

Aug. 31, 1937.

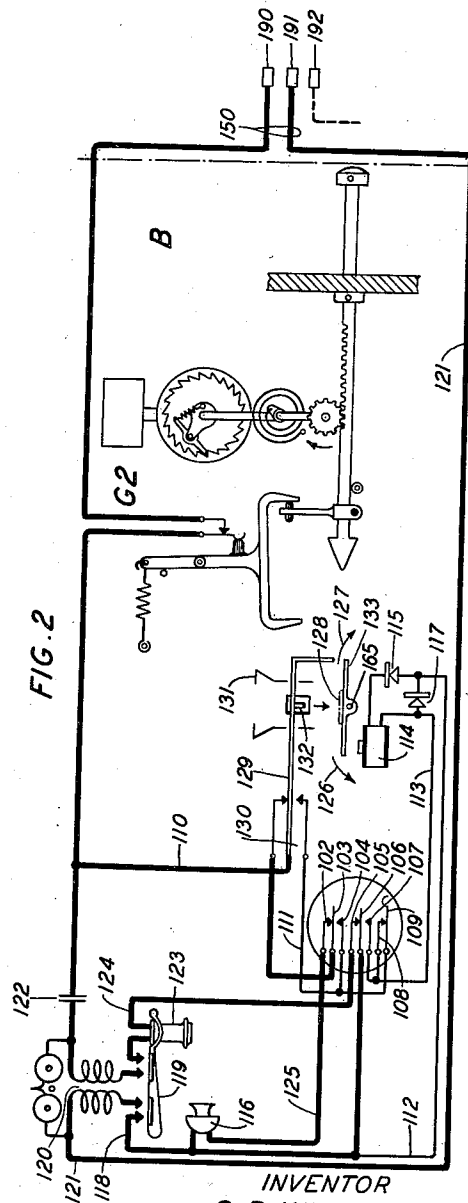
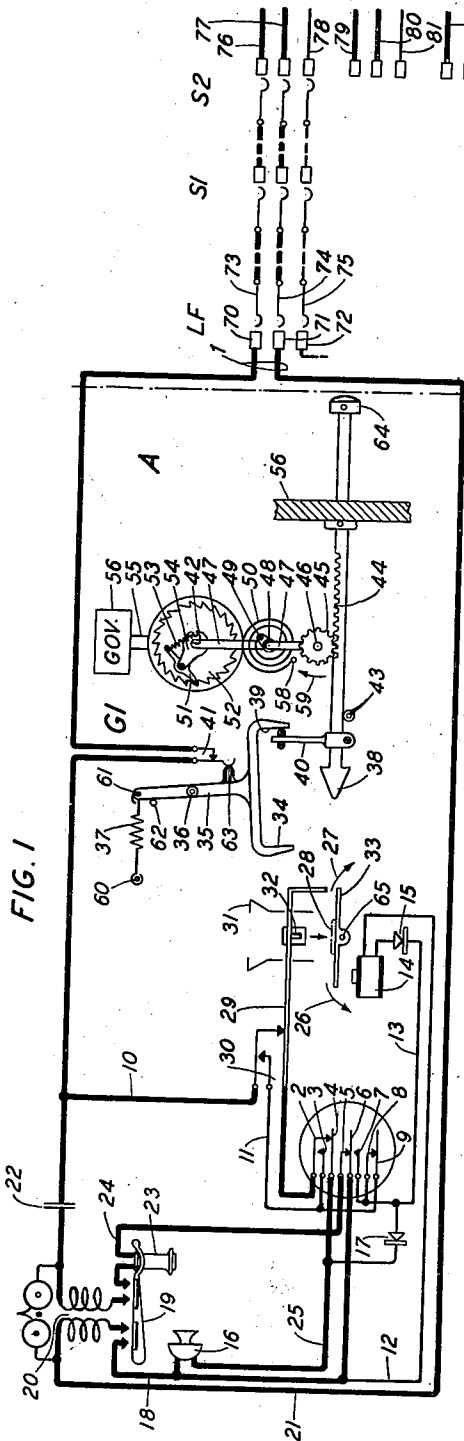
S. B. WILLIAMS

2,091,541

TELEPHONE SYSTEM

Filed April 18, 1935

3 Sheets-Sheet 1



INVENTOR
S. B. WILLIAMS
BY *M. R. McKenney*
ATTORNEY

Aug. 31, 1937.

