June 29, 1937. G. C. BIERSTEDT 2,085,141

TESTING CIRCUIT FOR TELEPHONE SYSTEMS

Filed July 8, 1936 2 Sheets-Sheet 1

FIG. 1

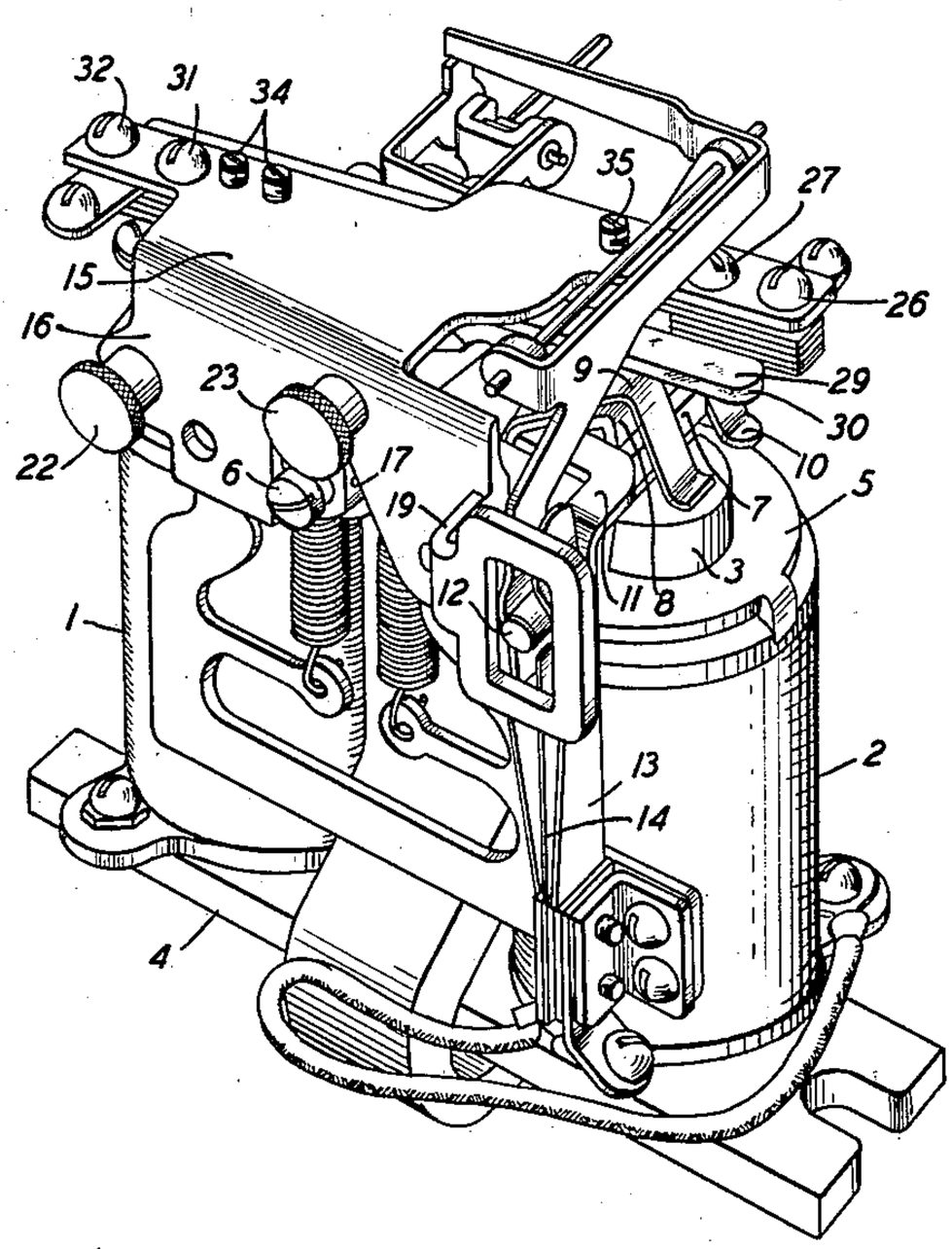
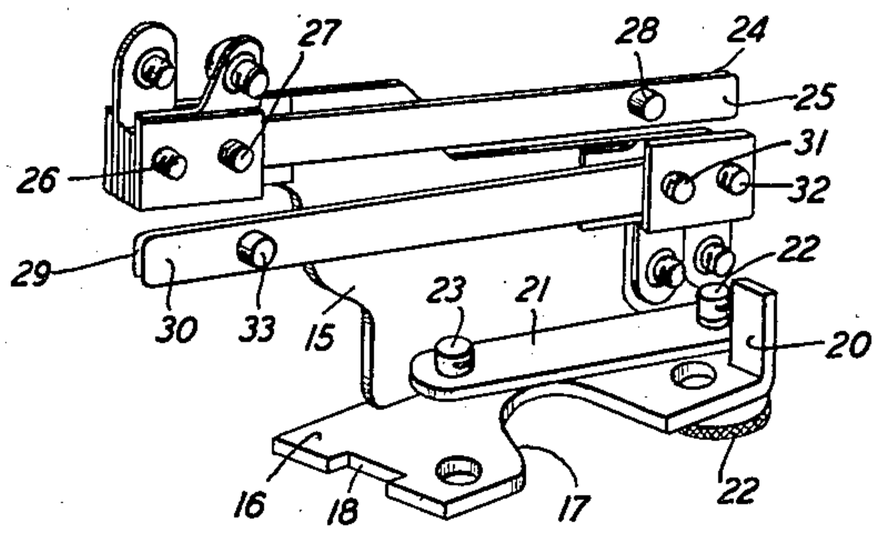


