

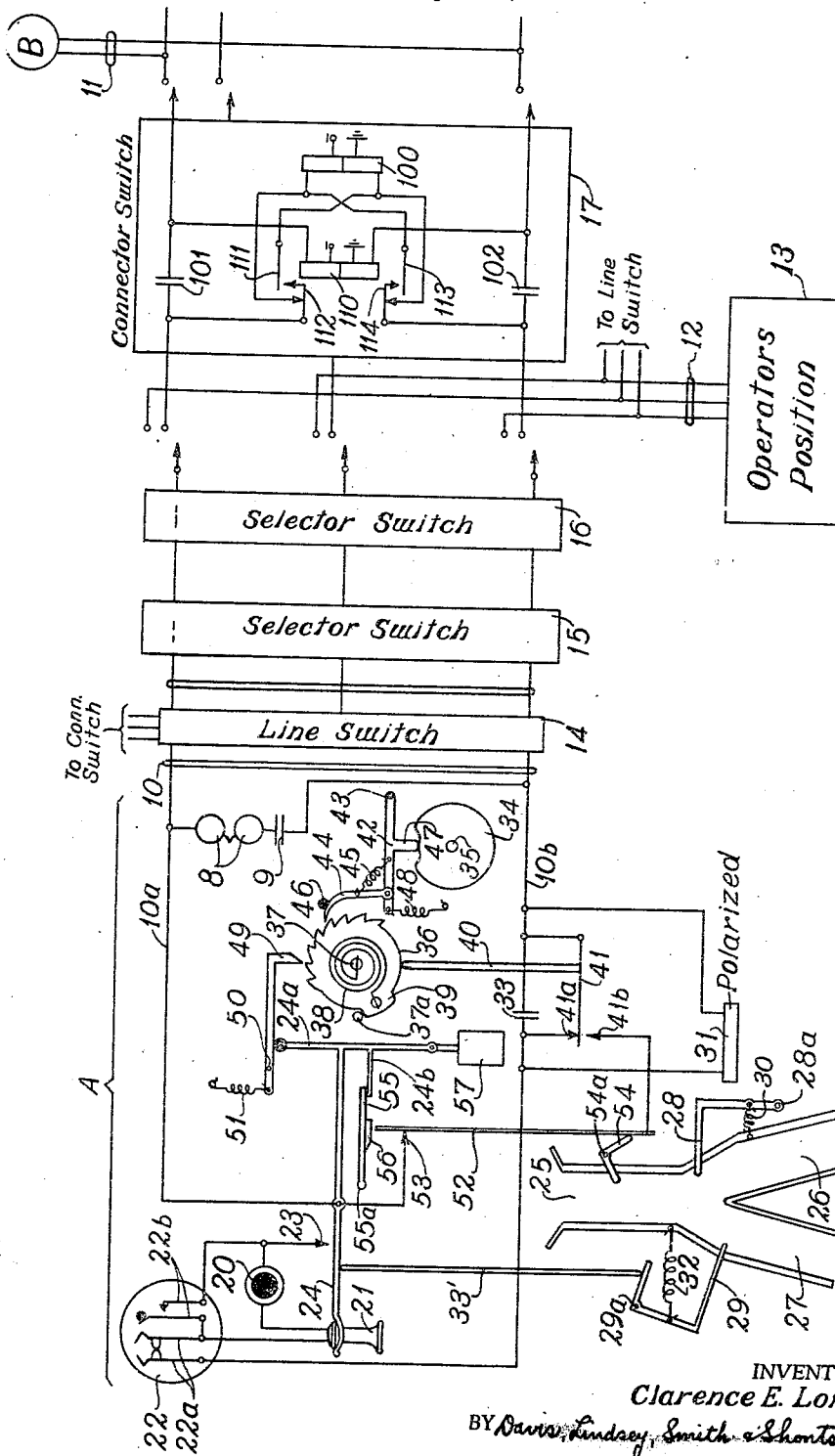
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TELEPHONE SUBSTATION APPARATUS

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TELEPHONE SUBSTATION APPARATUS

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The present invention relates to telephone substation apparatus of the paystation type and, more particularly, to improvements in automatic paystation apparatus of the character wherein a certain number of impulse digits may be transmitted from a paystation over its associated line without the deposit of a coin, thereby to permit certain specified calls to be made from the station, and the transmission of an unrestricted number of digits from the station is contingent upon the deposit of a coin.

When paystations of the general character briefly described above are incorporated in an automatic telephone system, the system switching apparatus may be so arranged that certain calls originating at the paystation may be rapidly and successfully completed without charge. For example, the automatic switching apparatus may be so arranged that calls originating at the paystations and intended for information operators, fire stations, and police stations may successfully be completed without coin deposits. This may be accomplished by arranging the switching apparatus so that directory numbers of only a few digits are assigned to the particular telephone stations which are to be reached without coin deposits at the paystations. As to all other substations of the system, the switching apparatus may be so arranged that several additional digits are required to complete connections thereto. Various paystation arrangements permitting this type of service have been previously developed, all of which are rather complicated in character and are restricted as to the coin collect and coin refund operations performed incident to the use of the apparatus in setting up regular substation connections.

