June 17, 1941. R. L. PEEK, JR 2,245,814

COIN COLLECTOR APPARATUS

Filed Aug. 19, 1938 4 Sheets-Sheet 1

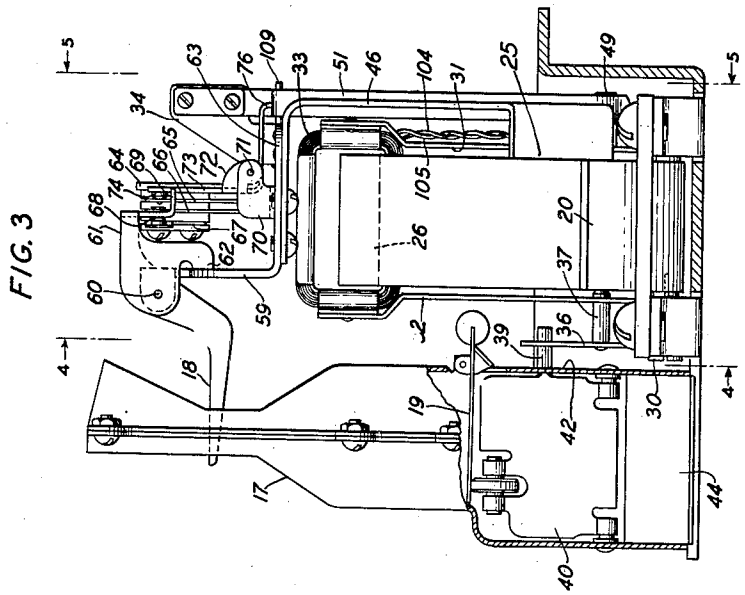

FIG. 3

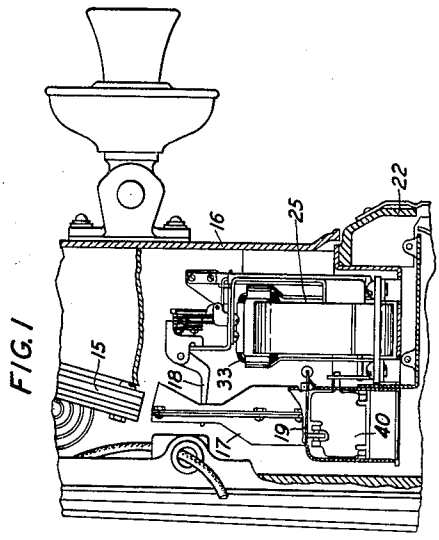

FIG. 1

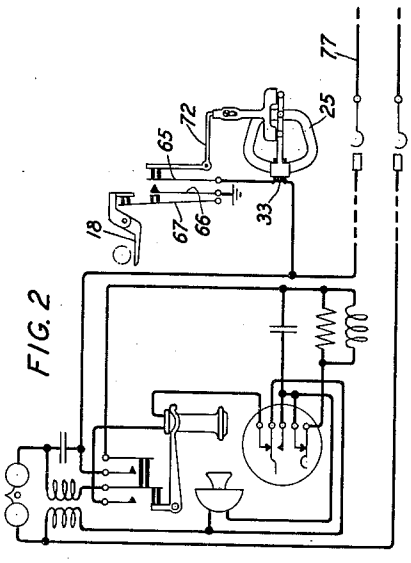

FIG. 2

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COIN COLLECTOR APPARATUS