FIG. 2



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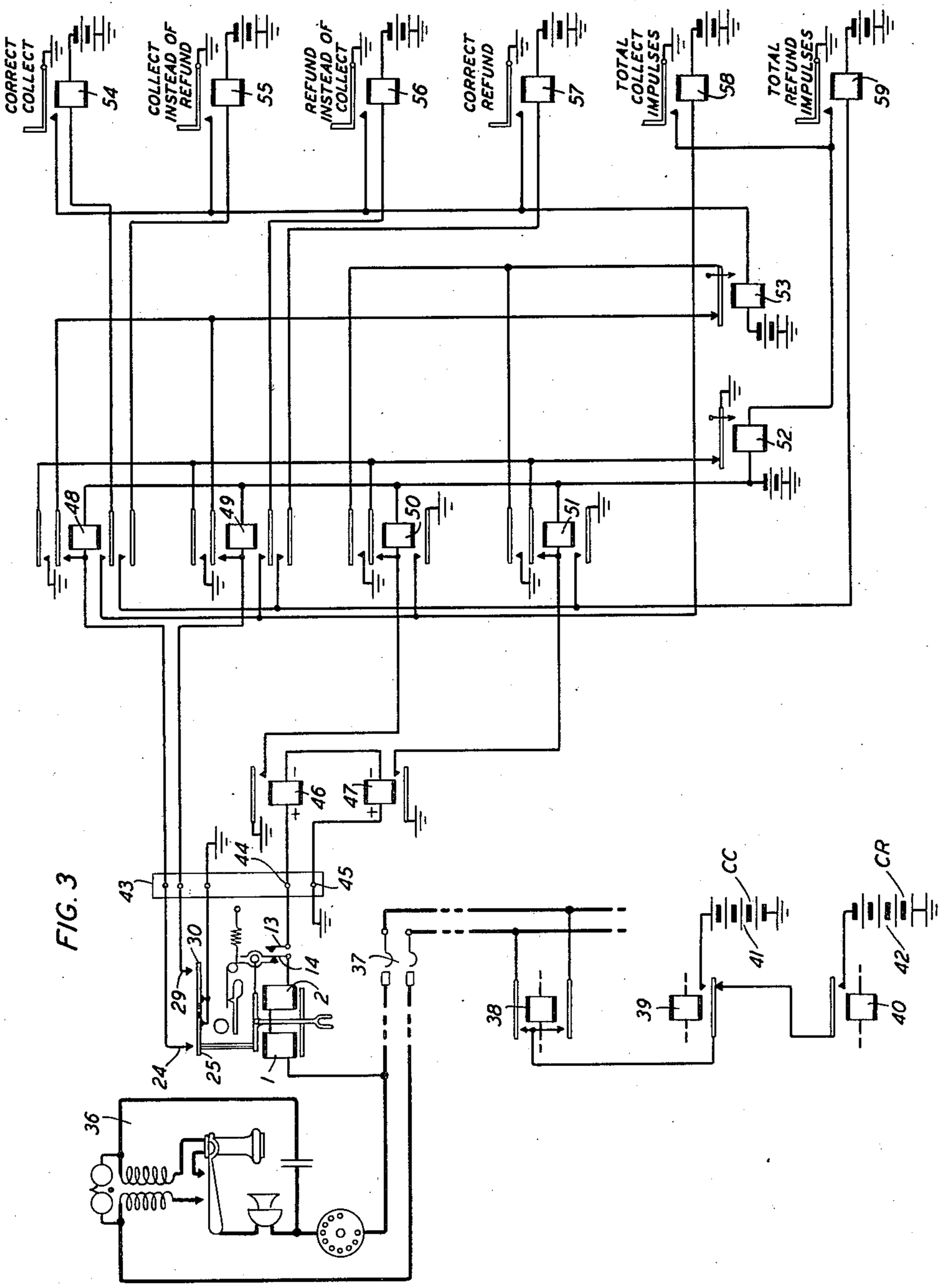