It is an object of the present invention to provide improved substation apparatus of the character briefly described which is of simple and economical arrangement, is positive and reliable in its operation and is exceedingly simple to operate.

It is another object of the invention to provide improved substation apparatus of the character described wherein the coin collect and coin refund operations are automatically accomplished in a simple manner.

It is a further object of the invention to provide apparatus of the character described which is so arranged that fraudulent use of the apparatus is positively prevented.

In the illustrated embodiment of the invention, the usual means for receiving coins or the like and comprising a coin deposit channel, a coin

collect channel and a coin refund channel is provided, together with an impulsing or calling device and a hook or cradle switch which is operative from a normal position to an off-normal position to connect the impulsing device in a circuit including the line extending to the substation so that one or more impulses may be transmitted over the line during each operation of the impulsing device. The apparatus further comprises means controlled by the impulsing device for preventing impulses from being transmitted over the line after a predetermined number of operations of the impulsing device. Switching apparatus is also provided, operative in response to the deposit of a coin in the coin deposit channel of the coin receiving means, for rendering the above-mentioned impulse suppressing means ineffective to prevent the transmission of impulses over the line. In order automatically to obtain coin collection when a call routed from the station over the line is answered at the called station, there is provided a polarized electromagnetic device which includes a winding connected to be energized over a circuit, including the above-mentioned line, and operative only when current of a predetermined polarity traverses its winding; together with an armature controlled by the device for permitting a coin deposited and held in the deposit channel of the coin receiving means to pass into the coin collect channel. For the purpose of automatically refunding coins deposited during the initiation of calls which are not completed, there is provided an element operative in response to operation of the hook or cradle switch from its off-normal position to its normal position to permit a coin deposited and held in the coin deposit channel of the coin receiving means to pass into the coin refund channel. In order to prevent a user of the apparatus from fraudulently obtaining a refund of a deposited coin, there is also provided a slow-acting device which functions to retard movement of the hook switch from its normal position to its off-normal position. Thus, a user of the substation is prevented from obtaining a refund of a deposited coin without also releasing the switch train established incident to operation of the impulsing device. Further features of the invention pertain to the particular manner in which the elements described above are controlled and the manner in which the apparatus is completely restored to normal in response to operation of the hook or cradle switch from its off-normal position to its normal position.

The novel features believed to be characteristic of the invention are set forth with particularity in the appended claims. The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the specification taken in connection with the accompanying drawing in which the single figure illustrates an automatic telephone system having incorporated therein substation apparatus constructed and arranged in accordance with the present invention.

Referring now to the drawing, the automatic telephone system there illustrated comprises a plurality of lines, three of which are indicated at 10, 11, and 12 together with automatic switching apparatus for setting up connections between the lines. More particularly, the line 10 extends to an automatic substation A of the paystation type having incorporated therein the features of the invention as briefly outlined above, the line 11 extends to an automatic substation B of conventional arrangement, and the line 12 is one of a group of lines extending to an operator's position 13. This operator's position may, for example, be one of the information operators' telephone stations provided in the exchange housing the automatic switching apparatus. Alternatively, the equipment diagrammatically illustrated at 13, may represent a private branch exchange of the character conventionally provided in police or fire headquarters. The automatic switching equipment for setting up connections between the various lines of the system comprises the usual line switches, one of which is indicated at 14, individually associated with the various lines emanating from the exchange; a plurality of first selector switches one of which is indicated at 15; a plurality of second selector switches one of which is indicated at 16; and a plurality of connector switches one of which is indicated at 17 as having access to the subscribers' line 11. Preferably, the line switches corresponding to and including the switch 14, are of the well-known non-homing rotary type, while the first selector, second selector and connector switches are of the well-known Strowger type of which several commercial embodiments are available. Each of the selector and connector switches is arranged to be seized over a trunk line extending thereto, these trunk lines individually including a pair of talking or line conductors and a control or private conductor. In order more clearly to explain the operation of the apparatus provided at the substation A, a portion of the control equipment embodied in the connector switch 17 is illustrated in detail. More particularly, this control equipment comprises a line relay 100 which operates in response to seizure of the switch 17 and functions to repeat received impulses transmitted to this switch to the vertical and rotary magnets, not shown, conventionally provided in the switch. The indicated control equipment further comprises a battery reversing relay 110, which functions to reverse the direction of direct current flow over an established loop circuit extending to a calling substation when a call routed by way of the connector switch 17 is answered at the called substation. In this regard it is pointed out that the calling and called loop circuits, both extending to the connector switch 17 when a connection routed by way of this switch is completed, are separated by a conventional capacitance bridge comprising the condensers 101 and 102.

