

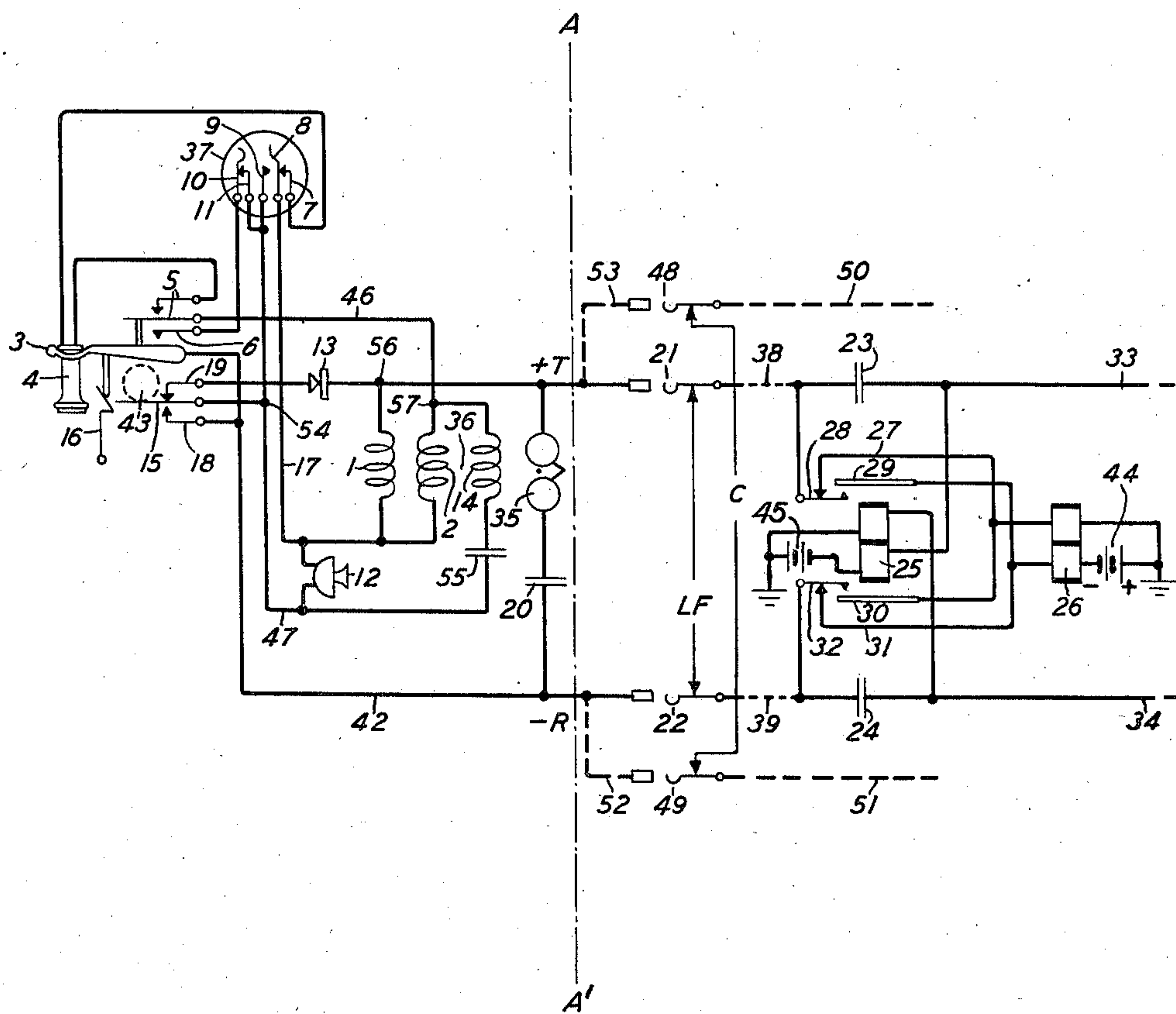
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A. H. INGLIS

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TELEPHONE SYSTEM

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INVENTOR  
A. H. INGLIS  
BY *John Fox*  
ATTORNEY



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## TELEPHONE SYSTEM

Alfred Hartwell Inglis, Orange, N. J., assignor to  
American Telephone and Telegraph Company,  
a corporation of New York

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9 Claims. (Cl. 179—6.3)

This invention relates to telephone systems and particularly to pay station circuit systems in which the calling subscriber must deposit a coin before he can converse with the called subscriber.