FIG. 3

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UNITED STATES PATENT OFFICE

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TESTING CIRCUIT FOR TELEPHONE SYSTEMS

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7 Claims. (Cl. 179—175)

This invention relates to telephone systems and more particularly to test circuits for determining if the coin box apparatus of a telephone line functions properly.

In all telephone exchange areas there are always several lines equipped with coin boxes in which coins must be deposited in payment for calls made therefrom. In some exchange areas these coin boxes are used largely in public places such as railroad stations, drug stores, etc. However, in other areas service to regular subscribers is furnished on this basis rather than on flat rate or message register basis. Furthermore in large dial switching areas all local calls are charged for in accordance with the zone of the exchange area in which such calls are terminated and also in accordance with the duration of each call.

In all exchange areas, coins deposited in the coin box of a coin box line are collected on successful calls or refunded on uncompleted calls under the control of apparatus at the central office. In some instances complaints have been made or the operating company suspects that calls have been incorrectly charged or that on uncompleted calls deposited coins have not been refunded. It is therefore the object of the present invention to provide a testing equipment which may be applied to the coin box of a line to make a check of the operation of such coin box.

In accordance with the present invention, a fixture is provided, which may be temporarily installed on the coin box magnet, having two sets of contacts closable respectively when the coin box magnet is operated to collect or refund deposited coins. This fixture is connected to a portable test box equipped with a pair of oppositely polarized relays whose windings may be connected in series with the coin box magnet windings to indicate the polarity of the operating current applied at any time to the coin box magnet, a group of relays whose circuits are controlled by the contacts of the fixture and by the polarized relays and a group of peg count meters or registers.

The circuits of the test box are so arranged that the total collect impulses received by the coin box magnet are registered on one register; the total refund impulses received by the coin box magnet are registered on a second register; the number of times the coin box magnet armature moves to the collecting position on collecting impulses is registered on a third register; the number of times the coin box magnet armature moves to the refunding position on collecting impulses is registered on a fourth register; the number of times the coin box magnet armature moves to the refunding position on refunding impulses is registered on a fifth register; and the number of times the coin box magnet armature moves to the collecting position on refunding impulses is registered on a sixth register. From an observation of the registers over the period during which the test is conducted a determination of whether the complaint was justified or not may be made.

For a clearer understanding of the invention reference may be had to the following detailed description taken in connection with the attached drawings of which:

Figure 1 shows a standard coin box magnet with the testing fixture attached thereto;

Fig. 2 is a perspective view of the fixture as seen from the underside showing two pair of contact springs operable respectively in the collecting and refunding positions of the coin box magnet armature; and

Fig. 3 shows the coin box circuit of a typical coin box line and the circuits of the test box.