From the foregoing description relative to the arrangement of the switching equipment embodied in the system, it will be apparent that in order to establish a connection with one of the lines extending to the operator's position 13, a two-digit number, such for example, as the number 00, must be dialed at the substation at which the call originates. On the other hand, in order to route a connection from a calling substation through one of the connector switches of the system to one of the subscribers' lines, a four-digit number, such for example, as the number 1582, must be dialed at the calling substation. By virtue of this arrangement of the lines, it is possible, with the paystations of the system arranged in the manner hereinafter explained with reference to the substation A, to initiate calls at these paystations without coin deposits. Calls to be routed to the regular subscribers' lines and originating at the paystations can, however, only be completed after the paystation user makes the appropriate coin deposit.

Referring now more particularly to the substation A, the apparatus provided at this substation comprises a transmitter 20; a receiver 21; a dial operated impulsing device 22 including a shaft 35, pulsing springs 22a and shunt springs 22b; and a hook switch comprising a fixed contact 23 and a switchhook 24, this switchhook being operative from its normal position, as indicated in the drawing, to its off-normal position to engage the contact 23 and thus complete a loop circuit which extends by way of the line 10 to the line switch 14 associated with this line. There is also provided a signal device in the form of a bell 8 which is bridged across the conductors of the line 10 in series with a condenser 9. The apparatus further comprises coin receiving means which includes a coin deposit channel or chute 25 diverging into a coin collect channel or chute 26, and a coin refund channel or chute 27. For the purpose of selectively routing coins deposited in the coin deposit channel 25 into either of the coin collect and refund channels 26 and 27, respectively, there are provided two spring biased rocker arms 28 and 29 individually including fingers arranged to block the passage of a coin deposited in the channel 25 into the channels 26 and 27, respectively. The arm 28 is pivotally mounted at 28a and is biased to the coin blocking position by means of a spring 30. This arm is arranged to be rocked out of the coin blocking position to permit a coin deposited and held in the channel 25 to pass into the coin collect channel by means of a polarized electromagnetic device 31 of the permanent magnet type which includes a winding serially connected in one side of the line 10. This winding is bypassed for voice frequency currents through the provision of a capacitor 33 connected in shunt therewith. The other rocker arm 29, is pivotally mounted at 29a in any suitable manner and is biased to the coin blocking position by means of a spring 32. This arm is arranged to be rocked to a position which will permit the passage of a coin from the channel 25 into the coin refund channel 27 in response to operation of a link or plunger 33 which is controlled by operation of the switchhook 24.

As indicated above, the apparatus provided at the substation A is so arranged that only a predetermined number of impulse digits may be transmitted therefrom without the deposit of a coin in the coin deposit chute 25. To this end a cam 34 is mounted upon the main shaft 35 of the

impulsing device 22 and is arranged to drive step-by-step, at the rate of one step for each operation of the impulsing device 22, a ratchet wheel 36 which functions to control a circuit for effectively short circuiting the pulsing springs 22a of the impulsing device 22. More particularly, the ratchet wheel 36 is rotatably mounted upon a shaft 37 and carries a cam projection 39 which, in the normal position of the ratchet wheel is biased to engage a stop 37a under the influence of a coil spring 38. The cam projection 39 is adapted to engage a cam follower 40 when the ratchet wheel 36 is operated from its normal position to a predetermined off-normal position. The cam follower 40 is arranged directly to control a movable contact spring 41 which is commonly included in a path normally short circuiting the winding of the electromagnetic device 31 and the above-mentioned circuit for short circuiting the pulsing springs 22a of the impulsing device 22. In order to drive the ratchet wheel 36 in response to operation of the shaft 35 there is provided a ratchet and pawl mechanism which comprises a rocker arm 42 pivotally mounted at 43 and carrying at its free end a pawl 44 which is spring biased by means of a spring 45 into engagement with a stop 46. The rocker arm 42 has fixedly mounted thereon a cam follower 47 which is biased into engagement with the peripheral surface of the cam 34 by means of a spring 48. For the purpose of retaining the ratchet wheel 36 in its operated position following each step taken thereby, there is provided a retaining pawl 49 which is pivotally mounted at 50 and is biased to engage the teeth of the ratchet wheel 36 by means of a spring 51. This retaining pawl is normally retracted out of engagement with the teeth of the ratchet wheel 36 by providing an extension 24a of the switchhook 24; this extension being arranged to rock the retaining pawl 49 away from the teeth of the ratchet wheel 36 when the switchhook 24 is operated from its off-normal position to its normal position in response to replacement of the receiver 21 upon the switchhook 24.