An object of this invention is to improve and simplify pay station circuits for post payment service.

Another object is to provide pay station circuits that function without any special equipment at the central office.

Heretofore systems have been provided in which the transmitter has been disabled during certain periods of the call in which rectifiers have been used as blocking means, one in series with the transmitter and the other in parallel to the transmitter. In such a system, when a calling subscriber removes his receiver from the switchhook, the transmitter current is such that it may pass through the transmitter and the rectifier in series therewith. When the called party answers, the current reverses at the central office and the transmitter is thereby disabled as the current passes through the rectifier in shunt of the transmitter. When the called party answers, the calling party can hear the answer of the called party. The calling party then deposits a coin and the series rectifier is short-circuited and the path for the shunting rectifier is opened so that without again reversing the current, the transmitter is made operative and without any rectifiers in the transmitter circuit. A system of this kind is disclosed in the copending application of G. Sandalls Jr. filed on even date herewith, Serial No. 740,167.

A feature of the present invention is a circuit arrangement of this type for pay station use in which the transmitter is disabled and the effect on the receiver by speech current in a telephone circuit is minimized by the reversal of current prior to payment and the transmitter and receiver are made fully operative upon payment without again reversing the current. This feature may be embodied in an arrangement where a rectifier is placed in shunt of the transmitter and a portion of the induction coil, employed for the transmission of speech current to the receiver. Normally the direction of the current is such that it passes through the transmitter and said portion of the induction coil as the current is then blocked by the rectifier from by-passing the transmitter and said portion of the induction coil. When the called party answers the current is reversed. The current now passes through the rectifier so that the transmitter is disabled and so that the effect from talking current on the receiver is minimized, due to the shunting of said

portion of the induction coil. When the calling party then deposits a coin, the rectifier circuit is opened so that without again reversing the current, the transmitter and receiver are made fully operative and the rectifier entirely disconnected from the active parts of the telephone circuit.

This invention will be more clearly understood by reference to the accompanying drawing. The section shown to the right of the dotted line AA' shows schematically in part a line finder LF and other apparatus at a dial step-by-step office including a relay 25 arranged to control the reversal of current supplied to conductors 38 and 39 from a bridged impedance battery supply in connection with coil 26. Also, there is shown an abbreviated schematic representation of a connector C with contacts 48 and 49. This apparatus is all well known in the art, and only that part of it necessary to explain the operation of this invention is shown, omitted portions being indicated by dotted lines. The section to the left of said line AA' illustrates a subscriber's post-payment station arranged in accordance with this invention which shows a conventional subscriber's set with a transmitter, receiver, induction coil, condensers, ringer, switchhook and dial. There is also illustrated a rectifier 13 which is normally connected in multiple with the transmitter 12, and with winding 1 of induction coil 36 in series with the transmitter. This rectifier is poled to pass current in the direction indicated by the arrow and to block current in the opposite direction. A coin switch is also shown. This operates when a coin is deposited and is arranged to be locked in its operated position under control of a hook actuated by the switchhook aforementioned.

A detailed description of the operation of the arrangement shown in the drawing will now be given.