The magnet structure of a coin box of the general type fully disclosed in Patent No. 1,117,485, granted November 17, 1914 to O. F. Forsberg, is shown in Fig. 1. This structure comprises two magnet coils 1 and 2 mounted on cores one of which is shown at 3, attached to the yoke 4. Near their pole faces the cores are united by a bridge 5 having an upturned extension on either edge thereof to which the armature structure is pivoted by two trunnion screws, one of which is shown at 6. The armature structure comprises an armature 7, a plate 8 and two centering and restoring yokes one of which is shown at 9 all mounted on the trunnion screws. The plate 8 partakes of the movement of the armature and is provided on each end with a downwardly extending arm 10 adapted when the armature is rotated to engage the bridge 5 to limit such rotary movement. The plate 8 is also provided with an extension 11 having an insulating roller 12 for operating the contact springs 13 and 14 and a further downwardly extending arm (not shown) for operating the coin distributing mechanism in the associated coin chute. Since the remaining structural details of the magnet structure are not directly concerned with the present invention, they will not be described in detail herein, but reference may be had to the aforesaid Forsberg patent for such description.

The testing fixture for use in testing the operation of the coin box magnet comprises an L-shaped supporting plate having a top portion 15 and a side portion 16. The side portion 16 is cut

away at 17 to give clearance for the trunnion screw 6 and, to enable the plate to be positioned accurately with respect to the magnet structure when it is assembled thereon, the side portion 16 is provided with a notch 18 for engagement with the contact spring guard 19 formed integral with one of the upturned extensions of bridge 5 and with an inturned leg 20 which engages with the upper surface of bridge 5 immediately above the magnet coil 1. For rigidly but detachably securing the supporting plate in the proper position with respect to the magnet structure, that is, with its top portion overlying the armature structure of the magnet and its side portion abutting the side extension of the bridge 5 with the leg 20 resting on the bridge 5 and the notch 18 engaging the guard 19, clamping strap 21 is provided which is secured to the side portion 16 of the plate by the knurl-headed screws 22 and 23. The strap 21 is adapted to engage back of the side extension of bridge 5 and, when the screws are tightened, clamps the side extension of bridge 5 securely between the strap 21 and the side portion 16 of the plate.

On the underside of its top portion 15 the supporting plate carries two contact spring pile-ups each comprising a pair of contact springs. One spring pile-up comprises the contact springs 24 and 25, each having a connection terminal, the springs being suitably insulated from each other and from the plate and secured to the plate by screws 26 and 27. The spring 25 is provided with an insulating stud 28 which engages with the left end of the armature structure, whereby when the armature 7 is rotated in a direction to collect a deposited coin, the springs 24 and 25 are closed. The second spring pile-up comprises the contact springs 29 and 30 each having a connection terminal, the springs being suitably insulated from each other and from the plate and secured to the plate by screws 31 and 32. The spring 30 is provided with an insulating stud 33 which engages with the right-end of the armature structure whereby when the armature 7 is rotated in a direction to refund a deposited coin, the springs 29 and 30 are closed. The screws 34 are provided for adjusting the springs 29 and 30 and two similar screws one of which is shown at 35 are provided for adjusting springs 24 and 25.

Having now described the testing fixture and the manner in which the pairs of contacts thereof are operated in response to the operation of the coin box magnet for collecting or refunding a deposited coin, the apparatus and circuits of the test box controlled thereby will be described.

Referring to Fig. 3, a subscriber's substation is shown at 36 terminating at the central office in the bank of a line-finder 37. The substation is also provided with a coin box, the magnet of which is schematically disclosed. The central office equipment for applying operating current to the coils 1 and 2 of the coin box magnet is schematically indicated by relays 38, 39 and 40 and the sources of positive 110 volt collecting current 41 and negative 110 volt refunding current 42.

Preparatory to making a test, the testing fixture is installed on the coin box magnet structure as previously described and the contacts thereof connected to terminals on the terminal strip 43 of the test box. Also the normal ground connection from the coin box spring 13 is intercepted and spring 13 is connected to terminal 44 on the strip 43. Terminal 45 on strip 43 is then connected to ground. With the coin box apparatus thus connected, spring 24 is connected through the winding of relay 48 to battery, spring 29 is connected through the winding of relay 49 to battery, springs 25 and 30 are both connected to ground and the windings of polarized relays 46 and 47 are interposed between spring 13 and ground. The apparatus is now in condition for the running of a test.