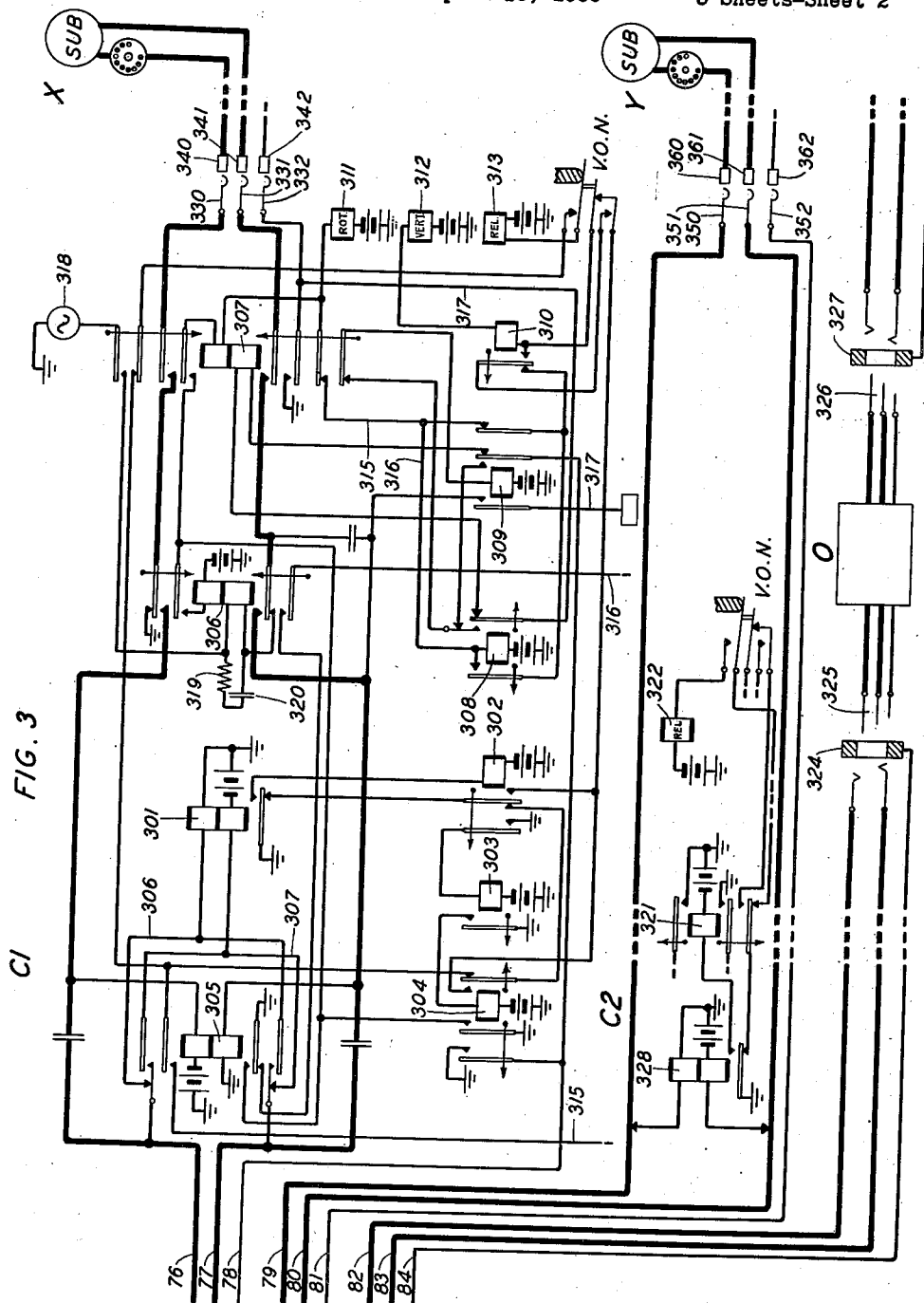
S. B. WILLIAMS

2,091,541

TELEPHONE SYSTEM

Filed April 18, 1935

3 Sheets-Sheet 2



INVENTOR
S. B. WILLIAMS
BY *W. P. McFerry*
ATTORNEY

Aug. 31, 1937.

S. B. WILLIAMS

2,091,541

TELEPHONE SYSTEM

Filed April 18, 1935

3 Sheets-Sheet 3

FIG. 4

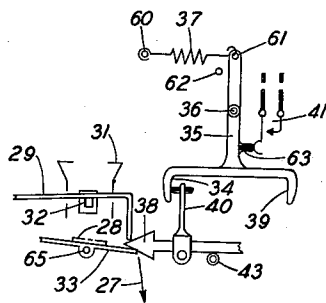


FIG. 5

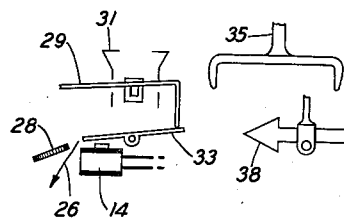
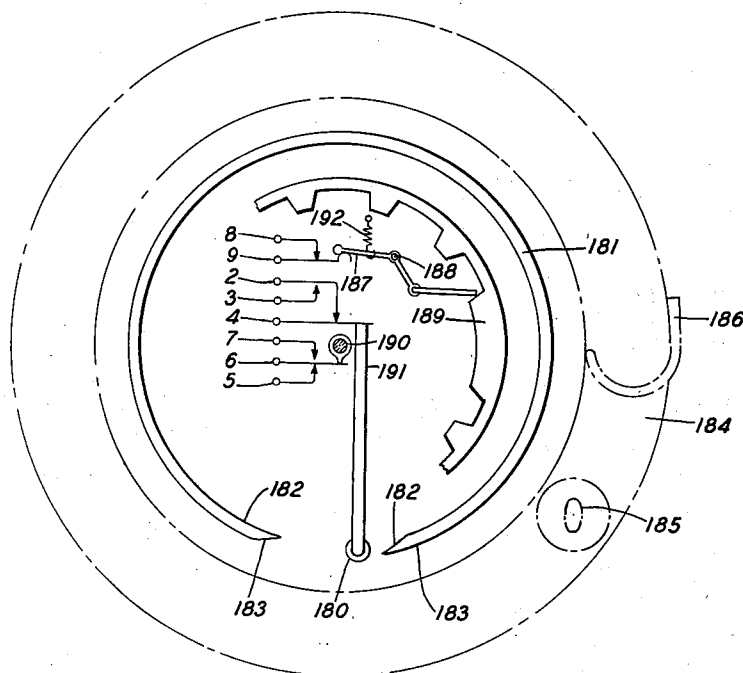


FIG. 6



INVENTOR
S. B. WILLIAMS

BY *John McKenney*
ATTORNEY

UNITED STATES PATENT OFFICE

2,091,541

TELEPHONE SYSTEM

Samuel B. Williams, Brooklyn, N. Y., assignor to
Bell Telephone Laboratories, Incorporated,
New York, N. Y., a corporation of New York

Application April 18, 1935, Serial No. 16,947

13 Claims. (Cl. 179-6.31)

This invention relates to telephone systems and particularly to those having coin-controlled stations.

The objects of the invention are to extend the range of service available to patrons of coin stations; to enable them to call different classes of lines without assistance of an operator; to enable them to refund coins deposited for the purpose of making free calls; and to otherwise improve systems of this character.

It has been the practice heretofore to equip coin-controlled stations with dials to enable the patron to complete certain calls without the assistance of an operator. In some of these prior systems, if he wishes to make a long distance call or a call to a free line, he must deposit a coin to obtain the service of the operator, and in other systems he may, without depositing a coin, obtain her assistance by dialing a particular number.

