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Filed June 16, 1958

2 Sheets-Sheet 1

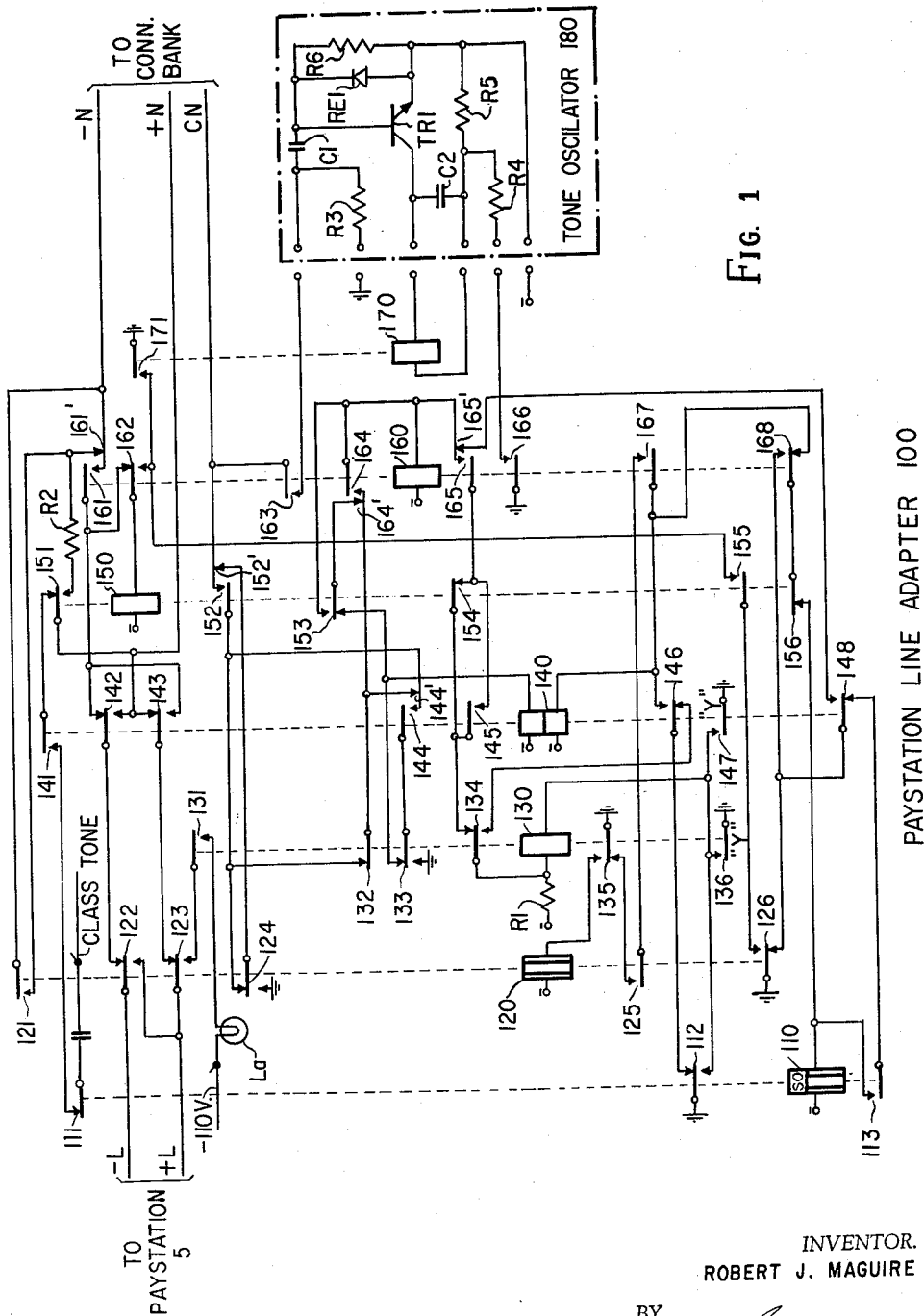


FIG. 1

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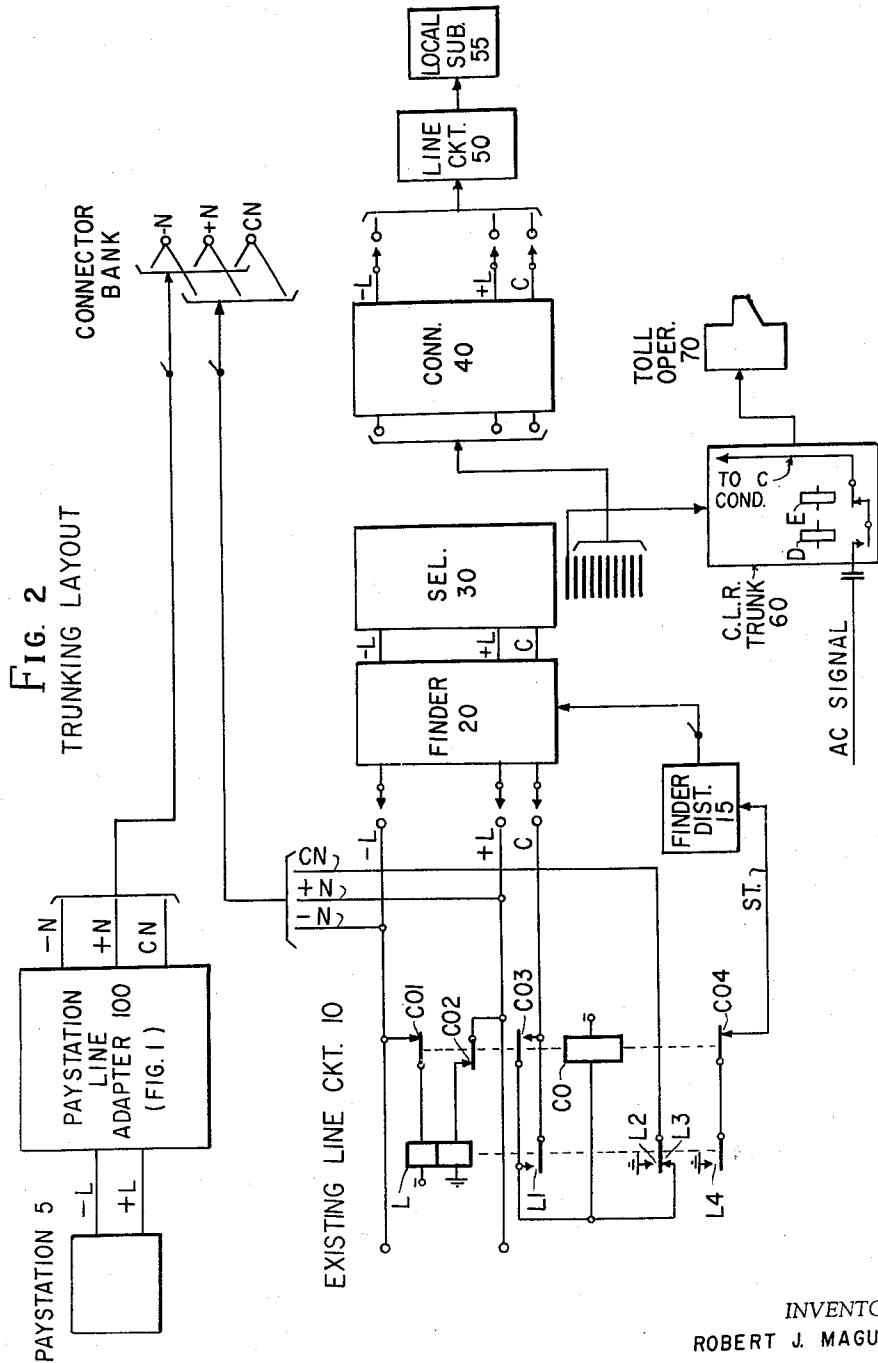
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The present invention relates to telephone systems in general and more particularly to an arrangement wherein a paystation is controlled during a local call to operate as a prepay paystation and during a toll, or reverse charge, call is converted from prepay to postpay operation and finally back to prepay at the completion of the call.