In order to render the apparatus described in the preceding paragraph ineffective to prevent the transmission of impulses from the substation A when a coin is deposited in the coin deposit channel 25 of the coin receiving means, there is included in the above-mentioned circuit for short circuiting the springs 22a of the impulsing device 22, a cantilever mounted conductive spring 52 which normally engages an associated fixed contact 53 and is adapted to be moved out of engagement with the contact 52 in response to movement of a rocker arm 54, resulting from the deposit of a coin in the coin deposit channel 25. More particularly, the arm 54 is pivotally mounted at 54a and includes a finger projecting in the path of a coin deposited in the channel 25, so that it is rocked in a counter-clockwise direction to move the spring 52 out of engagement with the fixed contact 53 each time a coin is deposited in the channel 25. In order to retain the spring 52 in its operated position following operation of the rocker arm 54, there is provided a latching spring 55 having one end fixedly mounted at 55a and carrying intermediate its two ends a latch 56 which is adapted to cooperate with the free end of the spring 52 to retain this spring 52 in its operated position. The free end of the latching spring 55 cooperates with a second extension 24b of the switchhook 24 in a manner such that the spring is operated from its latching position to a position out of engagement with the spring 52 in re-

sponse to movement of the switch hook from its off-normal position to its normal position. In order to prevent the unauthorized refund of a coin deposited in the coin deposit channel 25 of the coin receiving means in the manner more fully explained hereinafter, there is associated with the switchhook 24 a slow-acting device in the form of a dashpot 57 which retards movement of the switchhook from its normal position to its off-normal position.

Referring now more particularly to the operation of the apparatus, in order to initiate a call at the substation A, the receiver 21 is first removed from its supporting hook 24 permitting this hook to be rotated clockwise into engagement with the fixed contact 23 under the influence of the biasing springs 51 and 32. During such rotary movement of the switchhook 24, the extension 24a is moved downward permitting the retaining pawl 49 to be rotated clockwise under the influence of the spring 51 to engage one of the teeth of the ratchet wheel 36. Also, the switchhook extension 24b is moved downward permitting the latch 56 carried by the spring 55 to be moved under the influence of this spring into engagement with the free end of the spring 52. In addition, the spring 32 rotates the rocker arm 29 counter-clockwise about its pivot point 29a so that the finger thereof is moved to a position for blocking the passage of a coin from the coin deposit channel 25 into the coin refund channel 27. When the switchhook 24 engages its associated fixed contact 23, a loop circuit is completed from the substation A to the line switch 14. This loop circuit may be partially traced as extending by way of the line conductor 10a, the switchhook 24, the contact 23, the transmitter 20, the receiver 21, the pulsing springs 22, the movable contact spring 41 and its associated fixed contact 41a, and the opposite line conductor 10b. When this loop circuit is completed, the line switch 14 operates in the usual manner to select an idle one of the first selector switches to which it has access and to mark the calling line 10 as busy in the bank contacts of the connector switches having access thereto. If it be assumed, for example, that the first selector switch 15 is the first available idle one of the switches accessible to the line switch 14, when the last-mentioned switch functions to test the condition of the trunk line extending to the switch 15 and finds the trunk line to be idle, it operates to switch the calling loop circuit through to this selector switch. The selector switch 15, in turn, responds to the extension of the calling loop circuit thereto by operating to condition itself to respond to the impulses of the first digit dialed at the calling substation A. The next operation performed by the calling party depends upon the character of the call. Thus, if the call is to be forwarded to a telephone station, such, for example, as that provided at the operator's position 13, terminating a line accessible to certain of the second selector switches, the calling party may proceed to dial the directory number of the desired station without depositing a coin in the coin receiving means. Alternatively, if the call is intended for a substation line, such, for example, as the line 11 which is accessible only to certain of the connector switches of the system, the calling party must deposit a coin in the coin receiving means before more than two digits are dialed during the dialing operation. Assuming, first, that the call initiated at the substation A is to be forwarded to the operator's position 13, the

calling party proceeds to operate the impulsing device 22 in accordance with the directory number designating the operator's position.

During each operation of the calling device 22, the shunt springs 22b are closed to complete an obvious path for short circuiting the series connected transmitter 20 and receiver 21, thus lowering the resistance of the loop circuit over which the impulses are transmitted to the automatic switching apparatus. Also, during each operation of the impulsing device 22, the cam 34 carried by the shaft 35 is rotated from its normal position, as shown in the drawing, to an off-normal position determined by the number of the digit dialed. This cam is rotated in a clockwise direction during the forward movement of the dial and, during such rotation, the cam follower 47 is raised to rotate the arm 42 in a clockwise direction thus causing the pawl 44 carried by this arm to engage one of the teeth of the ratchet wheel 36 and to rotate this ratchet wheel one step. During such rotation of the ratchet wheel, the retaining pawl 49 rides over the tooth of the ratchet wheel 36 which it engages and drops into engagement with the next succeeding tooth, thereby to retain the ratchet wheel in its operated position. During the return movement of the dial, the cam 34 is rotated back to its normal position, permitting the cam follower 47 to drop into the notch formed in the periphery of the cam 34 so that the arm 42 is returned to its normal position under the influence of the spring 43, thereby to condition the pawl mechanism to operate the ratchet wheel 36 a second step. Also, when the shaft 35 assumes its normal position at the end of the return movement of the dial, the shunt springs 22b are opened to interrupt the above-mentioned path for short circuiting the receiver 21 and the transmitter 20. The cycle of operations just described are repeated during each operation of the impulsing device 22. Thus, the ratchet wheel 36 is advanced one step in response to each operation of the impulsing device. Since the pulsing springs 22a of the impulsing device 22 are opened and closed one or more times during each operation of this device, current impulses are transmitted in the usual manner over the line 10 to the automatic switching apparatus terminating this line.

