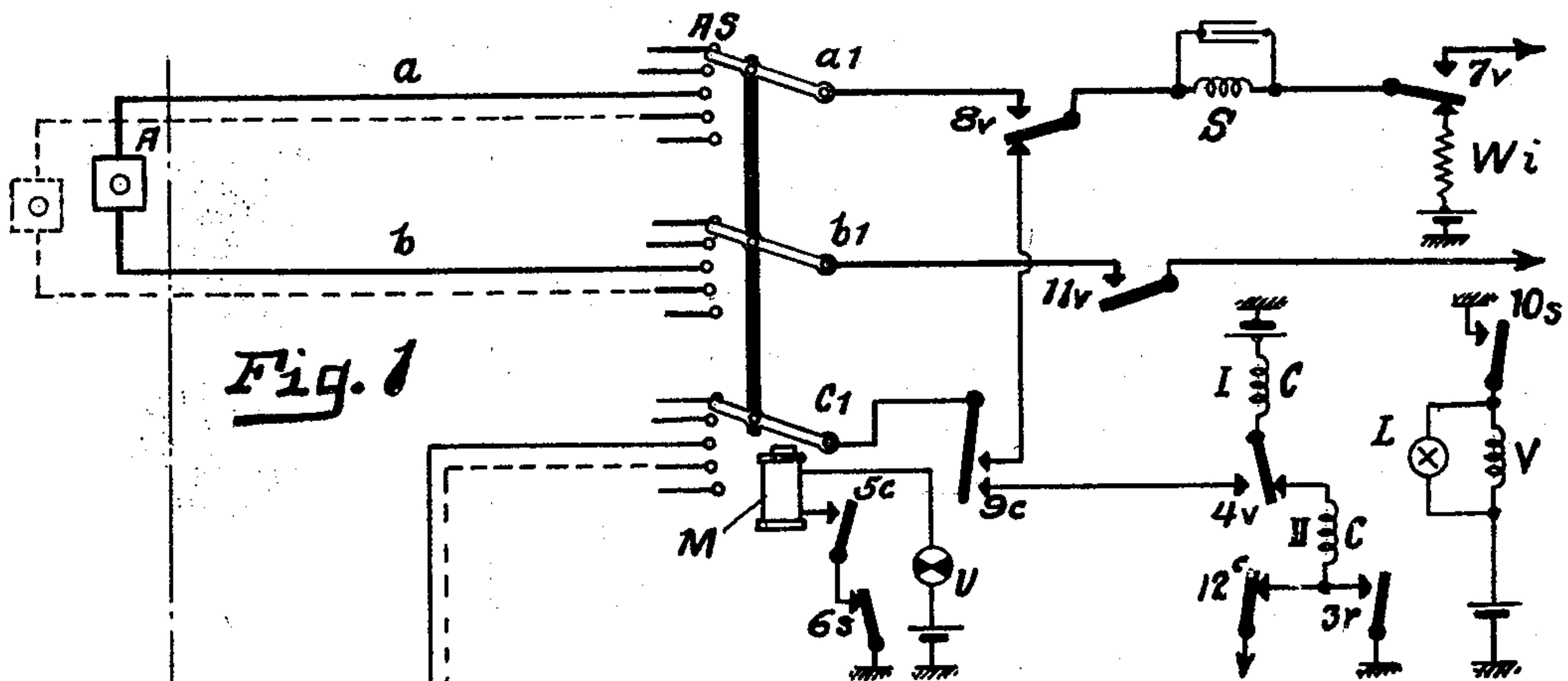
Jan 6, 1931.

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1,787,688

TELEPHONE SYSTEM

Filed Oct. 30, 1929



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TELEPHONE SYSTEM

Application filed October 30, 1929, Serial No. 403,489, and in Germany April 10, 1928.

This invention relates to electric telephone systems and has particular applicability to systems in which connections are made automatically by means of automatic switching mechanisms.