A feature of the present invention is to improve these prior arrangements by means of a system in which the coin station is equipped with a device so that the patron may refund his deposited coin at any time, and which system is so arranged that he may refund his coin without releasing the connection if he has called a free line, but, if he attempts to recover the coin on a call to a line for which a coin should be collected, the connection is automatically released. To this end the free lines are segregated in special final switches which are provided with timing devices to delay the release of the coin at the calling station and the reclosure of the line to hold the connection.

A further feature is a refund key at the coin station so constructed that it not only refunds the coin when actuated but opens the line and then recloses it after a measured interval of time.

These and other features of the invention will be described more fully in detail in the following specification which should be taken in connection with the accompanying drawings.

Referring to the drawings:

Fig. 1 shows in a diagrammatic form a coin station A and a line 1, a line-finder LF having access to the line 1, a first selector switch S1, and a second selector switch S2.

Fig. 2 shows in diagrammatic form an alternative coin station B and a line 150 to which the line-finder LF may have access.

Fig. 3 shows a connector switch C1 wired in accordance with this invention and having access

to any called subscriber station such as X, a connector switch C2 of a type well known to the art and having access to any called substation such as Y, and a circuit to an intercepting operator's position 0 also wired in a manner well known to the art and which gives an indication to an intercepting operator who may complete the call.

Figs. 4 and 5 show details of the coin return mechanism of Figs. 1 and 2 in the different operated positions. The numerical designations correspond with those shown in Fig. 1.

Fig. 6 shows in diagrammatic form the special dial used in Fig. 1. The numerical designations of the springs correspond to those of the dial shown in Fig. 1.

It is to be understood that the invention is not limited to the use of the particular apparatus shown in the drawings, as the apparatus and the circuits may be changed or modified in order to perform the desired circuit functions. Only such parts of the circuits as are necessary to illustrate the invention have been shown.

Substation A, in addition to the usual receiver and transmitter, comprises a special coin collect mechanism consisting of contact springs 30, a coin chute 31, a coin trigger 32, a coin trigger lever 29, a coin trap 33, a non-polarized coin magnet 14, and a copper oxide rectifier 15. Substation A has also a special governor and coin return mechanism G1 whereby the calling subscriber may return his coin when making a free call. This coin return mechanism G1 consists of a coin return button 64 attached to coin return lever 38. One end of coin return lever 38 to which is attached return button 64 protrudes from the frame 56 of the coin box and the other end rests on roller 43 and has lever arm 40 suitably attached. Associated with lever arm 40 is a T-arm 35 pivoted at 36. The T-arm 35 has a spring 37 suitably attached at one end 61. The other end of the spring 37 is attached to a pin 60 on the frame of the coin box. In the normal position T-arm 35 rests against the stop 62, and the control springs 41 are closed as shown in Fig. 1. Associated with the coin return lever 38 is a gear wheel 45 which is attached to the end 46 of a shaft 47. Adjacent to the gear wheel 45 is a spiral spring 50 one end of which is attached to the frame of the coin box and the other end of which is attached to a link 48 which in turn is suitably attached to shaft 47. At the other end of shaft 47 is attached a lever arm 54 associated with a ratchet 51. Ratchet 51 is actuated by a helical spring 53. Associated with ratchet 51

is a ratchet wheel 52 which in turn is connected to governor 56 by means of shaft 55.

In addition to this apparatus, substation A has a special dial in order to prevent the calling substation A from dialing any digit other than 0 without depositing a coin in the coin mechanism. This dial is shown diagrammatically in Fig. 6, and its outward appearance is similar to that of any standard dial. It has a finger wheel 184, a number plate 185 and a finger stop 186. The interior of the dial has a special construction and consists of contact springs 2 to 9 inclusive, a cam 190 which rotates in unison with the finger wheel 184, a lever arm 191 which has a roller 180 conveniently attached at one end and which joins spring 4 so that any movement of lever arm 191 is transmitted to spring 4, a collar 181 having an inner surface 182 and an outer surface 183, a pulse pawl 187, a pulse pawl spring 192 and a pulse wheel 189. When the finger wheel 184 is moved from its normal position the cam 190 moves in a clockwise direction and permits springs 6 and 7 to make contact and springs 6 and 5 to break contact. As soon as the finger wheel 184 is moved in a clockwise direction, roller 180 on lever arm 191 will contact with the surface 182 of collar 181 and move lever arm 191 in such a manner as to keep springs 2 and 4 from breaking contact and springs 2 and 3 from making contact until the digit 0 has been completely dialed, when the roller 180 will drop from surface 182 of collar 181 and permit spring 2 to make contact with spring 3 and spring 4 to break contact with spring 2. When the finger wheel 184 is released the roller 180 on lever arm 191 will contact with surface 183 of collar 181 in such a manner as to hold springs 2 and 4 open and springs 2 and 3 closed until the finger wheel 184 has restored to its normal position where the lever arm 191 again assumes its normal position as shown in Fig. 6. The pulsing springs 8 and 9 are operated in the usual manner by pulse pawl 187 which is pivoted at 188 and actuated under control of the pulse wheel 189 and the pulse pawl spring 192.

The finder LF, the selectors S1 and S2, and the connectors C1 and C2 are in general of the well-known type, such as the Strowger switch, except for circuit modifications made in connector C1 in accordance with this invention. Other types of switches may be used if desirable.

Referring to Fig. 1, let us assume that a party at the calling substation A removes the receiver 23 from the switchhook 19 to make a call to the subscriber of line X. In this case payment is not required, although a coin must be deposited temporarily to enable him to make the call. When the receiver 23 is removed from the switchhook 19 a metallic loop circuit will be closed through substation A from terminal 70, over line 1, conductor 10, the back contacts of contact springs 30, springs 3 and 4 of the dial, conductor 25, transmitter 16, conductor 18, the left contacts of switchhook 19, the left winding of induction coil 20, conductor 21, line 1 to terminal 71. A receiving circuit will be closed from conductor 10, through condenser 22, the right winding of induction coil 20, the right contacts of switchhook 19, receiver 23, conductor 24, contact springs 5 and 6 of the dial to conductor 18.