Assume that the subscriber at the post-payment station desires to establish connection with another subscriber's station, not shown, but connected to a dial office, the apparatus of which is partly shown at the right of line AA'. To this end the subscriber removes the receiver 4 from switchhook 3 causing the line finder LF to function and close contacts 21 and 22. Other apparatus of the line finder is not shown, the parts omitted being indicated by the dotted lines 38 and 39. A circuit may now be traced through the contacts of dial 37, from the grounded positive pole of a battery connection established by the



line finder (not shown), conductor 38, line finder contacts 21, winding 1 of induction coil 36, transmitter 12, conductor 47, dial contacts 11 and 10, switchhook contact 6, switchhook 3, conductor 42, through line finder contacts 22, conductor 39 to the negative pole of said battery. In shunt with the series circuit including transmitter 12 and winding 1 of induction coil 36 hereinbefore traced, a local circuit may be traced from junction point 56, through rectifier 13, coin switch contacts 19 and 15 to junction point 54. Through this shunt path, however, no appreciable current can flow at this time since the direction of flow opposes the direction of the arrow of rectifier 13. This high resistance path through rectifier 13 is only incidental at this time. However, its useful functioning will be described hereinafter in another connection. The subscriber on receiving the usual dial tone, now operates dial 37 and dials the number of the called subscriber. This causes pulsing contacts 10 and 11 to interrupt a circuit which was in part previously traced, from positive ground of said battery connection established by the line finder through winding 1 of induction coil 36, conductor 17 and off-normal contacts 8 and 9, (which are closed when the dial is moved from its normal position) through contacts 10 and 11, and thence over the circuit previously traced to the negative pole of the battery connection established by the line finder. To avoid clicks in the receiver 4 while dialing, dial contacts 7 and 8 are opened while the dial is off normal, thereby opening the circuit through the winding of receiver 4.

The interruptions in accordance with dial pulses of the pulsing circuit hereinbefore traced corresponding to the digits of the called number eventually effect a connection through the battery 44, windings of coil 26, conductors 27 and 31, contacts 28 and 32 of a relay 25, conductors 38 and 39, contacts 21 and 22 of the line finder back through the calling subscriber's circuit hereinbefore traced, and also a connection through condensers 23 and 24 over conductors 33 and 34 to the called subscriber's line (not shown). When the receiver at the called station is removed from the switchhook, a bridge (not shown) is connected across conductors 33 and 34, causing the operation of relay 25, through a circuit that may be traced from ground through the upper winding of relay 25 to conductor 34, thence through said bridge, over conductor 33 and through the lower winding of relay 25 to grounded battery 45. Relay 25 in operating reverses the polarity of the current connected to line finder contacts 21 and 22 and a circuit may now be traced, in direction of current flow from the grounded positive pole of battery 44, through the upper winding of coil 26, through contacts 30 and 32 of relay 25, conductor 39, line finder contacts 22, conductor 42, switchhook 3, switchhook contact 6, contacts 10 and 11 of dial 37, contacts 15 and 19 of the coin switch, through rectifier 13, through line finder contacts 21, springs 28 and 29 of relay 25, through lower winding of coil 26 to negative pole of battery 44. In the circuit just traced rectifier 13 is now poled so that current passes through it freely, and it acts as a low resistance shunt on transmitter 12 and the winding 1 of induction coil 36. The transmitter circuit may be traced from junction point 54, conductor 47, transmitter 12, winding 1 of induction coil 36 to junction point 56. The effect of the shunt is to disable transmitter 12 and to partially disable the receiving circuit as will herein-

after be described. The subscriber at the post-payment station, although he cannot converse with the called subscriber, can, however hear his answer, through a local circuit including receiver 4. This circuit may be traced from junction point 56, through windings 1, 2 and 14 of induction coil 36, condenser 55, over conductor 47, through dial contacts 11 and 10, switchhook contact 6, and switchhook 3, to conductor 42. Receiver 4 is connected in multiple with winding 2 of induction coil 36, over a circuit from junction 57, conductor 46, through switchhook contacts 5, winding of receiver 4, off-normal contacts 7 and 8 of dial 37, over conductor 17, through winding 2 of induction coil 36 back to the point 57. It will therefore be seen that under these circumstances the receiver circuit above traced will receive less current than before the current was reversed. The rectifier is now in parallel with all three windings of the induction coil. Consequently, a smaller portion of the speech current is effective through the windings of the induction coil and the receiver than as was formerly the case when the transmitter was in parallel with only windings 2 and 14 of the induction coil. Therefore, while the calling subscriber can hear, he will not be able to hear as clearly as when the efficiency of the telephone circuit is restored to normal by the deposit of a coin as will be hereinafter described.