The selector switch 15 responds to the impulses of the first digit dialed by operating in a conventional manner to elevate its wipers opposite the level of bank contacts terminating the desired group of trunk lines. During the inter-digit pause between the first and second digits, this selector switch functions, also in a conventional manner, automatically to select a trunk line extending to an idle one of the second selector switches in the selected group, and to switch the calling loop circuit through to the selected second selector switch. Assuming, for example, that the second selector switch 16 is seized by the first selector switch 15, when the calling loop circuit is switched through to the switch 16, the switch is automatically conditioned to respond to the impulses of the second digit dialed at the calling substation A. The second selector switch 16 responds to the impulses of the second digit by operating to select a desired group of lines and thereafter to select an idle one of the selected group of lines in the exact manner just described with reference to the first selector switch 15. In the present case, the two digits dialed at the calling substation A will cause the connection to be routed through the selector switches 15 and 16 to

the group of lines including the line 12. Assuming that the line 12 is the first available idle line of this group, the selector switch 16 operates to seize this line and to switch the calling loop circuit through to the operator's position 13. In response to the last-mentioned operation, the trunk circuit apparatus terminating the line 12 at the operator's position 13 functions to impress ground potential upon the control or private conductor of the line 12, thereby to maintain the selector switches 15 and 16 operated in the usual manner and, also, to energize the signal device provided at the operator's position 13, thereby to indicate that an incoming call is present upon the line 12. When the operator answers the call, the desired conversational circuit is fully completed and the calling party may converse with the operator to obtain the service or information desired.

The release of the established connection is primarily under the control of the operator who answers the call at the operator's position 13. More particularly, when the calling party at the substation A replaces the receiver 21 upon the switchhook 24 at the end of the conversation, the calling loop circuit is interrupted and the operator attending the position 13 receives the usual disconnect signal and proceeds to clear out the connection. During the release of the trunk circuit apparatus terminating the line 12 at the operator's position, ground potential is removed from the control conductor of the line 12 and the operated automatic switches 15 and 16 are released in the usual manner. When the receiver 21 is replaced upon the hook 24, the weight of the receiver causes the switch-hook 24 to be rotated in a counter-clockwise direction back to its normal position. During such movement, the link 33' is moved downward under the influence of the switchhook 24 to rotate the rocker arm 29 in a clockwise direction against the bias of the spring 32, so that the finger portion thereof is moved out of the coin refund channel 27. In addition, the retaining pawl 49 is moved against the bias of the spring 51 in a counter-clockwise direction out of engagement with the teeth of the ratchet wheel 36 in response to the counter-clockwise movement of the switchhook 24, thus permitting the ratchet wheel to be returned to its normal position under the influence of the spring 38. During movement of the switchhook to its normal position, the extension 24b thereof is elevated to move the free end of the spring 55 so that the latch 56 carried thereby no longer engages the free end of the contact spring 52. Thus, the apparatus provided at the substation A is fully restored to normal.

In the foregoing explanation with reference to the call routed to the operator's position 13, the desired connection was successfully completed because the ratchet wheel 36 was not rotated a sufficient amount to affect movement of the movable spring 41 into engagement with the contact 41b. If, however, the calling party attempts to dial more than two digits without depositing a coin in the coin deposit channel 25 of the coin receiving means, the ratchet wheel 36 is rotated a sufficient amount, upon the third operation of the impulsing device 22, to bring the cam projection 39 into engagement with the cam follower 40 so that the movable contact spring 41 is moved out of engagement with its associated contact 41a and into engagement with its associated contact 41b. As a result, the path normally short-circuiting the winding of the electromagnetic device 31 is interrupted, thereby serially

to include this winding in the calling loop circuit, and the pulsing springs 22a are effectively excluded from the loop circuit extending to the automatic switching equipment; thus preventing further impulses from being transmitted from the substation A over the line 10 to the automatic switching apparatus. The direction of current flow over the calling loop circuit is such that the polarized electromagnetic device 31 does not operate at this time. More specifically, engagement of the contact spring 41 with the contact 41b, effects the closure of the previously mentioned path for effectively short-circuiting the pulsing springs 22a. This path may be traced as extending from the line conductor 10a by way of the contact 53, the spring 52, the contact 41b and the contact spring 41 to the opposite line conductor 10b. As a consequence of the completion of this path, a connection cannot be extended beyond the second selector switch 16 regardless of the number of operations of the impulsing device 22. It will be apparent, therefore, that a calling party at the substation A is positively prevented from obtaining connections to the regular substations of the system without first depositing a coin in the coin receiving means.

