

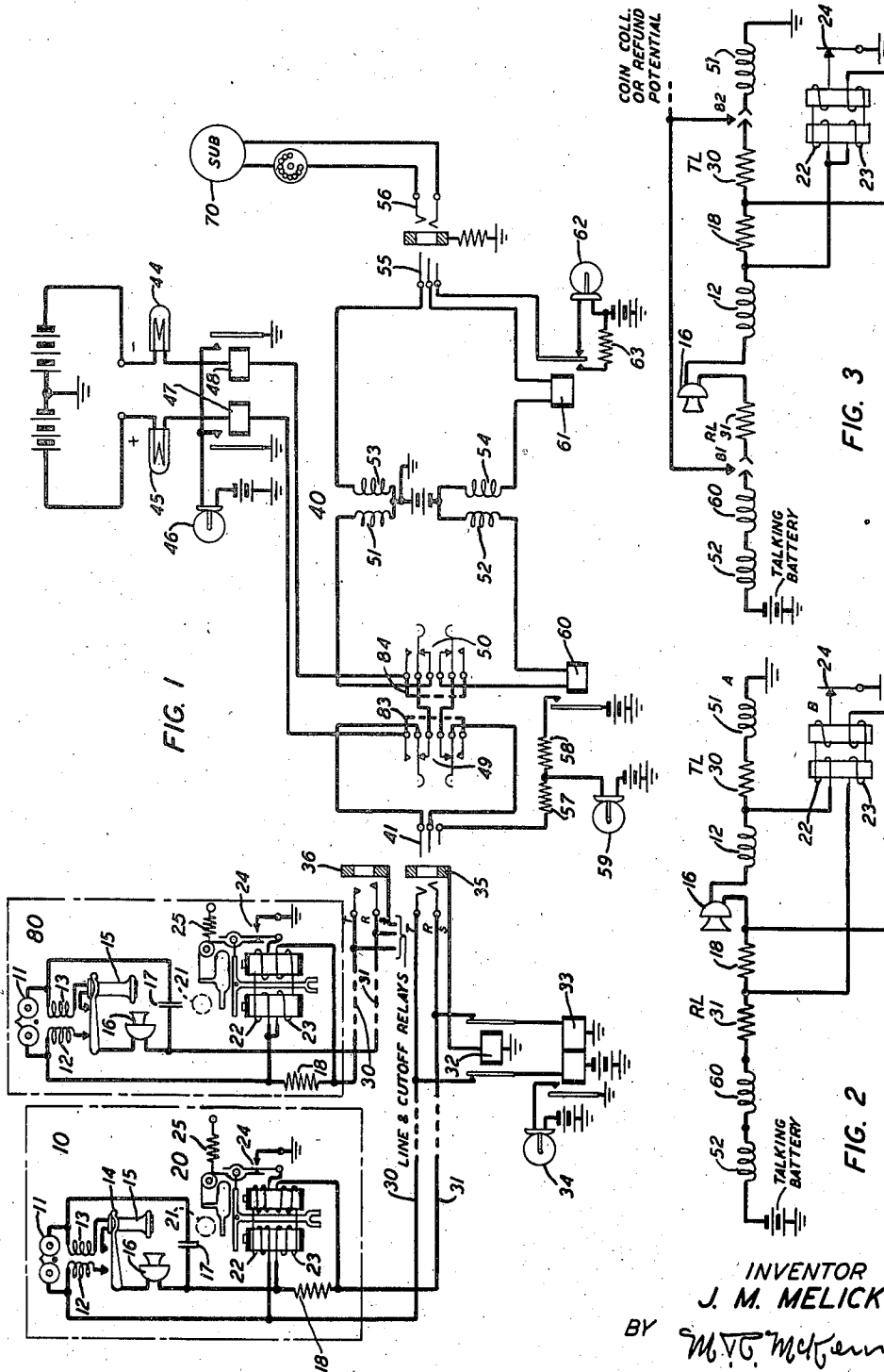
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J. M. MELICK

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TELEPHONE SYSTEM

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INVENTOR
J. M. MELICK
BY *M. G. McFerry*
ATTORNEY

UNITED STATES PATENT OFFICE

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TELEPHONE SYSTEM

John M. Melick, Cresskill, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

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This invention relates to telephone systems and, more particularly, to coin collect and refund equipment for such systems.