It has been the standard procedure that when a toll call is originated from a substation, it is generally routed to a combined line and recording (CLR) trunk, whereby an operator is signalled. When the operator connects her cord circuit to the CLR trunk to answer the call she receives a paystation identification signal, if the call has been initiated from a paystation, to enable her to distinguish between calls from a regular subscriber line and calls from a paystation line. If the call originates from the paystation line, the initial deposit is refunded and the operator requests the deposit of the proper toll fee before completing the desired connection. After the connection is completed and from time to time thereafter, as the call proceeds beyond a predetermined time, the deposit of more coins is requested and after the release of the connection at the end of the call, a coin magnet at the paystation is operated in the case of a prepay type paystation to collect the deposited coins. The above-described coin deposit and collect operations also take place on a reverse charge call to a prepay paystation. One difficulty arising from the aforedescribed operation is the collecting of the heavy load of deposited coins, due to the fact that the coin magnet is not able to rotate the coin trap to the collect position with the available power.

As described in an application filed by Hans Sengebusch on September 28, 1955, Serial No. 537,231, a prepay paystation is modified and arranged to function as a postpay paystation for toll purposes to thereby eliminate the aforementioned problems. In collecting the deposited heavy coin load. In the Sengebusch application, a paystation coin control arrangement is disclosed, wherein in addition to the apparatus, a single collect magnet and a single refund magnet are provided instead of the usual dual purpose magnet for obtaining both the refund and collect operations. The refund magnet is operated by refund potential being applied to the line conductors to cause the usual refund operation. The collect magnet is thereafter operated by reverse battery on the line conductors to convert the paystation to postpay service and it then shunts itself, while causing the paystation coin apparatus to automatically collect any coins deposited thereafter incident to their deposit. The paystation apparatus is now in the postpay, or collect, position and remains in this position until the refund magnet is reoperated to position, or reset, the coin apparatus to its normal position, which is the prepay position.

As described in an application filed by A. H. Faulkner on February 7, 1956, Serial No. 563,925, a paystation line circuit having a transistor oscillator included therein

is used in conjunction with the aforedescribed Sengebusch application. In the Faulkner application the transistor oscillator in the line circuit is operated responsive to a tone of high voltage returned over the C lead from the CLR trunk for controlling the application of refund potential to the paystation to refund the initial deposit thereat. When the toll call is answered by the operator, battery is reversed in response thereto for positioning the paystation apparatus to the postpay, or collect, position. The paystation remains in this position until the completion of the call, at which time refund potential is again caused to be applied to the paystation apparatus to restore the paystation to the postpay position.

As described in an application filed by C. E. Lomax on September 28, 1955, Serial No. 537,240, a circuit arrangement is also described to function with the above-mentioned Sengebusch application. The Lomax application disclosed certain circuit arrangements in the common central office equipment for controlling the mechanism at the paystation from this common equipment. This is an excellent arrangement where a large number of such paystations are to be accommodated, however, if only a few paystations are provided in the system, a more economical arrangement has been to modify and equip the line circuits of the paystations with the necessary control apparatus such as described in the Faulkner application.

Broadly, the present invention provides means whereby existing line circuits in the central office, regardless of whether they previously were prepay paystation line circuits or regular line circuits, have the herein disclosed paystation line adapter connected therewith at the connector terminals in the central office. This combined line circuit and adapter is then used with a paystation having the aforementioned Sengebusch paystation apparatus for providing the desired prepay postpay paystation service.

It is therefore a primary object of the present invention to provide an improved telephone system having the above-mentioned prepay-postpay type of paystation service that is reliable, efficient and economical in operation.

Another object of the invention is the provision of an improved paystation line adapter in combination with an existing line circuit adaptable for use in the telephone system and arranged to serve the above-mentioned type of paystations.

In accordance with the above-named objects, a feature of the present invention relates to means in the paystation line adapter whereby the line seizure on outgoing calls is repeated forward to the regular line relay in the associated line circuit.

Another feature of the present invention relates to means in the paystation line adapter whereby on all incoming calls, the line conductors are reversed to give reverse battery to the paystation. This battery reversal operates the paystation apparatus to place the paystation in the postpay, or collect, position.