My invention furthermore specifically relates to telephone stations which may be connected either manually or automatically with at least two exchange stations for calling a subscriber belonging to either one of such exchanges.

One specific example of such a system is an extension telephone station by which a subscriber is enabled to call either a subscriber belonging to a local exchange, such as a subscriber living in the same building, or to call a subscriber of a distant exchange over a distant office. For this purpose secondary or extension stations of this kind have been provided with two connection lines. One of these connection lines serves for making a call to a subscriber belonging to a local exchange and the other one of the connection lines serves for calling a distant subscriber over a distant exchange. The calling operation performed by the subscriber over the local exchange, as well as over the distant exchange, may be carried out by means of the well-known switching organs, such as call selectors or pre-selectors, the latter also being called line switches.

With systems of this kind, as used hitherto, it was necessary to equip each one of the connecting lines associated with a telephone station with at least one relay, serving the purpose of initiating the necessary switching operations for the establishment of the desired connections. This relay is, preferably, of the type of the so-called step relays and is provided, for instance, with at least two windings energized successively, whereby successive switching movements are carried out, the first operating step, e. g., initiating the switching operation for performing the desired connection and the second operating step releasing the switching mechanism when the connection has been completed. It is not necessary, however, for the purpose of my invention, to use such specific step relay, but any other relay, such as a calling relay and a

separating relay, may be provided for obtaining this object just mentioned. This will be more particularly described in connection with the circuit diagram illustrated in the accompanying drawing.

With stations of this nature, which may connect and may be connected over a local exchange, as well as over a distant exchange, a switching device, such as a key, is usually provided, by the operation of which the calling subscriber may connect himself with a distant line. By the use of such a key or other switching device, it is necessary to employ a special translating arrangement or repeater in the distant line, in order to prevent objectionable and undesired switching operations by connecting one of the lines to the ground when a call is made by the subscriber.

It is the object of the present invention to design a circuit system, according to which a single relay is provided for both the connection lines, which is rendered effective when making a local call and which will be ineffective when making a distant call.

A further object of this invention consists of dispensing with a special translating device or repeater to be inserted in the distant line connection.

These and further objects of my invention will become more apparent as the following detailed description proceeds, which is taken with reference to the accompanying drawing, which illustrates, by way of example, two circuit diagrams of a telephone system, in which my invention may be embodied. I wish it to be understood, however, that this description in reference to the specific example illustrated by the drawing serves the purpose of illustration only of the basic and fundamental principle forming the subject matter of my invention and that this specific description should not, in any way, have the effect of limiting the invention, short of its broad and most comprehensive scope, as expressed in the appended claims.

Figure 1 shows a circuit diagram of a telephone system, in which the idea of my invention is embodied, wherein two different

telephone sets are provided for initiating a local or a distant call, respectively.

Figure 2 shows a similar diagram to Figure 1, representing a simplified system, as compared to Figure 1, whereby a single set is provided serving for making either a local or a distant call.

Referring more particularly to Figure 1 of the drawing, a diagram of a telephone station is shown, which may connect itself over a distant exchange, as well as over a local exchange. In the example illustrated, two separate sets are shown for communicating with a local subscriber and with a distant subscriber, respectively. It is, of course, possible also to use a single set, as illustrated in Figure 2, but two sets have been shown in the present diagram for the sake of simplicity and for more clearly illustrating the new feature of the invention. Furthermore, the diagram only shows those elements necessary for a clear understanding of the invention. Thus, the usual automatic switching mechanisms for executing the desired connection have not been shown, as being out of the scope of the present invention.