It will be assumed that the subscriber to initiate a call deposits a coin in the coin box thereby causing the closure of contacts 13 and 14 and removes his receiver from the switchhook. In the well known manner the line-finder 37 is now operated to extend the calling line to the central office equipment and the desired connection is then established in response to the operation of the substation dial in the usual manner. If the call is successfully established, relays 38 and 39 will be operated thereby applying coin collecting current from the source of collecting current 41 over the contact of relay 39, contacts of relay 38, tip and ring brushes of line-finder 37, thence in the usual manner through the windings 1 and 2 of the coin box magnet, springs 13 and 14 now closed by the deposited coin, over terminal 44, through the windings of polarized relays 46 and 47 and terminal 45 to ground. The armature of the coin box magnet should now operate to its collecting position thereby closing contacts 24 and 25 and polarized relay 46 should operate. Relay 46 is poled to respond only when collecting current is applied to the coin box magnet and relay 47 is oppositely poled to respond only when refunding current is applied to the coin box magnet.

If the coin box magnet operates its armature to its collecting position as it should and thereby closes the contacts 24 and 25, the circuit of relay 48 will now be completed from battery through the winding of relay 48 and contacts 24 and 25 to ground and, with polarized relay 46 also operated, the operating circuit of relay 50 will be completed from battery, winding of relay 50 to ground over the contacts of relay 46. Relay 48 upon operating locks over its inner upper front contact, the back contact of relay 53 to ground at the upper front contact of relay 50 and relay 50 locks over its inner upper front contact to ground at the upper back contact of relay 52 and also to ground at the upper front contact of relay 48. With relays 48 and 50 both locked operated independent of the continued energization of the polarized relay 46 and the continued closure of contacts 24 and 25, the circuit of meter 54 is established from battery, winding of meter 54 and the inner lower front contact of relay 48 to ground at the lower contact of relay 50. The operating circuit of meter 58 is also established from battery through its winding to ground at the lower front contact of relay 50. The operation of meter 54 registers the fact that the coin box magnet has properly responded to collect the deposited coin and the operation of meter 58 registers the fact that coin collecting current was applied to the coin box magnet.

When meter 54 operated, it closed an obvious operating circuit for slow-to-operate relay 53 which at its back contact opens the locking circuit of relay 48 which thereupon releases opening the circuit of meter 54 and one locking circuit of relay 50. When meter 58 operated, it closed an obvious operating circuit for slow-to-operate relay 52 which at its back contact opens the other locking circuit of relay 50 which now releases opening the operating circuit of meter

58. When the meters 54 and 58 release, they open the circuits of relays 53 and 52 which now release. Relays 52 and 53 are made slow to operate to insure that the operating circuits of operated meters will not be opened until such meters have had sufficient time to become fully operated.

It will now be assumed that for some reason the coin box magnet operated its armature to the refunding position when coin collecting current was applied thereto from source 41 thereby closing contacts 29 and 30 and that polarized relay 46 operated indicating that collecting current was correctly applied. In this case the closure of contacts 29 and 30 will establish a circuit for relay 49 extending from battery through its winding and contacts 29 and 30 to ground and the operation of relay 46 will cause the operation of relay 50 in the manner described. Relay 49 upon operating locks over its inner upper front contact, the back contact of relay 53 to ground at the upper front contact of relay 50 and relay 50 locks over its inner upper front contact to ground at the back contact of relay 52 and also to ground at the upper front contact of relay 49. With relays 49 and 50 now both operated, the circuit of meter 56 is established from battery through its winding and the inner lower front contact of relay 49 to ground at the lower contact of relay 50. Relay 50 upon operating also establishes the circuit of meter 58. The operation of meter 56 registers the fact that the coin box magnet has operated erroneously to refund the deposited coin when it should have operated to collect the coin and the operation of meter 58 registers the fact that coin collecting current was applied to the coin box magnet.