Still another feature of the invention relates to means in the paystation line adapter responsive to an outgoing call, when a toll call is initiated and a CLR trunk is thereafter seized and operated upon receipt of a signal from the CLR trunk, for sending a pulse of refund current to the paystation and subsequently reversing battery to the paystation to convert it to postpay operation.

A further feature relates to means in the paystation line adapter whereby the refund pulse followed by the battery reversal is arranged to take place before the toll operator answers.

Another feature relates to means in the paystation line adapter operated at the completion of every call for send-

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ing a pulse of refund current to the paystation to convert it back to postpay operation.

These and other objects and features of the invention will become apparent upon a further perusal of the specification and claims taken in conjunction with the accompanying drawings comprising Figs. 1 and 2, which show by means of the usual diagrams a sufficient amount of the apparatus to enable the invention to be described and understood and in which:

Fig. 1 is a schematic representation of the paystation line adapter circuit showing the component parts and their interior relationship.

Fig. 2 represents a trunking diagram showing one method of a practical application of the invention in a telephone system, with block diagrams, other than the line adapter, representing standard equipment which may be of any well-known type and which operates in a well-known manner.

It is particularly desired to point out how readily the line circuit such as 10 of the prepay postpay paystation such as 5 and its associated line adapter such as 100 may be incorporated in a telephone system.

Referring in particular to Fig. 2 it will be seen that the $-N$, $+N$ and CN conductors of adapter 100 are connected to the same respective bank contacts of connector 40 that the $-N$, $+N$ and CN conductors of the existing line circuit 10 are connected, with little or no change of, or modification to, any of the central office equipment. It will be noted that line circuit 10 has been shown more in detail, but this is merely for the sake of the subsequent detailed operational description, since the line adapter 100 may be used with any standard 3 conductor line circuit.

It is to be noted that the transistor oscillator 180 as shown in Fig. 1, is shown as mounted on a plug-in type of card. This provides easy replacement of the transistor such as TR1 if necessary, but more important permits the oscillator 180 to be removed from the circuit in the event any work is being done on the adapter. This prevents the possibility of damage to the transistor TR1 due to transient currents induced in the line adapter incident to the result of such work.

It will also be appreciated that the CLR trunk such as 60 may be modified along lines similar to those disclosed in the previously mentioned Faulkner application, wherein seizure of the trunk causes a relay E (shown, but not described) therein to be operated for thereafter connecting the high voltage tone, or alternating current signal to the C conductor of the connection. Another relay D (shown, but not described) in the CLR trunk is operated responsive to answering by the operator for removing this tone from the C conductor.

In its preferred form, such as disclosed in the present application, a brief general description of the invention will now be given.

GENERAL DESCRIPTION

Referring in particular to Fig. 1 showing the apparatus of the paystation line adapter 100 and to Fig. 2 showing the existing line circuit 10 and further showing how the paystation line adapter 100 is combined with the existing line circuit 10 to be used in a telephone system, it will be appreciated that the present invention functions with the well-known Strowger type step-by-step finders, selectors and connectors, or with other types of well-known telephone switching equipment and represented in block diagram. It will further be appreciated that the paystation 5 contains all of the usual and well-known telephone instrumentalities.

When a call is initiated from the paystation such as 5, and the initial deposit is made, the paystation line adapter 100 is taken into use in a manner to be described in detail later on in this specification. Due to the multiple connection at the contact bank of the connector 40, the existing line circuit 10 is taken into use in a well-known

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manner, whereby the finder-distributor 15 is also operated in a well-known manner to cause the idle finder such as 20 to operate in a well-known manner to seize and connect with the calling line. The switching equipment is now ready for dialling to begin, with the first dialled digit determining whether the call is to a local subscriber or to a toll operator. With the first dialled digit being any digit but "0," the connection is extended to a connector such as 40 and the call may be to a local subscriber such as 55. Connector 40 is operated in a well-known manner, responsive to receipt of the remaining dialled digits of the call number, to connect with the line circuit 50 to cause local subscriber 55 to be signalled in a well-known manner. It is assumed that connector 40 is of the type that reverses battery responsive to answering in any well-known manner. When the call is answered and battery is reversed to the paystation, equipment thereat is operated as described in the aforementioned Sengebusch application, whereby the paystation is positioned to collect any coin deposit. At the termination of the call, ground potential is removed from the C conductor of the connection to cause equipment in the adapter 100 to operate and apply a high voltage potential to the connection to reset the paystation apparatus to normal.

On another type of outgoing call from the paystation such as 5, wherein the first dialled digit is the digit "0," the connection is extended from the selector such as 30 to the CLR trunk such as 60 and the call will further be extended to a toll operator. An alternating current signal is superimposed upon the C conductor at the CLR trunk as previously described and responsive to seizure causes the transistor oscillator such as 180 in the adapter 100 to operate, which in turn applies the high voltage potential to the line of paystation 5 to cause the operation of apparatus thereat to refund the initial deposit. Immediately subsequent to the refund operation, the line adapter 100 reverses the line leads to cause a reversal of battery to be applied to the paystation which operates the apparatus therein to convert the paystation to the postpay, or collect, position. The toll operator then answers the call and establishes the desired connection with the toll fee being collected as each coin is deposited. At the end of the toll call, the adapter 100 causes a pulse of high voltage to be sent to the paystation to reset the apparatus therein to normal and thereby convert it back to the postpay type.

When an incoming call is received, the line adapter 100 operates responsive to seizure from a connector to reverse the line leads to give reverse battery to the paystation, thus placing the paystation in the aforementioned postpay, or collect, position. This provides means for immediately collecting any deposited coins in case the call is of the reverse charge type. At the end of the call, a pulse of high voltage is sent to the paystation to reset all the apparatus therein to normal and thereby convert it back to the postpay type.

Having briefly described the invention, a detailed operational description will now be given for each specific type of practical use.

Local call

When an outgoing local call from paystation 5 is initiated, the initial deposit is made and the loop circuit is closed in the manner as described in the aforementioned Sengebusch application.