Referring now to the diagram of the drawing, let it be assumed that the subscriber wishes to be connected over the distant exchange. The operation will then be as follows:

To make such a call, the subscriber has to lift his receiver from the hook switch of his set, which latter is designated by the character A in the drawing. Furthermore, he has to press a key T_a , which is provided at his second set H, to be used for making a local call. With the lifting of the receiver of the set A for making distant calls, the following electrical circuit is formed for the two windings I of the relay T and the relay R, respectively: From ground to closed key T_a , connecting line a_3 , resting contact $1t$, winding I of relay T, which has a high ohmic resistance, winding I of the relay R, to battery and back to ground. By the establishment of this circuit, the relay R becomes energized. This relay is of the type of differential relays and may be operated only by pressing the key T_a . When making a call over the local exchange by the calling subscriber, the differential relay R is not excited. This will be more particularly described later on, in connection with the operation for making a local call over the local exchange. With the energization of the relay R, a contact $3r$ is closed, whereby the following further circuit is established: From ground to battery, to winding I of a further relay C, to resting contact $4v$, to winding II of the relay C, to working contact $3r$, back to ground.

By the terms "resting contact" and "working contact," the position of the relay contacts is understood to correspond to the relay

winding in its de-energized condition and its energized condition, respectively.

Through the establishment of the last mentioned circuit and the energization of the relay C, its contact $5c$ is closed, whereby the further circuit for the rotary operating magnet M of the call selector AS is closed, which latter is connected with the connection line leading to the distant exchange. The operating current circuit for the operating magnet M of the call selector AS is traced as follows: From ground, to battery, to interrupter U, to operating winding of rotary magnet M, working contact $5c$, resting contact $6s$, back to ground. The switch arm of the call selector, in accordance with its well known operation, will thus start to travel over its bank of contacts and pick out the calling line. As soon as it has found it, the following test circuit is formed: Ground, to battery, to resistance W_i , to resting contact $7v$, to winding of relay S, to resting contact $8v$, to double working contact $9c$, to switch-arm $c1$ of the call selector, to working contact $1t$, across connecting line a_3 , across closed key T_a , back to ground. The key T_a has to be pressed down by the calling subscriber until a signal is given to him from the distant exchange. With the establishment of the last mentioned circuit, the relay S becomes energized, whereby it operates its contacts $6s$ and $10s$. By the opening of the contact $6s$, the current for the rotary operating magnet M of the call selector AS is interrupted. By the closing of the contact $10s$, a current is formed for the relay V, which is traced as follows: From ground, to working contact $10s$, across winding of the relay V, to battery, back to ground.

A lamp L is connected in parallel to the relay winding V. This lamp will light up, whereby the operator of the local exchange is notified that a connecting line to the distant exchange has been occupied. The operator at the distant exchange is notified at the same time of the call and connects herself with the calling subscriber, who informs the operator which subscriber he wishes to be connected with. The desired connection is then made by the operator in the well-known manner. Of course, it may also be made automatically, by means of selector or connector mechanisms, but this is not described more fully in the present example, as it is out of the scope of the principle underlying the invention.

By the energization of the relay V, the contacts $4v$, $7v$, $8v$ and $11v$ will be operated. By the reversal of the contacts $7v$, $8v$ and $11v$, the connecting line is switched over to the distant exchange and the switching devices (relays) associated with the connecting line are simultaneously disconnected. By the reversal of the contact $4v$, the circuit

described above for the relay C becomes interrupted. The relay C is released and, at the same time, the calling subscriber releases the key Ta, when he receives a signal from the exchange. How this signal is given to him will not be described in more detail, as this is not concerned with the invention itself. Thus, the relay R will be de-energized, whereas the relay S will hold itself by means of the operating current supplied from the exchange to the subscriber's circuit. The call selector AS is blocked as contact 6s is in its working position and accordingly, the rotary magnet winding M de-energized. After completion of a conversation with the distant exchange, the connection will be dissolved again in the well-known manner. The relays S and V are released and the connection line is available for a new call.