The post-payment subscriber now deposits a coin 43, which causes coin switch spring 15 to break from spring 19 and thus disconnects the rectifier 13, and the spring 15 is then closed to make contact with spring 18. The effect of this is to remove the shunt that disabled the transmitter 12 and partially disabled the winding 1 and to connect the transmitter directly across the line in series with winding 1 of induction coil 36. This local circuit may be traced from conductor 42, coin switch contacts 18 and 15, conductor 47, transmitter 12, winding 1 of induction coil 36, to junction point 56. This local circuit, it should be noted, is different from the original circuit for the transmitter as it includes the dial contacts 11 and 10. The post-payment station is now ready for conversation. When the subscriber talks, current in primary winding 1 of induction coil 36 fluctuates in accordance with the sound waves impressed on the diaphragm of transmitter 12, inducing corresponding currents in secondary windings 2 and 14, which are in series with condenser 55. The induced currents in the secondary windings are transmitted to the line conductors through a circuit path from junction 56, through windings 1, 2 and 14, condenser 55, over conductor 47, through coin switch contacts 15 and 18 and in multiple through dial contacts 10 and 11, switchhook contact 6 and switchhook 3, to conductor 42. The receiver is now fully responsive to speech current and the subscriber is therefore able at this time to clearly hear the speech of the called subscriber. When spring 15 was depressed by the deposit of coin 43, it locked in its operated position under control of spring 16, which moved to the right when receiver 4 was removed from switchhook 3.

At the end of the conversation receiver 4 is restored to switchhook 3, which causes switchhook contact 6 to open and release the apparatus at the central office, and also spring 16 to move to the left releasing spring 15. The motion of spring 16 also causes coin 43 to be removed from spring 15, thereby restoring springs 15, 18 and 19



to their normal position. It will be noted that when springs 15, 18 and 19 are still in their operated position, before the coin is removed by restoring the receiver 4 to the switchhook 3, the apparatus at the central office cannot be released by moving the dial contacts off normal, since the dial contact springs 11 and 10 are disabled over a shunt path starting from junction 54 through contact springs 15 and 18 to conductor 42. It is thus impossible to dial another number without first disposing of the deposited coin 43 by restoring the receiver 4 to the switchhook 3.

The preceding description is for a call requiring the deposit of a coin. The invention will now be described for the case where the pay station subscriber wishes to call an official number, for which no charge is to be made. In this case the subscriber dials the desired number as previously described and when the called party answers there is no reversal of line current and the current passes through transmitter 12 over the circuit previously traced in connection with an outgoing call for a subscriber, before said subscriber answered and reversed the current. Consequently, it is now unnecessary to deposit a coin to converse with the called party.

A call incoming from the central office will now be described. When the calling subscriber (whose station is not shown) dials the number of the pay station subscriber, connection is made to the called line over conductors 50, 53, 52 and 51 and contacts 48 and 49 of an automatic switch type of connector C, the details of which are well known in the art, and need not be shown here. The omitted portions are indicated by the dotted lines representing conductors 50, 53, 52 and 51. As soon as a connection is established ringing current is applied and a circuit may be traced from one terminal of the source of ringing current (not shown) over conductor 50 through contact 48, over conductor 53, through ringer 35, condenser 20, over conductor 52, through contact 49 and over conductor 51 to the other ringing terminal (not shown). Ringer 35 sounds. When the subscriber in answering removes receiver 4 from the switchhook a bridge is closed, which causes the ringing current to be disconnected. This bridge is the same as that previously traced through the apparatus of the subscriber station for an outgoing call, before the called station answered and reversed the current. After ringing has ceased grounded battery and ground (not shown) are connected to conductors 50 and 51, respectively. It is assumed that the battery terminal is negative and the ground terminal positive. Current will now flow through contacts 48 and 49 of connector C and over conductors 53 and 52 through a circuit at the subscriber's station including transmitter 12, that was previously traced for a call outgoing from the pay station, before current was reversed by the answer of the called subscriber. The station is now ready for conversation through contacts 48 and 49 of connector C and over conductors 50 and 51. At the end of the conversation, the called subscriber replaces receiver 4 on the switchhook, and when the calling subscriber also disconnects, the connection is broken at contacts 48 and 49 of connector C. All apparatus is now restored to normal.