Relay 150 operates responsive to the closure of the above-mentioned loop circuit over a circuit traced from ground through the lower winding of line relay L of line circuit 10, contacts CO2, the $+N$ line conductor to the connector bank contact, the $+N$ line conductor to line adapter 100, break contact of armature 143, break contact of armature 123, the $+line$ conductor, the closed loop at paystation 5, the $-L$ line conductor break contact of armature 122, break contact of armature 142, break contact of armature 162 and through the winding of relay 150 to battery.

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In operating, relay 150 closes the make contact of armature 151 to place an obvious resistance bridge on the —N and +N line conductors to line circuit 10 for operating line relay L, closes a point in the operating circuit of relay 160 at contacts 152 and the make contact of armature 153, removes the connection of the upper winding of relay 140 from the CN conductor at contacts 152' and the break contact of armature 153 and performs no useful function at this time at its remaining operated contacts.

The circuit for operating line relay L of the line circuit 10 may be traced as extending from ground through the lower winding of relay L, contacts CO2, the +N line conductor, the bank contactor of the connector, the +N line conductor to adapter 100, make contact of armature 151, resistance R2, contact 161', the —N line conductor, the bank contact of the connector, the —N line conductor to line circuit 10, contacts CO1 and through the upper winding of relay L to battery.

In operating, line relay L prepares a point at contacts L1 in the future energizing circuit of cut-off relay CO, applies ground at contacts L2 to the CN conductor for busying the paystation line to other connectors and for operating relay 160 in the line adapter 100, disconnects relay CO from the connector banks at contacts L3 and grounds the start conductor ST at contacts L4 to cause the finder distributor 15 to operate in a well-known manner for starting an idle finder such as 20 to hunt for and seize the calling line, also in a well-known manner.

The circuit for operating relay 160 may be traced as extending from ground at contacts L2, the CN conductor of line circuit 10 to the bank contact of the connector, over the CN conductor to line adapter 100, contacts 152, 144', 164', make contact of armature 153 and through the winding of relay 160 to battery.

In operating, relay 160 extends the loop from paystation 5 to the line circuit 10 by way of contacts 161, opens the aforementioned resistance bridge at contacts 161', opens the previously traced circuit to relay 150 at the break contact of armature 162, connects the CN conductor to the transistor tone oscillator 180 at contacts 163, closes contacts 164 to prepare its own locking circuit to the CN conductor, opens its formerly traced energizing circuit at contacts 164', performs no useful function for the present at contacts 165 and 165', connects ground potential to the transistor tone oscillator 180 at contacts 166, performs no useful function at contacts 167 and prepares a point in the future energizing circuit of relay 110 at the make contact of armature 168. Even though ground has been connected to the transistor tone oscillator 180 as described above, the transistor is not rendered conductive and has no utility during the present type of call.

At this time it is thought advisable to mention that the idle finder such as 20 has found and seized the line of the calling paystation 5 in a well-known manner. Responsive to this seizure, the cut-off relay CO of line circuit 10 operates in a well-known manner from ground (not shown) in finder 20 over the C conductor to open the circuit to line relay L at contacts CO1 and CO2, opens the circuit start conductor ST at contacts CO4 to the finder distributor 15 and locks itself at contacts CO3 to the grounded C conductor from the finder 20. At the time that line relay L restores, the ground from finder 20 is extended through contacts CO3 of the cut-off relay CO to the line adapter 100 over the CN conductor for maintaining relay 160 operated.

In restoring, relay 150 opens a further point in the resistance bridge to line circuit 10 at the break contact of armature 151, maintains the holding ground for relay 160 from the CN conductor at contacts 152', performs no useful function for the present at armature 153, applies ground potential at contacts 154 from the CN conductor to the battery side of relay 130, performs no useful function at contacts 155 and at contacts 156 completes a circuit for operating relay 110. This circuit for operating

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relay 110 may be traced as extending from ground at the break contact of armature 126, make contact of armature 168, contacts 156 and through the winding of relay 110 to battery.

In operating, relay 110 opens contacts 111 to prevent the class tone common to paystation 5 from being applied to the connection during the present type of call, applies ground at the make contact of armature 112 for shunting the other side of relay 130 for the present and completes its own locking circuit at contacts 113 to the grounded break contact of armature 126.

The call number of the desired local subscriber such as 55 may now be dialled by paystation 5 with selector 30 and connector 40 operating in a well-known manner to extend the connection by way of line circuit 50 to the local subscriber 55. The local subscriber 55 is signalled in a well-known manner and responsive to answering, equipment (not shown) in connector 40 is operated in a well-known manner to reverse battery back over the connection. This reversal of battery when applied to the line of paystation 5 operates equipment at the paystation to the collect position in the same manner as described in the aforementioned Sengebusch application.

At the end of the call and responsive to the calling and called parties replacing their receivers, the finder 20, selector 30 and connector 40 restore in a well-known manner to remove ground from the C conductor of line circuit 10 also in a well-known manner. As previously mentioned, this ground has been forwarded over the CN conductor to the line adapter 100 for maintaining relay 160 operated and for shunting relay 130 from its battery side. This removal of ground therefore results in relay 160 restoring and relay 130 operating. The cut-off relay CO will also temporarily restore at this time.

In restoring, relay 160 performs no useful function at any of its contacts or armatures, with the exception that the closing of the break contact of armature 168 opens the aforementioned energizing circuit of relay 110. Relay 110 is maintained operated however, by way of its previously mentioned holding circuit. The operating circuit for relay 130 (since the shunt is removed therefrom) may be traced as extending from the make contact of armature 112 through the winding of relay 130 and resistance R1 to battery.

In operating, relay 130 prepares a point in the application of —110 volts to the paystation line at contacts 131, performs no useful function at contacts 132, armature 133 and armature 134, completes an obvious circuit at the make contact of armature 135 for operating slow-to-operate relay 120 and provides an obvious holding circuit for itself at contacts 136.

In operating after a reasonable length of time, relay 120 performs no useful function for the present at contacts 121, opens the break contacts of armatures 122 and 123 to open the forward extension of the line conductors, closes the make contacts of armatures 122 and 123 to complete the application of the —110 volts to the line conductors leading to paystation 5, closes the make contact of armature 124 to guard the connector banks and thus busy the line against seizure by other connectors and also to operate the cut-off relay CO for opening the ST conductor to prevent the line from being seized by other finders, performs no useful function at contacts 125 and at the break contact of armature 126 opens the locking circuit of slow-to-release relay 110 to allow it to restore.