Assuming now a call with a local subscriber is desired, the operation will then be as follows:

The extension subscriber connected to the local exchange in this case has to lift his receiver from the set H provided for making local calls. Thus the following circuit will be formed:

From ground, to battery, to winding I of the relay R, to winding I of the relay T, to resting contact 1t, over connecting line a3, through the set for making local calls H, over connecting line b3, to resting contact 11t, to winding II of the relay T, winding II of the relay R, winding of the starting relay An, back to ground. By the closing of this circuit, the relays T and An are energized. Relay T is energized on account of its two windings I and II being of unequal resistance, or by arranging both windings in such a sense as to assist each other. The differential relay R is not operated in this case, as both of its windings are flown through by the current in the same sense. The step relay T, when operated, reverses the contact 2t. The relay An serves to establish a circuit for the rotary magnet of the call selector AS1 of the local exchange. This latter operation is not specifically illustrated in the drawing, as it has nothing to do with the particular feature of the invention. The call selector AS1 is put in operation and selects the calling line. As soon as this is found, a further winding III of the step relay T is put in circuit. The relay will thus be operated to advance a further step, whereby the contacts 1t and 11t are opened. By the opening of these contacts, the relays T and R and An are separated from the subscriber's line.

The further operations for completing the connection to a local subscriber will not be described in more detail, as they are not essential to the understanding of the inventive object. The local subscriber may, of course, be called by another subscriber also and, in

this way, the call may be effected by means of a line switch or pre-selector, which is indicated in the drawing by the characters LW.

The key Ta is pressed down by the subscriber only when he wishes to make a distant call, whereby the differential relay is energized and starts the call selector AS, which connects the calling subscriber with the distant exchange, whereas the operating relay T for the local call selectors is not excited, as only its winding I of high ohmic resistance is inserted in the circuit. When making a call to a local subscriber, the key Ta should not be pressed down and, thus, the differential relay will not be operated in this case, as described. The relays R and An are common to all connection lines leading to local subscribers. Instead of the step relay T, one of which is provided for each subscriber with two connection lines, it is also possible to use a special calling relay and a separating relay, such as is well known in the art. It is also made possible, with a system as illustrated, to make a return call to a local subscriber during a conversation with a distant subscriber, without it being necessary to give up the distant connection.

Referring to Figure 2 of the drawings, in which similar reference characters refer to similar parts, a single telephone set is provided for a subscriber, which may be used for making a call either over a local exchange, or over a distant exchange. All the operations, in accordance with this arrangement, are exactly identical to those described in reference to Figure 1. If the subscriber desires to make a local call, he has to lift his receiver from the hook switch and the current flow through both windings of the relay R is such that compensation takes place and the relay is, accordingly, rendered inoperative. Whenever the subscriber wishes to make a call over a distant exchange, he has, besides lifting his receiver, to operate the key Ta, whereby only one winding of the relay R is excited and, thus, the relay rendered operative. The current in the latter case for the relay winding will be from ground, to winding I of relay R, to winding I of the relay T, resting contact 1t, connecting line a3, key Ta, back to ground. In this latter case, the current will not flow over the subscriber set a1 and the windings II of the relays T and R, but will go directly to ground across the closed key Ta, as this path to ground offers the least resistance.

While I have described my invention more or less specifically, with reference to the showing herein, it is obvious that I would have it understood that the invention may be practiced in many other ways, as becomes evident from the description, without departing from the spirit and scope thereunder, in attaining the object hereinbefore set forth.

What I claim is:

1. In combination in a telephone system, comprising a telephone station, two connecting lines emanating from said station to a local exchange and to a distant exchange, respectively, means associated with both of said connecting lines for making a call over said line to said distant exchange, said means being inoperative when making a call over said line leading to said local exchange and further means to be operated when making a call over said line to said distant exchange for rendering operative said first means.

2. In combination in a telephone system, comprising a telephone subscriber station, a connecting line associated with said station leading to a first exchange station, a second connecting line over said station leading to a second exchange station, a switching device associated with both of said connecting lines, said switching device being inoperative when making a call over said second line and means to be operated when initiating a call over said first line for rendering operative said switching device.