In subscribers' stations arranged for coin service, a relay is usually provided which is under the control of an operator or automatic equipment in a telephone office for the collection or refund of coins deposited in the coin box by a calling subscriber. This relay is made and adjusted so that it does not operate when talking current is connected to the subscriber's station but will operate on current of higher value when a higher voltage is supplied for collecting or refunding coins deposited in the coin box. This relay has a non-operate adjustment, an operate adjustment and a release adjustment and the non-operate adjustment has a mechanical and electrical characteristic which prevents the relay from operating on talking current connected to lines of lengths which subject the coin relay to comparative high voltage values. The non-operate characteristic of the coin relay is closely related to the operate characteristic by electrical standards and, consequently, a high non-operate requirement inherently limits the length of the line over which this relay will operate.

The object of this invention is, therefore, to improve the construction of subscriber's station coin collect and refund equipment for long lines.

A feature of the invention resides in adding a winding on the coin collect and refund relay so related to the line circuit and the operating winding of the coin collect and refund relay as to improve the operating margins of this relay.

This and other features will be discussed more fully in the following description as illustrated in the accompanying drawing, in which:

Fig. 1 illustrates a coin-operated subscriber's station connected to a subscriber's line and a cord circuit which is used for answering calls over this line; and

Figs. 2 and 3 are diagrammatic circuits to illustrate more clearly the relation of the coin collect and refund relay with the talking circuit and operating circuits.

The coin collect and refund circuit will be more clearly understood from the following detailed description.

A call initiated by removing the receiver in subscriber's station 10 energizes relay 33 in the central office to light lamp 34. This circuit may be traced from battery through the left winding of relay 33, line conductor 30, winding 12 of the subscriber's station induction coil, switchhook 14, transmitter 16, resistance 18, line conductor 31, right winding of relay 33 to ground. The same

circuit is used when a call is initiated in subscriber's station 80 with the exception that resistance 18 is in the tip side of the line. The right winding of relay 33 is not connected to the line conductor 31 for coin stations requiring the deposit of the coin before removing the receiver from the switchhook. Upon observing lamp 34, the operator inserts plug 41 in jack 35 or 36 to answer the call. The insertion of plug 41 in the jack energizes cut-off relay 32 from ground through the winding of relay 32, resistance 57, lamp 59 to battery, or through resistance 57 and resistance 58 to battery connected to the contact of supervisory relay 60. This supervisory relay is energized as soon as plug 41 is inserted in the jack. The operation of relay 32 releases line relay 33 and extinguishes the line lamp. The insertion of plug 41 in the jack also connects the talking battery through repeating coil windings 51 and 52 with the subscriber's station. The operator challenges the calling subscriber who then instructs the operator regarding the subscriber's station to be called. The operator requests the calling subscriber to deposit the proper coin in the coin box. The depositing of the coin establishes a circuit from talking battery through the operating winding 22 of the polarized coin collect and refund relay. This circuit for subscriber's station 10 may be traced from ground through coin relay springs 24, winding 22 of the coin relay, winding 12 of the subscriber's station retardation coil, transmitter 16, resistance 18, thence over the ring conductor 31 of the line, winding of supervisory relay 60, winding 52 of the cord circuit repeating coil to battery. The circuit above traced places winding 22 of the coin collect and refund relay in multiple with a circuit from ground through repeating coil winding 51 and the resistance of the tip conductor 30 of the line which also extends through winding 12 of the induction coil, transmitter 16, resistance 18, ring conductor of the line repeating coil winding 52 to battery. The coin collect and refund relay should not operate on current from talking battery in the circuit traced, and consequently, the non-operate adjustment is regulated accordingly. In telephone practices known to the applicant, this winding of the coin collect and refund relay is used for collecting or refunding the coin by associating a positive or negative voltage of higher value with the line.

The spring structure of the coin relay is shown in a conventional manner since it is well known in the art as shown in Patent 1,043,219 to O. F. Forsberg, November 5, 1912, and other coin collector patents showing this type of relay. The spring structure for subscribers' stations 10 and 80 may

be substantially the same as shown in Figs. 1 and 9 of the Forsberg patent. The spring 110 of the patent is represented by spring 25 of this disclosure and springs 111 and 112 are shown as contact 24 of the disclosure. The deposit of the coin causes the closure of this contact in the manner shown and described in the patent to Forsberg. Springs of this character are used on the coin relay according to the tension required and tension may be adjusted in the conventional manner according to the desired non-operate and operate requirements.