The application of the —110 volt potential to the line conductors leading to paystation 5 causes the apparatus thereat to operate, as previously described in the aforementioned Sengebusch application, to reset the apparatus to normal.

In releasing after an interval of time, relay 110 applies a ground at the break contact of armature 112 to shunt relay 130 from its battery side and opens its own locking circuit at contacts 113. Since relay 130 now

has ground applied to both sides of its winding, it will release and open the aforementioned circuit to slow-to-release relay 120. After a period of time, relay 120 releases to remove the ground from the CN conductor to allow the cut-off relay CO to restore and thereby condition the system to handle future calls.

Incoming, or reverse charge, call

When a call is made to paystation 5, it will be noted that when line adapter 100 is in its normal, or idle, condition, the upper winding of relay 140 is connected to the CN conductor leading to the CN contacts at the connector banks. Additionally, it will be noted that the cut-off relay CO of line circuit 10 is also connected to the CN conductor leading to the same CN contacts at the connector banks. It should be further noted that the equipment of adapter 100 will operate in the same manner on any type of an incoming call.

When the line of paystation 5 is seized by a connector on an incoming call, ground is forwarded in a well-known manner from the connector to the CN contact at the connector bank, thereby completing circuits to the cut-off relay CO in the line circuit 10 and the relay 140 in the line adapter 100. The circuit for operating relay CO may be traced as extending from the ground at the CN bank contact, the CN conductor of line circuit 10, contacts L3 and through the winding of relay CO to battery. Relay CO operates as described in the previous section to open the start conductor ST and thus prevent the seizure of the line of paystation 5 by other finders during the progress of the present call. The circuit for operating relay 140 may be traced as extending from the ground at the CN bank contact, the CN conductor of line adapter 100, contacts 152', the break contact of armature 124, contacts 132, 164', the break contact of armature 153 and through the upper winding of relay 140 to battery.

In operating, relay 140 applies the class tone to the line of the calling party at contacts 141 to thereby inform the calling party that the called station is a paystation, reverses the line leads at the make contacts of armatures 142 and 143 to subsequently apply reverse battery to the paystation line to operate the equipment therein in a well-known manner to the coin collect position in case the incoming call is of the reverse charge type, prepares an alternate path to the CN conductor at contacts 144 for maintaining itself operated by way of its upper winding, performs no useful function for the present at contacts 145, completes an obvious circuit at the make contact of armature 146 for energizing its lower winding from ground at the break contact of armature 112 and also at this same make contact completes a circuit for energizing relay 110, applies ground potential at contacts 147 for energizing relay 130, which does not operate for the present, since it will be shunted by relay 160 and completes a circuit at the make contact of armature 148 for operating relay 160. The circuit for operating relay 160 may be traced as extending from ground at the break contact of armature 126, the make contact of armature 148, contacts 165' and through the winding of relay 160 to battery. Since relay 110 is constructed as being slow-to-operate, relay 160 will operate first and open the aforementioned energizing circuit of relay 110 before it can operate over this circuit.

Relay 160 therefore, operates extremely fast and at contacts 161 extends the connection of the incoming conductors of the calling line through to the line of paystation 5, performs no useful function at contacts 161', disconnects relay 150 from the conductors of the calling line at the break contact of armature 162, performs no useful function during this type of call at contacts 163, completes its own locking circuit to the CN conductor at contacts 164, opens a point at contacts 164' in the first energizing circuit of the upper winding of relay 140, applies a shunting ground at contacts 165 to the bat-

tery side of relay 130 for preventing this energized relay from operating for the present, opens its previous energizing circuit at contacts 165' performs no useful function during this type of call at contacts 166 and 167 and completes a different operating circuit for relay 110 at the make contact of armature 168. This circuit for operating relay 110 may be traced as extending from ground at the break contact of armature 126, the make contact of armature 168, contacts 156 and through the winding of relay 110 to battery.

After a reasonable length of time relay 110 operates over the above-mentioned circuit and removes class tone from the calling line at contacts 111, opens the previous energizing ground to the lower winding of relay 140 and opens the first mentioned energizing circuit for itself at the break contact of armature 112, provides an alternate ground for the present shunt of the winding of relay 130 at the make contact of armature 112 and performs no useful function during the present at contacts 113.

At this time it will be noted that the call has been extended to paystation 5, with conversation taking place thereafter in the usual manner. In the event that this is a reverse charge type of call, the subscriber at paystation 5 will deposit the required fee before the operator will complete the connection to allow conversation to take place, with the deposited fee being collected as it is deposited.

At the end of the call and responsive to both parties replacing their receivers, the switching equipment restores in a well-known manner and the ground is removed from the CN conductor also in a well-known manner. At the time that this ground is removed, the holding circuit to relay 160 is opened to allow this relay to eventually restore. Also, since the ground is removed from the CN conductor as mentioned, the shunt is removed from relay 130 and this relay operates over a path from the ground at the make contact of armature 112.

In operating, relay 130 prepares a point in the application of the -110 volt potential to the line of paystation 5 at contacts 131, opens a point in the previous holding circuit of relay 160 at contacts 132, applies a ground at the make contact of armature 133 to temporarily guard the connector banks and thus busy the paystation line against seizure by other connectors for the present and also to maintain the cut-off relay CO in line circuit 10 operated to prevent the line from being seized by other finders, prepares a point in a future shunting circuit for itself at the make contacts of armature 134, completes an obvious circuit at the make contact of armature 135 for operating relay 120 and provides its own obvious locking circuit at contacts 136.

Before continuing further with the present description, it is thought advisable to point out that relay 140 has been maintained operated by way of the grounded CN conductor and the second-mentioned energizing circuit to its upper winding. Therefore when the ground is removed from the CN conductor, as previously mentioned when the switching equipment releases, relay 140 will restore after relay 130 has operated, but before relay 160 has restored and relay 120 has operated. It will further be noted that since relay 120 is constructed as being slow-to-release, it will tend to be slightly slow-to-operate and it will thus be assumed that relay 160 will be completely restored before relay 120 is completely operated.