When meter 56 operated, it closed an obvious operating circuit for relay 53 which at its back contact opens the locking circuit of relay 49 which thereupon releases opening the circuit of meter 56 and one locking circuit of relay 50. When meter 58 operated, it closed an obvious operating circuit for relay 52 which at its back contact opens the other locking circuit of relay 50 which now releases opening the operating circuit of meter 58. When the meters 56 and 58 release, they open the circuits of relays 53 and 52 which also release.

It will now be assumed that the call made by the calling subscriber was unsuccessful and that relays 38 and 40 were operated to apply refunding current from the source 42 to the coin box magnet for causing the refunding of the deposited coin. In this case the coin box magnet armature should operate to its refunding position thus closing contacts 29 and 30 and the polarized relay 47 should operate. Relay 47 upon operating closes an obvious circuit for relay 51 and the closure of contacts 29 and 30 establishes the circuit of relay 49 previously traced. Relay 49 upon operating locks over its inner upper front contact, the upper back contact of relay 53 to the upper front contact of relay 51 and relay 51 locks over its inner upper front contact to ground at the back contact of relay 52 and also to ground over the upper front contact of relay 49. With relays 49 and 51 now both operated, the circuit of meter 57 is established from battery through its winding and the lower front contact of relay 49 to ground at the lower contact of relay 51. Relay 51 upon operating also establishes an obvious circuit for meter 59. The operation of meter 57 registers the fact that the coin box magnet has operated properly to cause the deposited coin to be refunded and the operation of meter 59 registers the fact that coin refunding current was applied to the coin box magnet.

When meter 57 operated it closed an obvious operating circuit for relay 53 which at its back contact opens the locking circuit of relay 49 which thereupon releases opening the circuit of meter 57 and one locking circuit of relay 51. When meter 59 operated it closed an obvious operating circuit for relay 52 which at its back contact opens the other locking circuit of relay 51 which now releases opening the operating circuit of meter 59. When the meters 57 and 59 release, they open the circuits of relays 53 and 52 which also release.

It will now be assumed that for some reason the coin box magnet operated its armature to the collecting position when coin refunding current was applied thereto from source 42, thereby closing contacts 24 and 25 and that polarized relay 47 operated indicating that the refunding current was correctly applied. In this case the closure of contacts 24 and 25 will establish the operating circuit of relay 48 and the operation of relay 47 will establish the operating circuit of relay 51. Relay 48 upon operating locks over its inner upper front contact and the back contact of relay 53 to ground at the upper front contact of relay 51 and relay 51 locks over its inner upper front contact to ground at the back contact of relay 52 and also to ground at the upper front contact of relay 48. With relays 48 and 51 now both operated, the circuit of meter 55 is established from battery through its winding and the lower front contact of relay 48 to ground at the lower contact of relay 51. Relay 51 upon operating also establishes the circuit of meter 59. The operation of meter 55 registers the fact that the coin box magnet has operated erroneously to collect the deposited coin and the operation of meter 59 registers the fact that coin refunding current was applied to the coin box magnet.

When meter 55 operated, it closed the circuit for relay 53 which at its back contact opens the locking circuit of relay 48 which thereupon releases opening the circuit of meter 55 and one locking circuit of relay 51. When meter 59 operated it closed an obvious operating circuit for relay 52 which at its back contact opens the other locking circuit of relay 51 which now releases opening the operating circuit of meter 59. When the meters 55 and 59 release, they open the circuits of relays 53 and 52 which in turn release.

It will be apparent from the foregoing description that so long as the test equipment is associated with the coin box magnet of the line under test, each application of coin collecting current to the coin box magnet will be registered by the meter 58 and that each application of coin refunding current will be registered by the meter 59. Also each correct response of the coin box magnet when collecting current is applied thereto will be registered by meter 54 and each incorrect response will be registered by meter 56. Further that each correct response of the coin box magnet when refunding current is applied thereto will be registered by meter 57 and each incorrect response will be registered by meter 55. Thus by reading the meters prior to the starting of the test and by reading them again upon the termination of the test, the number of errors, if any, in the operation of the coin box magnet and their character may be ascertained and thereby the justification of the complaint made by the subscriber may be checked.