What is claimed is:

1. A telephone pay station comprising a microphone, an induction coil, a circuit for said microphone and a winding of said induction coil, a single rectifier in said circuit for shunting said

microphone and said winding of said induction coil from current in one direction, and means for eliminating said rectifier from said circuit to allow passage of current in said direction through the microphone and said winding of said induction coil.

2. A telephone pay station comprising a microphone, an induction coil, a circuit for said microphone and a winding of said induction coil, a circuit including a single rectifier for shunting said microphone and said winding of said induction coil from current in one direction applied to the first mentioned circuit and means for opening said second mentioned circuit to permit the passage of current in said first mentioned circuit in said direction through the microphone and said winding of said induction coil.

3. A telephone pay station comprising a microphone, a receiver, and a circuit therefor, a rectifier in said circuit, means for shunting said microphone from current in one direction through said circuit and for partially reducing the responsive characteristics of said receiver to speech currents, means for eliminating said rectifier from said circuit to enable the transmitter and restore the speech current responsive characteristics of said receiver to normal condition.

4. In a telephone system, a microphone, an induction coil, a circuit including said microphone and one winding of said induction coil, a rectifier, a circuit including said rectifier for shunting said microphone and said winding of the induction coil from current in one direction, and means for opening said circuit for the rectifier to allow passage of current of said direction through said microphone and said winding of the induction coil.

5. In a telephone set, a pair of line conductors, a microphone, an induction coil, a circuit across said conductors including the windings of said induction coil, a circuit across said conductors including said microphone and a first winding of said induction coil, a receiver, a circuit including said receiver in parallel with another winding of said induction coil, a rectifier, and means for shunting the circuit for the microphone and the first winding of said induction coil with said rectifier for current in one direction to disable the microphone and to change the effect of speech current on said receiver.

6. In a telephone set, a pair of conductors, a microphone, an induction coil, a circuit across said conductors including the windings of said induction coil, a circuit across said conductors including said microphone and a first winding of said induction coil, a receiver, a circuit including said receiver in parallel with another winding of said induction coil, a rectifier and means for shunting said circuit for the microphone and the first winding of said induction coil with said rectifier for current in one direction to disable the microphone and to reduce the speech current effects on said receiver.

7. In a telephone set, a pair of conductors, a microphone, an induction coil, a circuit across said conductors including the windings of said induction coil, a circuit across said conductors including said microphone and a first winding of said induction coil, a receiver, a circuit including said receiver in parallel with another winding of said induction coil, a rectifier, means for shunting said circuit for the microphone and first winding of said induction coil with said rectifier for current in one direction to change



the speech current responsive characteristics of said induction coil windings.

8. In a telephone set, a pair of line conductors, a microphone, an induction coil, a circuit across  
5 said conductors including the windings of said induction coil, a circuit across said conductors including said microphone and a first winding of said induction coil, a receiver, a circuit in-  
10 cluding said receiver in parallel with another winding of said induction coil, a rectifier, means for shunting the circuit for the microphone and the first winding of said induction coil with said  
15 rectifier for current in one direction to disable the microphone and to change the effect of speech current on said receiver, and means for eliminating said shunting means to enable the

transmitter and to restore the speech current responsive characteristics of said receiver.

9. A telephone pay station circuit comprising a microphone, a receiver, an inductive circuit  
5 connection for said receiver, a rectifier, means for shunting said microphone from current in one direction in said pay station circuit and for partially decreasing the responsive character-  
10 istics of said inductive circuit for said receiver to speech current prior to payment and means for eliminating said rectifier from said pay sta-  
15 tion circuit to enable the transmitter and restore the speech current responsive characteristics of said inductive circuit for said receiver to a normal condition upon payment.

ALFRED H. INGLIS.