In restoring, relay 140 opens an additional point at contacts 141 in the application of the class tone to the connection, restores the polarity of the line conductors to normal at the break contacts of armatures 142 and 143, performs no useful function at contacts 144, 144' and 145, prepares a further point at the break contact of armature 146 in the aforementioned shunting circuit for relay 130, removes one of the operating grounds for relay 130 at contacts 147 and prepares a point at the

break contact of armature 148 in a future holding circuit for relay 110.

Relay 160 restores at this time with no apparent effect on the circuits of adapter 100 other than to position all of its contacts and armatures to normal and to shift the holding circuit of relay 110 at contacts 156 to the aforementioned holding circuit prepared by the release of relay 140.

In operating, relay 120 performs no useful function at contacts 121 during the present type of call, opens the line conductors at the break contacts of armatures 122 and 123, closes the make contacts of armatures 122 and 123 to complete the application of the -110 volt potential to the line of paystation 5 to reset the apparatus therein to normal, applies ground potential to the CN conductor at the make contact of armature 124 for guarding adapter 100 against seizure and for maintaining relay CO in line circuit 10 operated as previously described, performs no useful function during the present at contacts 125 and opens the holding circuit of relay 110 at the break contact of armature 126.

Since relay 110 is constructed as being slow-to-release, a reasonable time must lapse before this relay restores. In restoring, relay 110 restores all of its contacts to normal, with no effect other than to apply ground at the break contact of armature 112 over an obvious circuit to the battery side of relay 130 for shunting this relay.

Relay 130 releases and restores all of its contacts and armatures to normal with no effect other than to remove the -110 volt potential from the line of paystation 5 and to open the operating circuit to relay 120 at the break contact of armature 135.

Relay 120 is also constructed as being slow-to-release and after a reasonable lapse of time restores all of its contacts and armatures to normal, whereby the guarding, or busying potential is removed from the CN conductor to allow relay CO in line circuit 10 to restore.

The line circuit of paystation 5 and adapter 100 is now at normal and conditioned to handle future calls.

Toll call to CLR operator

For the above-entitled type of call, it will be assumed that the calling party at paystation 5 desires to place a call requiring the services of a CLR, or toll, operator to complete the call. It will be appreciated that for the present type of call, the same operations take place as described in the operational description of the section entitled "Local call" up to and including the point in the description where the first digit is dialed.

In order for the calling party at paystation 5 to be connected with the CLR operator, the digit "0" must be the first dialed digit. Responsive to receipt of this first digit, selector 30 is first operated to its tenth level and then hunts for and connects with an idle CLR trunk such as 60 in a well-known manner.

As explained in the aforementioned Faulkner application, equipment in the CLR trunk is operated responsive to seizure for superimposing a high voltage alternating current signal on the C conductor of the connection.

Before continuing with the present description, it is thought advisable to mention that the operation of relay 160 at contacts 163 has connected the tone oscillator 180 to the line adapter 100 and the closing of contacts 166 has further prepared the oscillator for its future operation.

Thus, the high voltage alternating current signal which is transmitted over the C conductor of the connection to the CN conductor of line adapter 100 is applied by way of contacts 163 of relay 160 to the tone oscillator 180. Tone oscillator 180 operates in the manner similar to that described in the aforementioned Faulkner application. Briefly, when the alternating current signal is received at oscillator 180, transistor TR1 conducts upon the receipt of each positive half-cycle of the signal and delivers pulses of amplified direct current to relay 170 and its shunting condenser C2. Condenser C2 charges

during each pulse of current flow and discharges through relay 170 between the pulses, or during the periods of no current flow from transistor TR1. In this manner, the effective current through relay 170 is increased and the circuit is made more sensitive.

In operating, relay 170 completes an obvious circuit from ground at contacts 171 by way of the make contact of armature 162 for operating relay 150.

In operating, relay 150 opens a point in the circuit at the break contact of armature 151 to prevent class tone from being applied to the connection for the time being, closes an alternate path at contacts 152 from relay 160 to the CN conductor, opens a further point at the break contact of armature 153 to the upper winding of relay 140, removes the shunting ground at contacts 154 from the CN conductor to the battery side of relay 130 to allow this relay to energize from the grounded armature 112 and its make contact, prepares a point in its own holding circuit at contacts 155 and opens a point at contacts 156 in the original operating circuit of relay 110.

In operating, relay 130 prepares a point at contacts 131 for the application of -110 volt potential to the paystation line, performs no useful functions for the present at contacts 132, 133 and the make contact of armature 134, completes an obvious circuit for relay 120 at the make contact of armature 135 and completes its own locking circuit at contacts 136.

In operating, relay 120 closes the resistance bridge comprising resistance R2 forward on the line to the CLR trunk at contacts 121, opens the line leads at the break contacts of armatures 122 and 123, completes the application of the -110 volt potential to the line of paystation 5 at the make contacts of armatures 122 and 123, performs no useful function at the make contact of armature 124, prepares a point at contacts 125 in the energizing circuit to the lower winding of relay 140, completes an obvious holding circuit for relay 150 at the make contact of armature 126 and opens the circuit to relay 110 at the break contact of armature 126.

It will be noted that the above-mentioned application of the -110 volt potential to the paystation line causes the apparatus thereat to operate as described in the aforementioned Sengebusch application to refund the initial deposit made by paystation 5.

Relay 110 is slow-to-release as previously mentioned and after a period of time restores to prepare a point in the circuit at contacts 111 for the application of class tone forward over the line to the CLR operator, applies a shunting ground from armature 112 and its break contact to the battery side of relay 130 for initiating the release of this relay and removes the original operating ground for relay 130 at the make contact of armature 112.