It is now proposed to add winding 23 on the coin collect and refund relay to create a flux in this relay which opposes the flux created by talking battery in the operating winding 22 to reduce the tendency of this relay to operate on talking battery. Winding 23 is placed in multiple with non-inductive resistance 18. The latter resistance may be of the maximum value allowable in the talking circuit and is used to limit the impedance added to the talking circuit. Current from talking battery flows through winding 23 in the opposite direction to the current flowing through winding 22 which reduces the resultant flux in this relay; in fact the ampere turns of these windings may be made to approximately eliminate a resultant flux under the most severe conditions.

The addition of winding 23 thus greatly relieves the non-operate requirement of this relay which may, accordingly, be materially reduced by decreasing the spring tension on the armature. This brings about an operating adjustment of the relay which permits operation of the relay for collecting and refunding coins on less current and, therefore, over longer lines of greater resistance.

Two arrangements are shown in the circuit for collecting and refunding coins over lines of different lengths; one arrangement for collecting or refunding coins in subscriber's station 10 and another arrangement for collecting or refunding coins in the subscriber station 80. For lines up to a particular value of resistance the coin collect or refund current is connected only to the tip conductor of the line for collecting or refunding coins in subscriber's station 10 by the operation of keys 49 or 50, respectively, and the operation of either of these keys opens the ring conductor of the line. In this case, the upper and lower outer springs of keys 49 and 50 in the associated cord circuit are not connected together by strap wiring 83 and 84 shown in dotted lines. For lines of greater resistance value the strap wires 83 and 84 are used in the associated cord circuit so that the operation of key 49 or key 50 connects the coin collect or coin refund current to both the tip and ring conductors. This places the tip and ring conductors in multiple to increase the current flow for operating the collect and refund relay in subscriber's station 80.

This coin collect and refund relay is shown in the subscriber's station 10 and the schematic diagram Fig. 2 connected in the line wiring and wired to the telephone equipment for collecting and refunding coins over the tip line conductor and to reduce the resultant flux from talking battery potential after the coin has been deposited and before it has been collected or refunded. By referring to subscriber's station 10 and to Fig. 2, it may be seen that the deposit of the coin has caused current to be associated with the operating winding 22 through spring 24. This establishes a current flow from talking battery through repeating coil winding 52, supervisory relay 60, ring conductor of the line 31, resistance 18 and the coin relay winding 23 in multiple with transmitter

16, induction coil winding 12, coin relay winding 22 to ground and also through the tip line conductor 30 and repeat coil winding 51 to ground. As shown in this diagram the current from talking battery flowing through winding 23 creates a flux which opposes the flux created by current flowing through winding 22 which may reduce to a minimum the resultant flux in the coin relay. Key 49 is operated to connect positive coin collect potential through resistance lamp 45, pilot relay 47, upper springs of key 49, tip of plug 41, tip of jack 35, tip line conductor 30, winding 22 and spring 24 of the coin relay 20 to ground. Relay 47 operates to light lamp 46 as an indication that the coin collect current is flowing in the circuit traced and the coin relay 20 operates its armature in a direction to deposit the coin in the coin box. Key 50 is operated to connect negative coin refund potential through resistance lamp 44, pilot relay 48, upper springs of key 50, tip of line conductor 30, winding 22 and spring 24 of the coin relay 20 to ground. Relay 48 also lights pilot lamp 46 to indicate in this instance that the refund current is flowing over the circuit traced and the coin relay 20 operates its armature in a direction to refund the coin. As previously stated, the operation of key 49 or key 50 opens the ring side of the line when arranged to collect or refund coins by application of current to the tip conductor of short and medium length lines and, consequently, for this method of operation no current flows through winding 23 of the coin relay 20 when the collect or refund potential is applied for the operation of the coin relay 20.

This coin collect and refund relay is also shown in subscriber's station 80 and the schematic diagram Fig. 3, connected in the line wiring and to the telephone equipment for collecting and refunding coins by the application of collect or refund potential to both the tip and ring line conductors and to reduce the resultant flux from talking battery after the coin has been deposited and before it has been collected or refunded. By referring to the subscriber's station 80, it will be apparent that for this type of operation the winding 23 and resistance 18 are connected to the tip conductor instead of to the ring conductor as shown in subscriber's station 10.