The brushes 73 and 74 of the line finder LF will connect with the terminals 70 and 71, in a manner well known to the art, and extend the metallic loop circuit of substation A described above through to a selector switch S1. The se-

lector switch S1 will function to send dial tone to the calling substation A and to place negative battery on conductor 21 and ground on conductor 10 of the metallic loop circuit of substation A.

Under these circumstances dial tone will be heard in the receiver 23 of substation A. If no coin has been deposited at the calling substation A, the contact springs 30 of the coin mechanism of substation A will not operate and since contact springs 2 and 3 of the dial will not make contact when any digit other than 0 is dialed the pulsing circuit will not be closed through. This prevents dialing from the calling substation A until a coin is deposited in coin chute 31 of the coin mechanism.

If on or before receiving the dial tone, the calling party deposits a coin 28 in the coin chute 31, the coin 28 will pass through the coin chute 31 to the coin trap 33 thereby operating the coin trigger 32 which in turn will allow the coin trigger lever 29 to operate. Operation of the coin trigger lever 29 will cause the contact springs 30 to function closing the front contacts and opening the back contacts of said contact springs 30. Opening of the back contacts will open the transmitter circuit. Closure of the front contacts of springs 30 will close a loop circuit through conductor 11, the pulsing springs 8 and 9 of the dial, conductor 13, thence in parallel, one path leading to copper oxide rectifier 15, winding of coin magnet 14, conductor 12 to conductor 18, and the other path leading from conductor 13, rectifier 17, transmitter 16 to conductor 18. The copper oxide rectifiers 15 and 17 are unipolarity devices which will not permit current to pass through in the direction opposite to that indicated by the symbolic arrowhead. Therefore, coin magnet 14 will not operate. However, current does flow over the loop and through the path including rectifier 17. This holds the switches while the dial is in its normal position. When the dial is moved from normal to send a digit, it completes the pulsing circuit through from conductor 10 to conductor 11, pulsing springs 8 and 9 of the dial, off normal springs 6 and 7 of the dial, conductor 13, the left contacts of switchhook 19, the left winding of induction coil 20 to conductor 21. Contact springs 2, 3 and 4 of the dial will not operate when a digit other than 0 is dialed. As the dial is moved off-normal, contact springs 5 and 6 of the dial break contact to open the receiver circuit and contact springs 6 and 7 make contact to place a short circuit around the coin magnet 14 and at the same time to close the pulsing circuit to conductor 18. The dial is then operated and released in the usual manner causing the selector S1 and the selector S2 to function in a manner well known to the art.

Assume that selector S2 seizes connector C1 thereby closing the subscriber loop of substation A from brush 73 of line finder LF to conductor 76 of connector C1, the upper back contact of relay 305, conductor 306, the upper winding of relay 301 to ground, positive grounded battery, the lower winding of relay 301, conductor 307, the lower outer back contact of relay 305, conductor 78 to brush 71 of line finder LF. Closure of this loop circuit causes relay 301 to become energized and close its front contact, thereby closing a circuit from ground through the front contact of relay 301, winding of slow-to-release relay 302 to battery. Relay 302 becomes energized and closes a circuit from ground through the left outer front contact of relay 302, winding of slow-to-release relay 303 to battery. Relay 303

becomes energized and closes a circuit from ground through the left front contact of relay 303, winding of slow-to-release relay 304 to battery. Relay 304 becomes energized and closes a circuit from ground through the left outer front contact of relay 304 to the sleeve conductor 78 of connector C1 for holding the preceding switches in their operated positions and to guard the connector C1 from seizure by other hunting selector circuits.

As the pulsing contacts 8 and 9 of the dial in subscriber station A are opened, relay 301 will release and close a circuit from ground through its lower back contact, the left inner front contact of relay 302, the back contact of the vertical off-normal springs V. O. N., winding of relay 310, winding of vertical magnet 312 to battery. This causes relay 310 and vertical magnet 312 to become energized. Operation of the vertical magnet will cause the switch to take on step in a vertical direction. As soon as the shaft of connector C1 is moved from the normal position on the first vertical step, the V. O. N. springs will operate and transfer the operating and holding circuit for relay 310 under the control of the left front contacts of relay 310 and the lower front contacts of the V. O. N. springs. When the pulsing contacts 8 and 9 of the dial close, relay 301 will reoperate. Relay 302 being slow to release will remain operated during the pulsing of a digit and thereby holds relays 303 and 304 in their operated position. Relay 310 being slow to release will remain operated also during the pulsing of a digit. As the pulses are sent out from the dial over the subscriber loop, relay 301 will operate and release for each pulse of the dial and connector C1 will take a vertical step for each of the pulses received. As soon as the first set of pulses have been transmitted, relay 301 will remain in the operated position and relay 310 will release.

The next set of impulses received from the dial will again cause relay 301 to release and to reoperate as previously described. Relay 301 in releasing will close a circuit from ground through its lower back contact, the left inner front contact of relay 302, the lower front contact of the V. O. N. springs, the left back contact of relay 310, the right outer back contact of relay 309, conductor 315, the lower inner back contact of relay 307, winding of rotary magnet 311 to battery. A circuit will be closed also from ground on conductor 315, conductor 316, winding of relay 308 to battery. The rotary magnet 311 will function and cause the shaft of the connector C1 to step in a horizontal direction in response to the number of pulses received from the subscriber's dial. Relay 302 will again remain operated as during the vertical stepping described previously. During the functioning of rotary magnet 311, relay 308 will operate in multiple with rotary magnet 311 and, being slow to release, will remain operated during the series of pulses to close the circuit for testing the called line.

If the called line is busy, ground will be connected to the sleeve terminal 342. This will cause relay 309 to operate over a circuit extending from terminal 342, brush 332, conductor 317, the right front contact of relay 308, the lower back contact of relay 307, winding of relay 309 to positive grounded battery before relay 308 releases. Relay 309 having operated will lock as the relay 308 releases over a circuit extending from positive grounded battery, winding of relay 309,

lower back contact of relay 307, right inner back contact of relay 308, right front contact of relay 309, left outer front contact of relay 304 to ground. Opening of the right outer back contact of relay 309 will open the holding circuit for relay 308 and for the rotary magnet 311. Closure of the left front contact of relay 309 will close a circuit to busy tone over conductor 317. This busy tone will be extended to the calling subscriber in a manner well known to the art.