Due to the above-mentioned shunt, relay 130 releases a bit slowly and upon releasing removes the -110 volt potential from the paystation line at contacts 131, prepares a point in the connection of the CN conductor to its own battery side at contacts 132 and at the break contact of armature 134, prepares a point in a future locking circuit for relay 140 at the break contact of armature 133, opens the circuit to relay 120 at the make contact of armature 135, completes a circuit at the break contact of armature 135 for operating relay 140 over its lower winding and opens its own holding circuit at contacts 136. The circuit for operating relay 140 may be traced as extending from grounded armature 135 and its breakcontact, contacts 125, 167 and through the lower winding of relay 140 to battery.

Relay 120 is constructed as being slow-to-release and will therefore restore after relay 140 operates.

In operating, relay 140 prepares a further point in the class tone circuit at contacts 141, reverses the incoming line leads from the CLR trunk leading to paystation 5 at the respective make and break contacts of armatures 142 and 143, completes its own holding circuit over its

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upper winding to the CN conductor at contacts 144, changes the route of the locking circuit for relay 160 to the CN conductor at contacts 144', applies ground from the CN conductor to the battery side of relay 130 at contacts 145, completes the locking circuit by way of its lower winding and the make contact of armature 146 to the grounded armature 112 and its break contact, applies shunting ground to the other side of relay 130 at contacts 147 and performs no useful function for the present at its armature 148.

Relay 120 releases and at contacts 121 opens the resistance bridge to the CLR trunk, connects the reversed line leads to the line of paystation 5 at the break contacts of armatures 122 and 123, performs no useful function at the make contacts of armatures 122, 123 and 124, opens the previously mentioned energizing circuit to the lower winding of relay 140 at contacts 125, opens the previously mentioned holding circuit for relay 150 at the make contact of armature 126 and performs no useful function for the present at the break contact of armature 126. It will be appreciated, that the reversal of the line leads reverses the battery to the paystation apparatus for causing this apparatus to operate to the collect position as previously described.

When the CLR operator answers, equipment (not shown) is operated in the CLR trunk as explained in the aforementioned Faulkner application for removing the high voltage alternating current signal from the C and CN conductors of the connection. Transistor TR1 of tone oscillator 180 ceases to conduct responsive to the removal of this signal and the circuit for operating relay 170 is no longer effective. Upon releasing, relay 170 opens the aforementioned operating circuit of relay 150 at contacts 171 and relay 150 restores. It will be appreciated that in the event that the CLR operator answers very quickly, such as before relay 120 restores, relay 150 will be held operated from the make contact and grounded armature 126 of relay 120 until relay 120 restores.

In restoring, relay 150 completes the class tone circuit at the break contact of armature 151, with this tone being extended forward over the +N line conductor of the connection to the CLR operator, opens another point in the aforementioned resistance bridge at the make contact of armature 151, converts the connection of the CN conductor in adapter 100 back to the normal path at contacts 152 and 152', performs no useful function at the contacts controlled by armature 153, closes an alternate path for connecting the grounded CN conductor to the battery side of relay 130 at contacts 154, opens a further point in its holding circuit at contacts 155 and completes a circuit for energizing relay 110 at contacts 156.

At this time it is thought advisable to mention that the class tone that is transmitted to the operator is a special tone common only to paystations and therefore indicates to the operator that the call has originated at a paystation line. In the event that the operator is unsure of the tone, she may have it reapplied to the line by momentarily removing her plug. The removal of the plug restores the high voltage alternating current signal to the C conductor, with this signal causing transistor TR1 in the tone oscillator 180 to again conduct and reoperate relay 170 as previously described. Relay 170 causes the reoperation of relay 150, which in turn causes the release of relay 110 also as previously described. When the operator's plug is again inserted, relays 170 and 150 restore to transmit the class tone and relay 110 operates after an interval.

In operating, relay 110 opens the class tone circuit at contacts 111, removes the holding ground to the lower winding of relay 140 at the break contact of armature 112 and applies a multiple ground at the make contact of armature 112 for shunting the winding of relay

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130. Relay 140 however, holds operated over its upper winding to the CN conductor.

No further operations of the disclosed equipment take place for the present, since the extension of the desired call is under control of the operator and completed thereby in a well-known manner. The party at the calling paystation must deposit the required fee as requested by the operator before the talking connection is completed, with the fee being collected as it is deposited.

At the termination of conversation and responsive to both the calling party at the paystation hanging up and the operator removing her plug, the switching equipment restores in a well-known manner and ground is removed from the CN conductor also in a well-known manner. The release of the equipment in adapter 100 is the same as explained in detail in the section entitled "Incoming, or reverse charge, call." Briefly, the removal of ground on the CN conductor causes relays 130 to operate and 140 and 160 to restore in the named sequence. Slow-to-operate relay 120 next operates responsive to the operation of relay 130 for applying -110 volt potential to the line of paystation 5 to reset the apparatus therein to normal and open the circuit to relay 110. Relay 110 restores and in so doing shunts relay 130 so that this relay will restore. The restoration of relay 130 opens the circuit to release relay 120, which upon restoring removes the guarding ground from the CN conductor to allow relay CO in line circuit 10 to restore.

The line circuit 10 of paystation 5 and adapter 100 is now at normal and conditioned to handle future calls.

If the call is abandoned after it has reached the CLR trunk, but before the operator answers, relays 140, 150, 160 and 170 will be operated. When the ground and the superimposed alternating current signal disappear from the C conductor, relay 130 will operate immediately as described above, connecting the guarding ground to the CN conductor and opening the circuit to relay 160. Relays 160, 170 and 150 release in this order, with relay 150 completing a circuit to relay 110. Relay 110 operates and relay 140 restores immediately thereafter, with the remaining cycle of release being the same as described above.

Having described my invention, what is considered new and desired to have protected by Letters Patent will be pointed out in the appended claims.

What is claimed is:

1. In a telephone system, an adapter circuit, a paystation connected to said adapter circuit, a line circuit connected to said adapter circuit, an operator's position, a trunk circuit terminating at said operator's position, switching means operated responsive to the initiation of a call by said paystation for connecting with said line circuit, said switching means thereafter operated to seize said trunk circuit and extend a connection from said calling paystation to said operator's position, said connection including a pair of line conductors extending from said paystation to said operator's position, a control conductor also included in said connection extending between said adapter circuit and said trunk circuit, a source of signalling current at said trunk, means operated responsive to said seizure of said trunk for applying said signalling current to said control conductor, a source of high potential, first relay means including an oscillator operated responsive to receipt of said signalling current for applying said high potential to said pair of line conductors leading to said paystation to operate said paystation to a refund condition, second relay means controlled by said first relay means for causing said first relay means to remove said high potential from said line conductors, and third relay means operated responsive to said second relay means for reversing the said line conductors in said connection leading to said paystation, whereby the polarity is reversed thereto and said paystation is operated to a collect position before said connection is answered at said operator's position.