By reference to subscriber's station 80 and Fig. 3, the direction of current flow in the circuits from talking potential and from the coin collect or refund potential may be noted. After the coin is deposited, current flows from the talking battery through repeating coil winding 52, supervisory relay 60, ring line conductor 31, transmitter 16, induction coil winding 12, winding 22 to ground and also through winding 23 and resistance 18 in multiple, tip line conductor 30, repeating coil winding 51 to ground. During this period of current flow from talking battery, the flux created in winding 23 opposes the flux created in winding 22 and thus reduces the resultant flux in the relay. For this character of operation keys 49 and 50 have the strap wiring 83 and 84 connected across their outer contacts which applies collect or refund current to both the tip and ring conductors of the line at points 81 and 82 as shown in the diagrammatic circuit, Fig. 3. When key 49 is operated the positive coin collect current thus flows through lamp 45 and relay 47, upper springs of key 49 and thence over the tip line conductor 30, windings 23 and 22 of the coin relay, contact 24 of the coin relay to ground which in this case creates an aiding flux in the windings 22 and 23 of the coin relay 20. This coin collect current flows over the lower springs of key 49 and thence over

the ring line conductor 31, transmitter 16, retard coil 12, coin relay winding 22 and spring 24 to ground. The coin relay winding 23 thus aids in the operation of the coin relay 20 when connected in this manner for operation over both the tip and ring conductors to collect a coin. This same circuit may be followed for operating relay 20 to refund the coin with the exception that negative potential is applied to the tip and ring line conductors through resistance lamp 44, pilot relay 48 and the upper and lower springs of key 50. The current from this source also flows through windings 22 and 23 in a direction to create an aiding flux for the operation of coin relay 20.

What is claimed is:

1. In a telephone system, a central office, telephone stations having coin collect and refund equipment therein including a coin collecting and refunding relay having its operating winding in an electrical circuit extending over the line from said central office before a deposited coin has been collected or refunded and means for improving the operating margins of said relay by having a second winding thereon in said electrical circuit so related to the relay operating winding and so related to the electrical circuit that the flux due to current flowing through said second winding opposes the flux due to current flowing through said operating winding.

2. In a telephone system, a central office, a coin payment telephone station connected to said central office over a line, a talking circuit established over said line from the central office, coin collect and coin refund circuits established over said line from central office sources of positive and negative coin collect and refund currents, a coin collect and refund relay at said station having two windings so related to said line and so related to each other in said talking circuit that flux due to current flowing through one winding opposes the energizing effect of flux due to current flowing through the other winding and having said windings so related to said line and said coin collect or refund circuits that the resultant flux serves to operate said relay.

3. In a telephone system, a central office, a coin payment telephone station connected to said central office over line conductors, a talking circuit established over said line including a source of talking current, coin collect and refund circuits established over said line from central office including sources of positive and negative coin collect and refund currents, a coin collect and refund relay in said subscriber's station having a first winding in said talking circuit and a second winding so related to said talking circuit and to said first winding as to oppose the energizing effect of the current flowing through said first winding to reduce the resultant energizing flux in said relay and so related to said coin collect or coin refund circuits and to said first winding as to increase the resultant flux for operating said relay.

4. In a telephone system, a central office, a coin payment station for connection to said central office over transmission lines of minimum and maximum resistances, a transmission circuit established over one of said lines from a central office current source, coin collect and refund circuits established over said line from central office positive and negative coin control current sources, a coin collect and refund relay in said station so arranged in said circuits as to produce a wide margin between its non-operate and operate characteristics to effect its operation over maximum transmission lines, said relay having a first wind-

ing and a second winding so related to said transmission circuit that the second winding opposes the energizing effect of current flowing through the first winding before a deposited coin has been collected or refunded to reduce the resultant flux and accordingly reduce the non-operate requirement for said relay and to aid the operating characteristic of said relay in said coin collect and refund circuits.

5. In a telephone system, a central office, lines, telephone stations having coin collect and refund equipment therein connected to said lines, positive and negative coin collect and refund current sources, a current source for a voice transmission circuit, a polarized relay having a first winding for operating the relay armature in one direction for collecting coins and in the other direction for refunding coins according to the polarity of the current source connected in circuit with said winding, means including a deposited coin to connect said first winding in said voice transmission circuit, and a second winding on said relay connected in said voice transmission circuit so related in said transmission circuit to said first winding that the flux due to current flowing through said second winding opposes the flux due to current flowing through said first winding to prevent the operation of said relay armature.