3. In a telephone system, a first exchange station, a second exchange station, a subscriber's station, a line extending from said subscriber's station to said first exchange station, a second line extending from said subscriber's station to said second exchange station, a switching device consisting of a relay having at least two windings, and circuit connections between said relay and said lines whereby when a call is being initiated over said second line compensating currents flow through said windings and when a call is being initiated over said first line the flow of compensating currents in said windings is prevented.

4. In combination in a telephone system, comprising a telephone subscriber station, a connecting line associated with said station leading to a distant exchange station, a second connecting line from said station leading to a local exchange station, a relay switching device associated with both of said connecting lines, having at least two operating windings, a switching element to be operated for initiating a call over said connecting line leading to said distant exchange for exciting only one winding of said relay for starting the execution of a connection with said distant connecting line and circuit connections associated with said subscriber station for rendering said relay inoperative upon initiating a call over said second connecting line leading to said local exchange by exciting both of said relay windings compensating each other.

5. In combination in a telephone system, comprising a subscriber station, a first connecting line leading to a distant exchange station, a second connecting line leading to a local exchange station, means for enabling

a call to be made over either one of said connecting lines, said means including a relay associated with both of said connecting lines and having at least two operating windings for starting the execution of a connection over said line leading to said distant exchange and circuit connections between said subscriber station and said windings of said relay, whereby with the initiation of a call over said line to said distant exchange said relay is excited for operation and whereby with the initiation of a call over said connecting line leading to said local exchange said windings of said relay are excited to compensate each other.

6. In combination in a telephone system, comprising a subscriber station, a first connecting line associated with said station leading to a local automatic exchange, a relay associated with said first line operated with the initiation of a call to be made over said first line, a circuit for said relay, a second connecting line from said station leading to a distant exchange station, a further relay associated with said circuit of said first relay and means including a switching element and circuit connections, whereby said second relay is rendered inoperative with the initiation of a call over said first connecting line leading to said local exchange and whereby said relay is rendered operative with the initiation of a call over said second connecting line leading to said distant exchange.

7. In combination in a telephone system, comprising a subscriber station, a first connecting line associated with said station leading to a local exchange, a switching element operated with the initiation of a call over said line, an automatic selector switch of said local exchange operated by said switching element, a controlling circuit of said switching element operated upon initiation of a call over said first connecting line leading to said local exchange, a second connecting line from said station leading to a distant exchange station, a call selector device associated with said second line for automatically selecting an idle line of a bunch of connecting lines leading to a distant exchange, a relay for operating said call selector device having at least two operating windings, a key to be operated for initiating a call over said second connecting line leading to said distant exchange and circuit connections between said key, said switching element and said relay whereby with the initiation of a call over said first connecting line both of said windings of said relay compensate each other and whereby with the initiation of a call over said second one of said connecting lines compensation of said relay windings is suppressed.

8. In combination in a telephone system, comprising subscriber stations, an automatic exchange station for said subscriber stations,

including a selector mechanism, connection lines between said subscriber stations and said selector mechanism, a relay device for each one of said connecting lines, means to operate said relay devices from said subscriber stations for initiating the operation of said selector mechanism for executing a connection with a desired called subscriber, a further automatic selecting apparatus including selector devices, connection lines from said subscriber stations to said last selector devices, a second relay device associated with all of said subscriber stations, means to operate said second relay from either one of said subscriber stations for initiating the operation of said last selector devices for executing a connection over said second selector apparatus and means including circuit connections whereby said second relay is rendered inoperative when a call is made to said first exchange station.

9. In combination in a telephone system, as described in claim 8, a key to be closed for making a call over said second selector apparatus, at least two windings of said second relay, an exciting circuit of said relay whereby one of said relay windings is short-circuited by the closing of said key and whereby both of said relay windings are excited when said key is in its open position to compensate each other.

In testimony whereof I affix my signature.

THEODOR KORTHÄUER.