During ordinary use of the substation A, wherein the calling party first removes the receiver 21 from the switchhook 24, then inserts a coin in the coin deposit channel 25 of the coin receiving means and thereafter dials the digits of the directory number designating the desired substation, the above-traced circuit for short-circuiting the pulsing springs 22a of the impulsing device 22 is not completed. More particularly, when a coin is deposited in the coin duct 25 following operation of the switchhook 24 to its off-normal position, the rocker arm 54 is rotated in a counter-clockwise direction to move the free end of the spring 52 to the right a sufficient amount so that the latching element 56 is moved downward under the influence of the spring 55 to latch the spring 52 in a position out of engagement with the contact 53. Hence, when thereafter and during the dialing operation, the movable contact spring 41 is moved out of engagement with its associated spring 41a and into engagement with its associated spring 41b, the previously traced path short-circuiting the pulsing springs 22a is not completed. It is noted, however, that this operation on the part of the movable spring 41 interrupts the path normally short-circuiting the operating winding of the electromagnetic device 31, thereby serially to include this winding in the established loop circuit extending to the automatic switching apparatus. It is noted further that with the switchhook 24 occupying its off-normal position, the rocker arm 29 is moved to its coin blocking position so that the deposited coin is held in the duct 25 between the coin retaining fingers of the two arms, 28 and 29.

If it be assumed, for example, that the call under consideration is to be routed to the substation B associated with the line 11 and, further, that the connector switch 17 is seized by the selector switch 16 at the end of the second digit dialed at the substation A, the indicated selector switch 16 operates to switch the calling loop circuit through to the connector switch 17, whereby the line relay 100 of this connector switch is energized and operates. The manner in which the line relay 100 functions to repeat the impulses of the third and fourth digits dialed at the substation A to the vertical and rotary magnets of

the connector switch 17 to cause the wipers of this switch to be positioned in engagement with the contacts terminating the conductors of the desired line 11, is entirely conventional. Following the selection of the called line 11, this line is tested in the usual manner to determine the idle or busy condition thereof and if found busy, the usual busy tone signal is returned to the calling party. On the other hand, if the called line is idle, the control apparatus of the connector switch 17 functions in a well-known manner to project ringing current thereover and to return the usual ring back tone signal to the calling party. When the call is answered at the called substation, a direct current bridge is placed across the line conductors of the line 11 and a loop circuit is completed for energizing the called party answer or battery reversing relay 110. When energized over this loop circuit, the relay 110 operates its armatures 111 to 114, inclusive, to reverse the direction of current flow over the loop circuit extending to the calling substation A. Following operation of the relay 110, the direction of current flow through the operating winding of the polarized electromagnetic device 31 is such that the electromagnetic device 31 operates to attract the rocker arm 28 thereby to move the coin blocking finger of this arm to a position such that the coin held in the duct 25 is permitted to pass through the coin collect channel 26 to a coin receiving box. Simultaneous with the last-mentioned operation, the desired conversational circuit between the calling and called substations is completed. At the end of the conversation and when the connection is cleared out at the called substation B, the connector switch 17 is released and the battery reversing relay 110 restores to again reverse the direction of current flow over the calling loop circuit with the result that the electromagnetic device 31 is released to permit the rocker arm 28 to be restored to its normal position under the influence of the spring 30. The remaining steps in the release of the apparatus are exactly the same as set forth previously with reference to the call routed to the operator's position 13.

In the event the called line 11 is busy at the time it is selected by the connector switch 17, or the calling party at the substation A abandons the call before it is answered, the polarized electromagnetic device 31 is not caused to operate and the deposited coin held in the coin deposit duct 25 is returned to the calling party when the receiver 21 is replaced upon the switchhook 24. More particularly, when the switchhook 24 is returned to its normal position, the link 33' is moved downward to rotate the rocker arm 29 in a clockwise direction so that the coin blocking finger thereof is moved out of the coin refund channel 27 to permit the deposited coin to pass through this channel to the coin refund pocket conventionally provided in substations of the pay station type.

From the preceding explanation it will be understood that the calling party might, by momentarily depressing the switchhook 24, obtain the refund of the deposited coin. It will also be apparent that if the switchhook were operated from its off-normal position to its normal position and back to its off-normal position with sufficient rapidity, a refund of the deposited coin might be obtained without releasing the operated switch train through which the connection is routed to the called substation. In order to obviate this difficulty, the slow-acting device or

dashpot 57 is provided, this device functioning to retard movement of the switchhook 24 from its normal to its off-normal position. Thus, when the switchhook is depressed from its off-normal position to its normal position and then released, the device 57 retards the movement of the switch hook sufficiently so that the calling loop circuit is maintained interrupted at the contact 23 for a time interval greater than the interval required for the release of the operated switch train. By virtue of this arrangement, a user of the apparatus provided at the substation A is precluded from obtaining a connection and thereafter fraudulently obtaining a refund of the deposited coin.

On a call incoming to the substation A, the signal device 8 is energized by ringing current projected over the line 10 shortly following seizure of this line by the operated connector switch through which the call is routed. To answer the call, the receiver 21 is removed from its supporting hook 24 to establish the previously traced direct current bridge across the conductors of the line 10. When this bridging path is completed the connector switch, through which the connection extends, operates to terminate the ringing operation and to establish the desired talking circuit in the usual manner. In this case the partial operation of the coin collecting and call restricting apparatus is without effect, all of the elements of this apparatus being fully restored to normal in an obvious manner when the receiver 21 is replaced upon the switchhook 24 at the end of the conversation.