6. In a telephone system, a central office, lines, telephone stations having coin collect and refund equipment therein connected to said lines, positive and negative coin collect and refund current sources, a current source for a voice transmission circuit, a polarized relay having a first winding for operating the relay armature in one direction for collecting coins and in the other direction for refunding coins according to the polarity of the current source connected in circuit with said winding, means including a deposited coin to connect said first winding in said voice transmission circuit, a second winding on said relay connected in said voice transmission circuit so related in said transmission circuit to said first winding that the flux due to current flowing through said second winding opposes the flux due to current flowing through said first winding to prevent the operation of said relay armature, and means in said central office to connect said positive or negative current sources to said first winding and eliminate the opposing effect on said second winding for operating said relay.

7. In a telephone system, a central office, line circuits, a telephone station having subscribers' sets and coin collect and refund equipment therein including a coin box and a two-winding relay for collecting and refunding coins, the first of said windings being normally in the line circuit, means in said subscriber's set for operating a signal in said central office to initiate a call, a talking current source in said central office, means in said central office for establishing a talking circuit from said talking current source over line conductors to said subscriber's station, means including a deposited coin in said coin box for connecting the second winding of said coin relay in the line circuit, said coin relay windings being so related with each other in the line talking circuit that the flux due to current flowing through the first winding opposes the flux due to current flowing through said second winding to prevent the operation of said coin relay in said talking circuit, coin collect and refund current sources, and means in said central office for connecting said coin collect or refund current sources to the second winding of said coin relay and simultaneously eliminating the opposing effect of the first winding

of said coin relay for operating said coin relay.

8. In a telephone system, a central office, a talking battery current source, a coin collect current source and a coin refund current source in said office, subscribers' lines, subscribers' stations having coin collect and coin refund mechanism therein including a polarized relay operable for collecting and refunding coins over lines of increased length, means in said central office for connecting said talking current in a circuit through windings of said polarized relay in a direction tending to operate said relay after the removal of the receiver and the deposit of a coin by a calling subscriber, second windings on said polarized relay connected in a second circuit from said talking current to oppose the operating tendency of said relay in lieu of a rigid spring tension non-operate adjustment otherwise required to prevent the operation of the relay in said first circuit, and means for applying said coin collect or coin refund currents to said line and for disposing of the opposing effect of said second windings for operating said relay for collecting or refunding coins, the operating margins of said relay being improved by the absence of said rigid spring tension and the opposing effect of said second winding.

9. In a telephone system, a central office, a talking battery current source, a coin collect current source and a coin refund current source in said office, subscribers' lines, subscribers' stations having coin collect and coin refund mechanism therein including a polarized relay operable for collecting and refunding coins over lines of increased length, means in said central office for connecting said talking current in a circuit through windings of said polarized relay in a direction tending to operate said relay after the removal of the re-

ceiver and the deposit of a coin by a calling subscriber, second windings on said polarized relay connected in a second circuit from said talking current to oppose the operating tendency of said relay in lieu of a rigid spring tension non-operate adjustment otherwise required to prevent the operation of the relay in said first circuit, and means for applying said coin collect or coin refund current to said first winding in a direction to operate said relay and for altering the direction of current through said second winding to aid in the operation of said relay.

10. In a telephone system, a central office, a talking battery current source, a coin collect current source and a coin refund current source in said office, subscribers' lines, subscribers' stations having coin collect and refund mechanism therein including a polarized relay arranged to pivot its armature in one angular direction for collecting coins and to pivot its armature in the opposite angular direction for refunding coins over lines of increased length, means in said central office for connecting windings of said relay in a circuit established from said talking current source in a direction tending to cause said relay to move its armature in one of said angular directions after the removal of the receiver and the deposit of a coin by a calling subscriber, means including second windings on said polarized relay connected in a second circuit established from said talking current source for opposing said tendency to move said armature, and means for applying said coin collect or coin refund current to said line and disposing of the opposing effect of said second windings for moving said armature in an angular direction for collecting or refunding coins.

JOHN M. MELICK.