If the called line is idle, battery will be connected to the sleeve terminal 342. Relay 309 will not operate therefore, and the connector C1 will cut through to the called line upon the release of relay 308. When the called line is seized, relay 307 will operate over a circuit through its lower winding upon the release of relay 308. The operating circuit for relay 307 will extend from battery on terminal 342, through brush 332, conductor 317, the right outer back contact of relay 308, lower winding of relay 307, the right inner back contact of relay 309 to ground through the left outer front contact of relay 304. The circuit for operation of relay 307 is thereby controlled from ground at relay 304 and acts as a guarding potential on the sleeve terminal 342 until relay 307 has operated and connected ground through its lower front contacts to the sleeve terminal 342. The circuit through the lower winding of relay 307 serves only to operate the upper inner front contacts of relay 307. This will close a circuit from positive grounded battery through the winding of rotary magnet 311, the upper winding of relay 307, the upper inner front contacts of relay 307 to ground on the left inner front contacts of relay 304. This circuit is maintained until the release of the connector C1. The operation of relay 307 also closes a ringing circuit from the ringing machine 318, through resistance 319 and condenser 320 in parallel with the lower winding of relay 306 to the loop circuit of the called subscriber X.

The called subscriber at station X is signaled in any desired manner by use of the ringing signals. As the ringing continues a ringing tone is sent to the calling station A in a manner well known to the art.

The calling subscriber at station A has instructions when calling a free line, such as line X, to depress the pushbutton 64 to obtain refund of coin 28 when he hears ringing tone. When the pushbutton 64 is depressed, coin return lever 38 engages the coin trigger lever 29 and the coin trap 33. With the coin return lever 38 in the operated position the coin return mechanism used in Fig. 1 assumes the position as shown in Fig. 4. The end of coin return lever 38 causes the coin trap 33 to pivot about its fulcrum 65 thereby causing the coin 28 to be dropped in the direction indicated by the arrow 27 and thus returned to the calling subscriber at station A. As the coin return lever 38 is moved from the normal to the operated position, the teeth 44 on coin return lever 38 engage gear 45 thereby causing gear 45 to turn in a clockwise direction. Turning of gear 45 will cause shaft 47 to turn and thus cause the lever arm 48 to wind up the spring 50 and cause the ratchet 51 to turn in a clockwise direction inside of the ratchet wheel 52. Also, as the coin return lever 38 is moved from the normal to the operated position, arm 40 attached to coin return lever 38 moves away from surface 39 of T-arm 35 and makes contact with surface 34 of T-arm 35 and thus causes T-arm 35 to pivot about fulcrum 36. This permits

stud 63 on T-arm 35 to move away from contact springs 41 thereby permitting contact springs 41 to break contact and open the subscriber loop circuit.

- 5 As the pushbutton 64 is released, the ratchet 51 engages the teeth of ratchet wheel 52 thereby affording a rigid connection between governor 56 and the coin return lever 38 by means of the shaft 47. When pushbutton 64 is released the
- 10 spiral spring 50 tends to cause shaft 47 and the entire timing mechanism G1 to turn in a counterclockwise direction. The governor 56 is so timed that the control springs 41 will be held open sufficiently long to permit the release of all
- 15 selectors and connectors other than free call connectors, such as C1 of Fig. 3. In the case of connectors such as C1 slow-to-release relays 302, 303 and 304 have been placed in cascade to slow up the release of the connector until the contact
- 20 springs 41 become closed after the return of the coin 28 by the subscriber at calling station A. As soon as the timing mechanism G1 restores, arm 35 recloses contacts 41, and line relay 301 in connector C1 reoperates to reestablish the
- 25 holding circuits of slow relays 302, 303 and 304. And since this occurs before relay 304 has time to release, the connection is held. This makes it possible for the calling party to recover his coin when he calls a free line.
- 30 When the receiver is removed at the called station X, a circuit is closed to operate relay 306 and cause the ringing signal to cease in a manner well known to the art. Relay 306 will operate
- 35 to close its upper inner front contacts due to the current flowing through its lower winding. This circuit leads from battery, the upper winding of relay 306, the upper inner front contacts of relay 306, to ground through the left inner front contacts of relay 304. The operation of relay 306
- 40 will connect the talking leads through to the windings of relay 305 which now supplies talking battery to the called station X. The called station X and the calling station A are now connected for talking purposes. Under this condition relay 305 will operate. Operation of relay
- 45 305 will reverse the direction of the current flow in the metallic loop circuit of substation A described before which is in series with the windings of relay 301. This reversal is accomplished by
- 50 transferring the negative battery supply from the lower back contact to the lower front contact of relay 305 and by transferring the ground supply from the upper back contact to the upper front contact of relay 305. The direction of the
- 55 current flow is reversed therefore through conductor 13, copper oxide rectifier 15, coin magnet 14 and conductor 12. The copper oxide rectifier 15 will permit current to pass through this circuit under this condition and the coin magnet 14 will
- 60 operate. Operation of the coin magnet 14 will operate the coin trap 33 as shown in the detail illustration of Fig. 5. Operation of the coin trap 33 will reset the coin trigger lever 29, the coin trigger 32 and the contact springs 30. With
- 65 the functioning of the contact springs 30, the front contacts will open and the back contacts will close. Opening of the front contacts will open the circuit through the copper oxide rectifier 15 and the coin magnet 14 thus removing the bridge
- 70 from the line and permitting coin magnet 14 to release. Closure of the back contacts of contact 30 will close the talking circuit through to the transmitter 16. The calling party may then talk to the called subscriber in the usual manner.
- 75 If it is desired to abandon the call at the sub-

station A because the line of the called subscriber X is busy or because the called subscriber X does not answer, the receiver at substation A is replaced on the switchhook 19 and the subscriber at station A depresses pushbutton 64. When the push button 64 is depressed the coin return mechanism G1 functions and the coin 28 is returned to the subscriber as described heretofore.