While there has been described what at present is considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is contemplated to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A telephone substation adapted to be connected to a telephone line and comprising, in combination, means for receiving coins or the like and including a coin deposit channel and a coin collect channel, an impulsing device adapted to be connected in a circuit including said line to transmit one or more impulses over said line during each operation of said device, means controlled by said impulsing device for preventing impulses from being transmitted from said substation over said line after a predetermined number of operations of said device, means responsive to the deposit of a coin in said coin deposit channel for rendering said last-named means ineffective to prevent the transmission of impulses over said line, a polarized electromagnetic device including a winding connected to be energized over a circuit including said line and operative only when current of a predetermined polarity traverses said winding, means controlled by said electromagnetic device for permitting a coin deposited in said deposit channel to pass into said coin collect channel, a path normally short-circuiting said winding, and means operative after said predetermined number of operations of said impulsing device for interrupting said path.

2. A telephone substation adapted to be connected to a telephone line and comprising, in combination, means for receiving coins or the like and including a coin deposit channel and a coin collect channel, an impulsing device adapted to be connected in a circuit including said line and operative to transmit one or more

impulses over said line during each operation thereof, an element operative to a predetermined position in response to a predetermined number of operations of said device, a circuit completed in response to operation of said element to said predetermined position to prevent impulses from being transmitted from said substation over said line, a switch operative to interrupt said circuit in response to the deposit of a coin in said coin deposit channel, a polarized electromagnetic device including a winding connected to be energized over a circuit including said line and operative only when current of a predetermined polarity traverses said winding, means controlled by said electromagnetic device for permitting a coin deposited in said deposit channel to pass into said coin collect channel, a path normally short-circuiting said winding, and means responsive to operation of said element to said predetermined position for interrupting said path.

3. A telephone substation adapted to be connected to a telephone line and comprising, in combination, means for receiving coins or the like and including a coin deposit channel and a coin collect channel, an impulsing device adapted to be connected in a circuit including said line and operative to transmit one or more impulses over said line during each operation thereof, a hook or cradle switch having a normal position and operative to an off-normal position to complete said circuit, an element having a normal position and operative to a predetermined off-normal position in response to a predetermined number of operations of said impulsing device, means responsive to operation of said element to said predetermined off-normal position for preventing impulses from being transmitted from said substation over said line, means responsive to the deposit of a coin in said coin deposit channel for rendering said last-named means ineffective to prevent the transmission of impulses over said line, a polarized electromagnetic device including a winding connected to be energized over a circuit including said line and operative only when current of a predetermined polarity traverses said winding, means controlled by said electromagnetic device for permitting a coin deposited in said deposit channel to pass into said coin collect channel, means operative to cause said element to be returned to its normal position in response to operation of said hook switch from its off-normal position to its normal position, and means comprising a slow-acting device for retarding movement of said hook switch from its normal position to its off-normal position.

4. A telephone substation adapted to be connected to a telephone line and comprising, in combination, means for receiving coins or the like and including a coin deposit channel and a coin collect channel, an impulsing device adapted to be connected in a circuit including said line and operative to transmit one or more impulses over said line during each operation thereof, a hook or cradle switch having a normal position and operative to an off-normal position to complete said circuit, an element having a normal position and operative to a predetermined off-normal position in response to a predetermined number of operations of said impulsing device, a circuit completed in response to operation of said element to said predetermined off-normal position to prevent impulses from being transmitted from said substation

over said line, a second switch having a normal position and operative to an off-normal position to interrupt said circuit in response to the deposit of a coin in said coin deposit channel, a polarized electromagnetic device including a winding connected to be energized over a circuit including said line and operative only when current of a predetermined polarity traverses said winding, means controlled by said electromagnetic device for permitting a coin deposited in said deposit channel to pass into said coin collect channel, and means operative to cause said second switch to be returned to its normal position in response to operation of said hook switch from its off-normal position to its normal position.

5. A telephone substation adapted to be connected to a telephone line and comprising, in combination, means for receiving coins or the like and including a coin deposit channel and a coin collect channel, an impulsing device adapted to be connected in a circuit including said line and operative to transmit one or more impulses over said line during each operation thereof, a hook or cradle switch having a normal position and operative to an off-normal position to complete said circuit, an element having a normal position and operative to a predetermined off-normal position in response to a predetermined number of operations of said impulsing device, a circuit completed in response to operation of said element to said predetermined off-normal position to prevent impulses from being transmitted from said substation over said line, a second switch having a normal position and operative to an off-normal position to interrupt said circuit in response to the deposit of a coin in said coin deposit channel, a polarized electromagnetic device including a winding connected to be energized over a circuit including said line and operative only when current of a predetermined polarity traverses said winding, means controlled by said electromagnetic device for permitting a coin deposited in said deposit channel to pass into said coin collect channel, means operative to cause said second switch to be returned to its normal position in response to operation of said hook switch from its off-normal position to its normal position, and means operative to cause said element to be returned to its normal position in response to operation of said hook switch from its off-normal position to its normal position.