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2. In a telephone system, a paystation having a line adapter circuit individual thereto, a line circuit connected to said adapter, a circuit comprising a normally incomplete resistance bridge in said adapter, means in said adapter operated responsive to the line loop closure when a call is initiated by said paystation for completing said resistance bridge circuit to forward the said line loop closure to said line circuit, an operator's position, a trunk circuit terminating at said operator's position, means for extending said initiated call from said paystation to seize said trunk circuit and complete a connection thereover to said operator's position, a source of special signalling current at said trunk, means for applying said special current to said connection responsive to said seizure of said trunk, a source of control potential, refund initiating means operated responsive to receipt of said special current for applying said control potential to said connection leading to said paystation to initiate a refund operation thereat, means responsive to said refund initiating means for causing said refund initiating means to remove said control potential from said connection, and means operated responsive to said last-mentioned means for effecting a reversal of polarity in said connection to initiate a collect operation at said paystation before said connection is answered at said operator's position.

3. In a telephone system, a paystation, an adapter circuit individual thereto, a line circuit connected to said adapter, switching means having access thereto for extending desired connection, a trunk circuit accessible to said switching means, an operator's position terminating said trunk circuit, relay means in said line circuit, means in said adapter operated responsive to the initiation of a call by said paystation for operating said relay means, means responsive to the operation of said relay means for operating said switching means to connect with said line circuit, said switching means thereafter operated for extending said initiated call from said paystation to seize said trunk circuit and complete a connection thereover to said operator's position, a source of signalling current at said trunk circuit, means responsive to said seizure of said trunk circuit for applying said signalling current to said connection, a source of control potential at said adapter, means in said adapter operated responsive to receipt of said signalling current for applying said control potential to said connection to initiate a refund operation at said paystation, release means operated by said last-mentioned means for restoring said last-mentioned means to normal to remove said control potential from said connection, and means operated responsive to said release means for effecting a reversal of polarity in said connection to initiate a collect operation at said paystation before said connection is answered at said operator's position.

4. In a telephone system, a paystation, a line adapter circuit individual thereto, a line circuit, means for connecting said adapter circuit with said line circuit to individually connect said line circuit with said paystation, means for extending and completing calling connections to a plurality of different classes of called lines from said paystation; means operated responsive to the answering of a completed calling connection, in the event said calling connection is to a particular class of called line for operatively producing a collect condition at said paystation; a source of control potential in said adapter; means in said adapter operated responsive to the extension of a calling connection to a class of called line different than said particular class for applying said control potential to the connection leading to said paystation to operatively produce a refund condition thereat; means in said adapter also operated responsive to said extension, and before the answering of said different class calling connection, for operatively producing a collect condition at said paystation; and means in said adapter operated respon-

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sive to the termination of a calling connection, regardless of the class, for applying said control potential to the connection to said paystation for operatively restoring said paystation from said collect condition to a normal condition.

5. In a telephone system, a prepay-postpay type paystation normally in the prepay condition, an adapter circuit having a pair of line conductors connected to said paystation, an operator's position, a trunk circuit terminating at said operator's position, means responsive to the initiation of a call by said paystation for seizing said trunk circuit and extending a connection to said operator's position, said connection including an extension of said pair of line conductors from said adapter circuit to said operator's position, a control conductor also included in the said connection between said adapter circuit and said operator's position, a source of alternating current at said trunk circuit, means operated responsive to said seizure for connecting said source of alternating current to said control conductor, a control circuit, means in said control circuit operated in response to said initiation of said call for connecting said control circuit to said control conductor, a transistor in said control circuit rendered conductive in response to receipt of said alternating current for transmitting an output signal of amplified direct current, a normally ineffective resistance bridge and a source of high potential at said adapter circuit, control means operated responsive to receipt of said amplified direct current for opening said line conductors of said connection in said adapter circuit to thereafter connect said resistance bridge across said line conductor leading to said operator's position for maintaining said connection therewith and to connect said high potential to said line conductors leading to said paystation for initiating a refund operation thereat, restoring means operated responsive to said operation of said control means for restoring only certain of said control means to normal, said restoration of said control means thereby reclosing said line conductors and removing said resistance bridge and said high potential from said connection to said line conductors, reversing means operated responsive to said operation of said restoring means for reversing the connection of said line conductors leading to said paystation to initiate an operation thereat for converting said paystation from said normal prepay condition to said postpay condition, and means in said trunk circuit for thereafter removing said alternating current from said control conductor responsive to the answering of said initiated call at said operator's position to render said transistor non-conductive, whereby said remainder of said control means is restored to normal for conditioning said adapter to subsequent call supervision by way of said operator's position.

6. A telephone system such as claimed in claim 5, including means at said adapter for busy-guarding said extended connection by way of said control conductor, means operated responsive to said call being completed from said operator's position, and subsequently terminated, for removing said busy-guarding of said connection from said control conductor, and means operated responsive to said removal of said busy guarding for reoperating the said certain of said control means to reapply said high potential to said line conductors leading to said paystation to initiate an operation thereat for converting said paystation from said postpay condition back to said normal prepay condition.

7. A telephone system such as claimed in claim 5, including a source of special tone at said adapter, a normally incomplete tone circuit, means operated by said restoring means for closing a first point in said tone circuit, means operated responsive to said operation of said reversing means for closing another point in said tone circuit, and means operated responsive to said restoring of said remainder of said control means to normal, at the time said initiated call is answered to

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said operator's position, for completing said tone circuit by connecting said special tone to said extended connection, whereby said tone is transmitted over said connection to said operator's position as an indication thereto that said initiated call originated at said paystation.

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