After conversation is completed and the subscriber at called station X disconnects, relay 305 will release and when the calling station A disconnects relays 301, 302, 303 and 304 will release which in turn allow relay 307 to release. With the connector C1 in this condition a circuit is closed from positive grounded battery, winding of release magnet 313, upper front contacts of the V. O. N. springs, upper back contact of relay 307, right back contact of relay 304, left back contact of relay 302 to ground on the lower back contact of relay 301. The release magnet 313 being energized will release connector C1 which will restore the connector shaft to normal. When the shaft returns to normal the V. O. N. springs are operated thereby opening the circuit to the release magnet 313 and allowing it to release. When the called station X or the calling station A are disconnected, supervisory signals are given over conductors 315 and 316 to common alarm equipment not shown. The removal of ground from conductor 78 also causes the release of finder LF and selectors S1 and S2.

Assuming that the subscriber at station A desires to make a call to line Y for which payment is required, he removes the receiver 23 from the switchhook 19. The line finder LF and selectors S1 and S2 will function as described heretofore when the subscriber at station A makes a free call, except that, because of grouping arrangements, the selector S2 will seize a connector such as C2 by way of conductors 79, 80 and 81. When the connector C2 is seized the subscriber loop is closed to battery and ground through the windings of relay 328. Relay 328 will operate and close a circuit from ground through its lower front contact, winding of slow-to-release relay 321 to battery, thereby causing relay 321 to operate. As the digits are dialed at substation A, relay 328 will release on the first pulse of the dial but relay 321 will remain operated. A circuit will be closed thereby for operating the connector C2 in the same manner as outlined heretofore for connector C1, relay 321 remaining operated during the pulsing for any digit.

The called subscriber Y is signaled in a manner well known to the art. If the subscriber at calling station A depresses push button 64 at any time before the called station Y answers, the subscriber loop will be held open long enough by the governor assembly G1 for the relays 328 and 321 to release, thereby closing the circuit to the release magnet 322 and allowing the connector C2 to restore to normal. When the called station Y answers a reversal of battery and ground over the calling subscriber loop at station A is created in connector C2 in a manner well known to the art. The coin collect mechanism at station A will function as outlined heretofore when a battery reversal was made when using connector C1 and the deposited coin will enter the coin hopper in the direction indicated by arrow 25.

Assuming that a call originating at station A has been routed by selector S2 to an intercepting operator's position 0 by way of conductors 82, 83 and 84, the transmitter circuit at station A

will extend from conductor 10, front contacts of springs 30, conductor 11, pulsing contacts 8 and 9 of the dial, copper oxide rectifier 17, conductor 25, transmitter 16 to conductor 18 and the receiving circuit will extend from conductor 10 through condenser 22, right winding of induction coil 20, right contacts of switchhook 19, receiver 23, conductor 24, contacts 5 and 6 of the dial to conductor 18. This circuit arrangement allows the calling subscriber at station A to converse with the intercepting operator at position 0 without disposing of the coin. If no charge is to be made the coin may be refunded at the calling station A in the manner outlined heretofore. If a charge is to be made the operator at position 0 completes the call in a manner well known to the art. When the called station answers a battery reversal is obtained which causes coin magnet 14 to function and collect the coin 28 in the same manner as outlined heretofore.

Let us assume that the calling substation A desires to obtain a connection to the zero operator. In this event no coin is required. The receiver 23 at substation A is removed from the switchhook 19, and the dial at substation A is operated and released in accordance with the code number of the zero operator, which is usually 0. As the dial is moved from the normal position, springs 6 and 7 of the dial are closed and springs 5 and 6 are opened. Spring 2 of the dial will not make contact with spring 3 and spring 4 will not break contact from spring 2 until the dial has been fully operated to the "0" position when said springs will operate and remain locked in their operated positions thus closing the pulsing circuit and opening the transmitter circuit to prevent pulsing through the transmitter 16 until the dial has restored to normal. Opening of contact springs 2 and 4 will open the circuit through the transmitter 16. Closure of contact springs 2 and 3 will complete a metallic pulsing circuit through conductor 21, the left winding of the induction coil 20, the left contacts of switchhook 19, conductor 18, contacts 6 and 7 and pulsing contacts 8 and 9 and contacts 2 and 3 of the dial, the back contact of contact springs 30, to conductor 10. The selector S1 will accordingly be set in accordance with its primary movement upon the proper trunk level which we will assume to be the 10th or 0 trunk level of the switch. The selector S1 will function in the usual manner and extend the connection to the zero operator displaying a signal at her position as an indication that a call is in waiting. When the call is answered by the zero operator there is no current reversal in the calling line loop, thus preventing the operation of the coin magnet 14. The zero operator will complete the call in a manner well known to the art.

Referring to Fig. 2, substation B, in addition to the usual receiver and transmitter, comprises a special coin collect mechanism consisting of contact springs 130, a coin chute 131, a coin trigger 132, a coin trigger lever 129, a coin trap 133, a non-polarized coin magnet 114, a copper oxide rectifier 115. Substation B has also a special governor and coin return mechanism G2 the same as that described in Fig. 1. In addition to this apparatus substation B is equipped with a special dial in order to prevent the calling substation B from dialing any digit other than 0 without depositing a coin in the coin mechanism. This dial is similar to the dial shown diagrammatically in Fig. 6 and used at station A. The outward appearance of the dial is similar to that of any

standard dial. It has a finger wheel, a number plate and a finger stop identical with the parts shown in Fig. 6. The interior of the dial has a special construction and consists of contact springs 102 to 109, inclusive. The cam which rotates in unison with the finger wheel, the lever arm which has a roller conveniently attached at one end, the collar having an inner surface and an outer surface, the pulse pawl, the pulse pawl spring and the pulse wheel are the same and function the same as those described in Fig. 6. The lever arm, which has the roller attached at one end, joins spring 103 so that any movement of the lever arm is transmitted to spring 103.