What is claimed is:

1. In a test device for testing the operation

of a polarized relay which operates its armature in one direction in response to operating current of one polarity and in another direction in response to current of the opposite polarity, two pairs of contacts for said relay operable respectively by the movement of said armature in said two directions, relay means connectable into the operating circuit of said polarized relay for detecting the polarity of the operating current of said polarized relay and a plurality of registers operable under the joint control of said relay contacts and said relay means.

2. In a test device for testing the operation of a coin box magnet which operates its armature to a collecting position in response to operating current of one polarity and to a refunding position in response to current of the opposite polarity, a pair of contacts for said magnet closable when said armature moves to its collecting position, a second pair of contacts for said magnet closable when said armature moves to its refunding position, relay means connectable into the operating circuit of said magnet for detecting the polarity of the operating current of said coin box magnet, and a plurality of registers under the joint control of said magnet contacts and said relay means.

3. In a test device for testing the operation of a coin box magnet which operates its armature to a collecting position in response to operating current of one polarity and to a refunding position in response to current of the opposite polarity, a pair of contacts for said magnet closable when said armature moves to its collecting position, a second pair of contacts for said magnet closable when said armature moves to its refunding position, two oppositely polarized relays connectable into the operating circuit of said magnet for detecting the polarity of the operating current of said coin box magnet, and a plurality of registers operable under the joint control of said magnet contacts and said polarized relays.

4. In a test device for testing the operation of a coin box magnet which operates its armature to a collecting position in response to operating current of collecting polarity and to a refunding position in response to current of the opposite or refunding polarity, a first pair of contacts for said magnet closable when said armature moves to its collecting position, a second pair of contacts for said magnet closable when said armature moves to its refunding position, a first and a second polarized relay connectable into the operating circuit of said magnet and responsive respectively to current of collecting and refunding polarities, and a plurality of registers jointly controlled by said contacts and said polarized relays for registering whether or not said coin box magnet correctly responds to current of collecting or refunding polarity.

5. In a test device for testing the operation of a coin box magnet which operates its armature to a collecting position in response to operating current of collecting polarity and to a refunding position in response to current of the opposite or refunding polarity, a first pair of contacts for said magnet closable when said armature moves to its collecting position, a second pair of contacts for said magnet closable when said armature moves to its refunding position, a first and a second polarized relay connectable into the operating circuit of said magnet and responsive respectively to current of collecting and refunding polarities, a plurality of registers jointly controlled by said contacts and said polarized relays for registering whether or not said coin box magnet correctly responds to current of collecting or refunding polarity, and registers for registering respectively the number of times current of collecting or refunding polarity is applied to said coin box magnet.

6. In a test device for testing the operation of a coin box magnet, which operates its armature to a collecting position in response to operating current of collecting polarity and to a refunding position in response to current of the opposite or refunding polarity, a first pair of contacts for said magnet closable when said armature moves to its collecting position, a second pair of contacts for said magnet closable when said armature moves to its refunding position, a first and a second polarized relay connectable into the operating circuit of said magnet and responsive respectively to current of collecting and refunding polarities, a first register operable upon the closure of said first contacts and the operation of said first polarized relay, a second register operable upon the closure of said first contacts and the operation of said second polarized relay, a third register operable upon the closure of said second contacts and the operation of said first polarized relay.

7. In a test device for testing the operation of a coin box magnet which operates its armature to a collecting position in response to operating current of collecting polarity and to a refunding position in response to current of the opposite or refunding polarity, a first pair of contacts for said magnet closable when said armature moves to its collecting position, a second pair of contacts for said magnet closable when said armature moves to its refunding position, a first and a second polarized relay connectable into the operating circuit of said magnet and responsive respectively to current of collecting and refunding polarity, a first register operable upon the closure of said first contacts and the operation of said first polarized relay, a second register operable upon the closure of said first contacts and the operation of said second polarized relay, a third register operable upon the closure of said second contacts and the operation of said second polarized relay, a fourth register operable upon the closure of said second contacts and the operation of said first polarized relay, a fifth register operable upon each operation of said first polarized relay, and a sixth register operable upon each operation of said second polarized relay.

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