6. A telephone substation adapted to be connected to a telephone line and comprising, in combination, means for receiving coins or the like and comprising a coin deposit channel, a coin refund channel and a coin collect channel, an impulsing device adapted to be connected in a circuit including said line and operative to transmit one or more impulses over said line during each operation thereof, a hook or cradle switch having a normal position and operative to an off-normal position to complete said circuit, an element having a normal position and operative to a predetermined off-normal position in response to a predetermined number of operations of said impulsing device, means responsive to operation of said element to said predetermined off-normal position for preventing impulses from being transmitted from said substation over said line, means responsive to the deposit of a coin in said coin deposit channel for rendering said last-named means ineffective to prevent the

transmission of impulses over said line, a polarized electromagnetic device including a winding connected to be energized over a circuit including said line and operative only when current of a predetermined polarity traverses said winding, means controlled by said electromagnetic device for permitting a coin deposited in said deposit channel to pass into said coin collect channel, means operative in response to operation of said hook switch from its off-normal position to its normal position for permitting a coin deposited in said coin deposit channel to pass into said coin refund channel, and means comprising a slow-acting device for retarding movement of said hook switch from its normal position to its off-normal position.

7. A telephone substation adapted to be connected to a telephone line and comprising, in combination, means for receiving coins or the like and comprising a coin deposit channel, a coin refund channel and a coin collect channel, an impulsing device adapted to be connected in a circuit including said line and operative to transmit one or more impulses over said line during each operation thereof, a hook or cradle switch having a normal position and operative to an off-normal position to complete said circuit, an element having a normal position and operative to a predetermined off-normal position in response to a predetermined number of operations of said impulsing device, means responsive to operation of said element to said predetermined off-normal position for preventing impulses from being transmitted from said substation over said line, means responsive to the deposit of a coin in said coin deposit channel for rendering said last-named means ineffective to prevent the transmission of impulses over said line, a polarized electromagnetic device including a winding connected to be energized over a circuit including said line and operative only when current of a predetermined polarity traverses said winding, means controlled by said electromagnetic device for permitting a coin deposited in said deposit channel to pass into said coin collect channel, means operative in response to operation of said hook switch from its off-normal position to its normal position for permitting a coin deposited in said coin deposit channel to pass into said coin refund channel, means operative to cause said element to be returned to its normal position in response to operation of said hook switch from its off-normal position to its normal position, and means comprising a slow-acting device for retarding movement of said hook switch from its normal position to its off-normal position.

8. A telephone substation adapted to be connected to a telephone line and comprising, in combination, means for receiving coins or the like and comprising a coin deposit channel, a coin refund channel and a coin collect channel, an impulsing device adapted to be connected in a circuit including said line and operative to transmit one or more impulses over said line during each operation thereof, a hook or cradle switch having a normal position and operative to an off-normal position to complete said circuit, an element having a normal position and operative to a predetermined off-normal position in response to a predetermined number of operations of said impulsing device, a circuit completed in response to operation of said element to said predetermined off-normal position to prevent impulses from being transmitted from said substation over said line, a second switch having a normal posi-

tion and operative to an off-normal position to interrupt said circuit in response to the deposit of a coin in said coin deposit channel, a polarized electromagnetic device including a winding connected to be energized over a circuit including said line and operative only when current of a predetermined polarity traverses said winding, means controlled by said electromagnetic device for permitting a coin deposited and held in said coin deposit channel to pass into said coin collect channel, means operative in response to operation of said hook switch from its off-normal position to its normal position for permitting a coin deposited in said coin deposit channel to pass into said coin refund channel, and means operative to cause said second switch to be returned to its normal position in response to operation of said hook switch from its off-normal position to its normal position.

9. A telephone substation adapted to be connected to a telephone line and comprising, in combination, means for receiving coins or the like and comprising a coin deposit channel, a coin refund channel and a coin collect channel, an impulsing device adapted to be connected in a circuit including said line and operative to transmit one or more impulses over said line during each operation thereof, a hook or cradle switch having a normal position and operative to an off-normal position to complete said circuit, an element having a normal position and operative to

a predetermined off-normal position in response to a predetermined number of operations of said impulsing device, a circuit completed in response to operation of said element to said predetermined off-normal position to prevent impulses from being transmitted from said substation over said line, a second switch having a normal position and operative to an off-normal position to interrupt said circuit in response to the deposit of a coin in said coin deposit channel, a polarized electromagnetic device including a winding connected to be energized over a circuit including said line and operative only when current of a predetermined polarity traverses said winding, means controlled by said electromagnetic device for permitting a coin deposited in said coin deposit channel to pass into said coin collect channel, means operative in response to operation of said hook switch from its off-normal position to its normal position for permitting a coin deposited in said coin deposit channel to pass into said coin refund channel, means operative to cause said second switch to be returned to its normal position in response to operation of said hook switch from its off-normal position to its normal position, and means operative to cause said element to be returned to its normal position in response to operation of said hook switch from its off-normal position to its normal position.

CLARENCE E. LOMAX.