When the finger wheel is moved from its normal position the cam moves in a clockwise direction and permits springs 105 and 106 to make contact and springs 106 and 107 to break contact. As soon as the finger wheel is moved in a clockwise direction, the roller and the lever arm will function as described for Fig. 6, in such a manner as to keep springs 102 and 103 from breaking contact and springs 103 and 104 from making contact until the digit 0 has been completely dialed when the roller and the lever arm will drop from the surface of the collar and permit spring 103 to make contact with spring 104 and spring 103 to break contact with spring 102. When the finger wheel is released the roller on the lever arm will contact with the outer surface of the collar in such a manner as to hold springs 102 and 103 open and springs 103 and 104 closed until the finger wheel has restored to its normal position where the lever arm again assumes its normal position as shown in Fig. 6. The pulsing springs 108 and 109 are operated in the usual manner by pulse pawl.

Referring to Fig. 2, let us assume that a party at the calling substation B removes the receiver 123 from the switchhook 119 to make a free call. Although payment is not required, he must deposit a coin temporarily to enable him to make the call. When the receiver 123 is removed from the switchhook 119 a metallic loop circuit will be closed through substation B from terminal 190, over line 150, conductor 110, the back contacts of contact springs 130, springs 102 and 103 of the dial, conductor 125, transmitter 116, conductor 118, the left contacts of switchhook 119, the left winding of induction coil 120, conductor 121, line 150 to terminal 191. A receiving circuit will be closed from conductor 110, through condenser 122, the right winding of induction coil 120, the right contacts of switchhook 119, receiver 123, conductor 124, contact springs 105 and 106 of the dial to conductor 118.

The brushes of the line finder LF will connect with the terminals 190 and 191 and extend the metallic loop circuit of substation B described above through to a selector S1. The selector S1 will function to send dial tone to the calling substation B and to place negative battery on conductor 121 and ground on conductor 110 of the metallic loop circuit of substation B. Under these circumstances dial tone will be heard in the receiver 123 of substation B. If no coin has been deposited at the calling substation B, the contact springs 130 of the coin mechanism of substation B will not operate and since contact springs 103 and 104 of the dial will not make contact when any digit other than 0 is dialed the pulsing circuit will not be closed through. This prevents dialing from the calling substation B until a coin is deposited in coin chute 131 of the coin mechanism. If on or before receiving the

dial tone, the calling party deposits a coin 128 in the coin chute 131, the coin 128 will pass through the coin chute 131 to the coin trap 133 thereby operating the coin trigger 132 which in turn will allow the coin trigger lever 129 to operate. Operation of the coin trigger lever 129 will cause the contact springs 130 to function closing the front contacts and opening the back contacts of said contact springs 130. Opening of the back contact will open the transmitter circuit. Closure of the front contacts of springs 130 will close a loop circuit through conductor 111, the pulsing springs 108 and 109 of the dial, conductor 113, winding of coin magnet 114, copper oxide rectifier 115, conductor 112 to conductor 118. The copper oxide rectifier 115 is a unipolarity device which will not permit current to pass through in the direction opposite to that indicated by the symbolic arrowhead. Therefore, coin magnet 114 will not operate. A parallel path leads through the rectifier 117, which serves the same function as did rectifier 17 in Fig. 1. Closure of the front contacts will complete the pulsing circuit from conductor 110, the front contacts of contact springs 130, conductor 111, pulsing springs 108 and 109 of the dial, off normal springs 106 and 107 of the dial, conductor 118, the left contacts of switchhook 119, the left winding of induction coil 120 to conductor 121. Contact springs 102, 103 and 104 of the dial will not operate when a digit other than 0 is dialed. As the dial is moved off normal, contact springs 105 and 106 of the dial break contact to open the receiver circuit and contact springs 106 and 107 make contact to place a short circuit around the coin magnet 114 and at the same time to close the pulsing circuit. The dial is then operated and released in the usual manner causing the selector S1 and the selector S2 to function.

Assume that selector S2 seizes a connector such as C1 and closes the subscriber loop thereto, the call will be completed in the manner outlined herein for substation A. When ringing tone is heard the subscriber at station B will obtain a refund of the deposited coin 128 by operation of coin return mechanism G2. The talking circuit will be established as outlined heretofore for station A.

Assuming next that the called station B desires to make a call for which payment is required, the circuit at station B, the line finder LF, the selectors S1 and S2 and the connector C2 will function as outlined herein for station A when making a similar call. When the called station Y answers, the current flow through the subscriber loop at station B will be reversed in the manner described heretofore in the operation of station A, thereby reversing the current flow through conductor 113, coin magnet 114, copper oxide rectifier 115, and conductor 112. The copper oxide rectifier 115 will permit current to pass through this circuit under this condition and the coin magnet 114 will operate. Operation of the coin magnet 114 will operate the coin trap 133. Operation of the coin trap 133 will reset the coin trigger lever 129, the coin trigger 132 and the contact springs 130 and will collect the coin 128 in the manner outlined for station A. With the functioning of the contact springs 130, the front contacts will open and the back contacts will close. Opening of the front contacts will open the circuit through the copper oxide rectifier 115 and the coin magnet 114 thus removing the bridge from the line and permitting coin magnet 114 to release. Closure of the back

contacts of contact 130 will close the talking circuit through to the transmitter 116. The calling party may then talk to the called subscriber in the usual manner.

If it is desired to abandon the call at the substation B because the line of the called subscriber Y is busy or because the called subscriber Y does not answer, the receiver at substation B is replaced on the switchhook 119 and the subscriber at station B depresses pushbutton of the coin return mechanism G2 to obtain refund of the coin.

On a call to the intercepting operator's position 0, the circuit at station B will function in the manner outlined heretofore when making a free call but the calling subscriber at station B must refund his coin before he can talk to the intercepting operator at operator's position 0.

Let us assume that the calling substation B desires to obtain a connection to the zero operator. In this event the receiver 123 at substation B is removed from the switchhook 119 and the dial at substation B is operated and released in accordance with the code number of the zero operator, which is usually 0. As the dial is moved from the normal position, springs 106 and 107 of the dial are closed and springs 105 and 106 are opened. Spring 103 of the dial will not make contact with spring 104 thus keeping the pulsing circuit open and spring 103 will not break contact from spring 102 thus keeping the transmitter circuit closed until the dial has been fully operated to the "0" position when said springs will operate and remain locked in their operated positions thus closing the pulsing circuit and opening the transmitter circuit to prevent pulsing through the transmitter 116 until the dial has restored to normal. Opening of contact springs 102 and 103 will open the circuit through the transmitter 116. Closure of contact springs 103 and 104 will complete a metallic pulsing circuit through conductor 121, the left winding of the induction coil 120, the left contact of switchhook 114, conductor 118, off-normal contact springs 106 and 107, pulsing contact springs 108 and 109 of the dial, conductor 111, contact springs 103 and 104, back contacts of springs 130, conductor 110.

The selector S1 will accordingly be set upon the proper trunk level which we will assume to be the 10th or 0 trunk level of the switch. The selector S1 will function in the usual manner and extend the connection to the zero operator displaying a signal at her position as an indication that a call is in waiting. When the call is answered by the zero operator there is no current reversal in the calling line loop, thus preventing the operation of the coin magnet 114. The zero operator will complete the call in a manner well known to the art.

What is claimed is:

1. In a telephone system, a calling line having a coin-controlled station thereon, a first called line and means for establishing a connection thereto from said calling line, a second called line and means for establishing a connection thereto from said calling line, refunding means for refunding a coin deposited at said station without releasing a connection established to said first called line, and means for releasing a connection established to said second called line in response to the operation of said refunding means.

2. In a telephone system, a coin-controlled station, means for setting up a connection from

said station to either of two different destinations, a refund device operable to refund a coin deposited at said station without releasing one of said connections, and means responsive to the operation of said device for releasing the other of said connections.

3. In a telephone system, a coin-controlled station, means for establishing a connection from said station to either of two destinations, a refund device operable to refund a coin deposited at said station without releasing one of said connections, means responsive to the operation of said device for releasing the other of said connections, and means controlled from said station for releasing either of said connections.

4. In a telephone system, a coin-controlled station having an impulse dial thereat, two different called stations, automatic switches responsive to said dial for establishing a connection from the coin-controlled station to either of said called stations, a refund key at the coin station for refunding a deposited coin, means for holding the connection established to one of said called stations when the refund key is operated, and means responsive to the refund key for releasing the connection established to the other of said called stations.

5. In a telephone system, a coin line having a coin-controlled station, called lines some of which may be called free and some of which require a charge, means controlled by the deposit of a coin for enabling the party at said station to establish a connection either to one of said free lines or to one of said charge lines, means to collect the coin automatically when the called party answers, means for refunding the deposited coin before the called party answers, means for holding the connection to one of said free lines when the coin is refunded, and release means for releasing the connection to one of said charge lines in response to the refunding of the coin.

6. In a telephone system, a calling line having a coin station thereon, called lines some of which may be called free and some of which require a charge, means controlled by the deposit of a coin for enabling the calling party to establish a connection to a free line or to one of said charge lines, means to collect the coin automatically on the response of the called party, means for refunding the coin and for opening the established connection for an interval before the called party answers, means for holding the connection to a free line to prevent release during said open interval, and release means for releasing the connection to a charge line in response to the opening of said connection.

7. In a telephone system, a calling line having a coin-controlled substation thereon, switchhook contacts at said substation for opening and closing the line, a called line, automatic switches for establishing a connection between the calling and called lines, a refund device at said substation for refunding a deposited coin and for opening the circuit of the calling line, release means controlled over said calling line for effecting the release of said automatic switches, and means associated with said release means for distinguishing between an opening of the calling line caused by said refund device and an opening caused by said switchhook contacts.

8. In a telephone system, a calling line having

a coin station thereon, a called line, automatic switches, a dial at the calling station for operating said switches to establish a connection to said called line, means at the calling station for receiving a deposited coin, refund means at the calling station operable to refund the deposited coin and to open temporarily the established connection, and means for holding the established connection for conversation after the coin has been refunded.

9. In a telephone system, a calling line having a coin station thereon, a called line, automatic switches, a dial at the calling station for operating said switches to establish a connection to the called line, means at the calling station to receive a deposited coin, means at the calling station for refunding a deposited coin and for opening the connection for an interval, means for holding said connection during said interval, and means controlled from the calling station for releasing said connection.

10. In a telephone system, a calling line having a coin-controlled substation thereon, a called line, automatic switches, means controlled by the deposit of a coin at said coin station for enabling the calling party to operate said switches to establish a connection to the called line, means for collecting the deposited coin in response to the answer of the called party, means at the calling station for refunding a deposited coin before the called party answers, means for holding the established connection after the coin has been refunded, and means for releasing the established connection.

11. In a telephone system, a calling line having a coin-controlled station thereon, a called line of one class, a called line of a second class, automatic switches, means for establishing a connection from the coin line over said automatic switches to the first mentioned called line, means for establishing a connection from the calling line over said automatic switches to the second mentioned called line, said second established connection including a particular one of said switches, means for refunding a deposited coin at the calling station, and means in said particular switch for holding the established connection during the refunding of the deposited coin.

12. In a telephone system, a calling line having a coin-controlled station thereon, a called line, means for establishing a connection between said lines, a refund key at the calling station for restoring the deposited coin and for opening the connection, a timing device controlled by said key for reclosing a connection at the end of an interval, and means for holding said connection during said interval.

13. In a telephone system, a calling coin line, a called subscriber's line, means on the calling line for receiving a deposited coin, contacts operated by the deposited coin, means for establishing a connection between said lines, a refund key for refunding the deposited coin, for restoring said coin operated contacts, and for opening the line, a timing device set by said key and serving to reclose the line after a measured interval, means associated with the established connection for holding the same against release while said line is open, and other means for opening said line to cause the release of said connection.

SAMUEL B. WILLIAMS.