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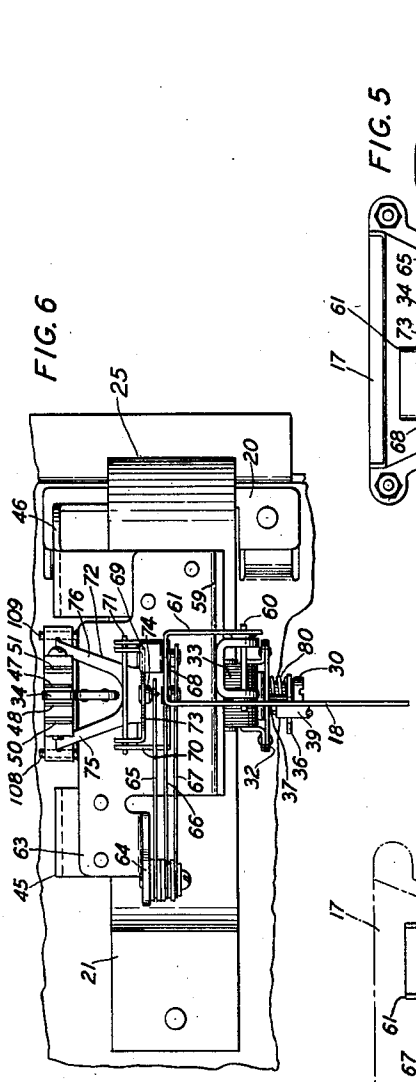

FIG. 6

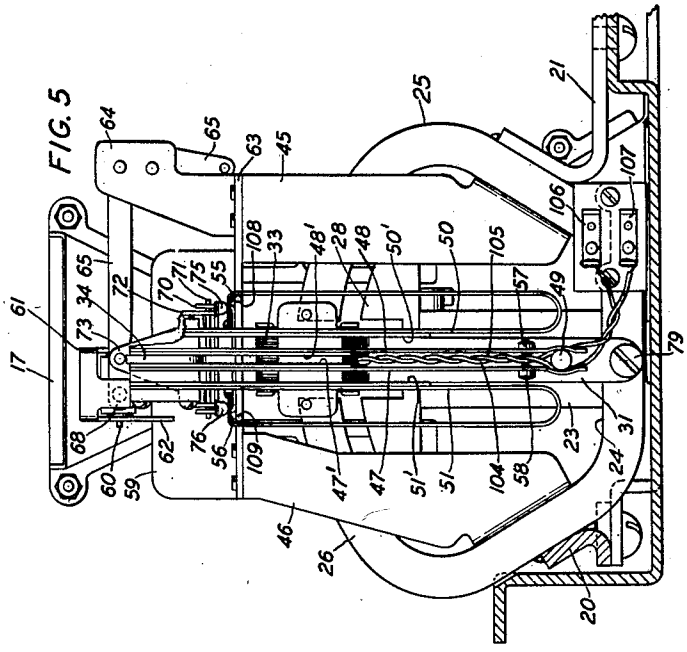

FIG. 5

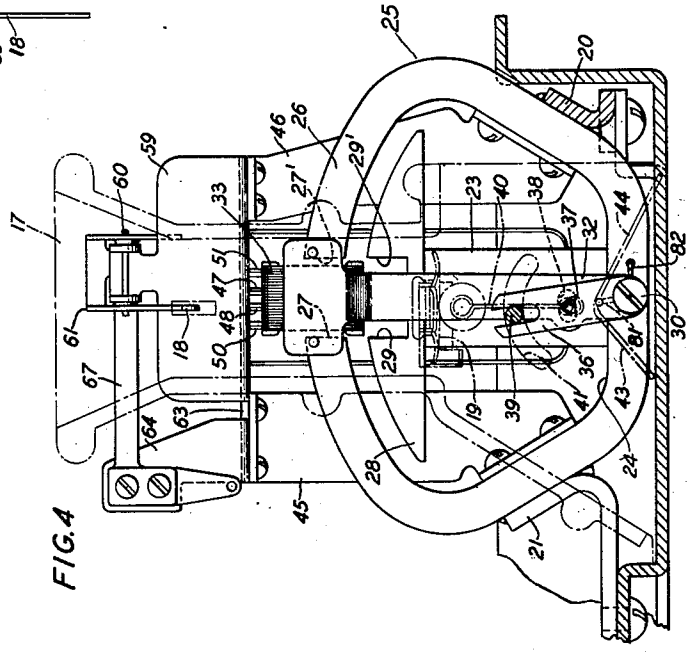

FIG. 4

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COIN COLLECTOR APPARATUS

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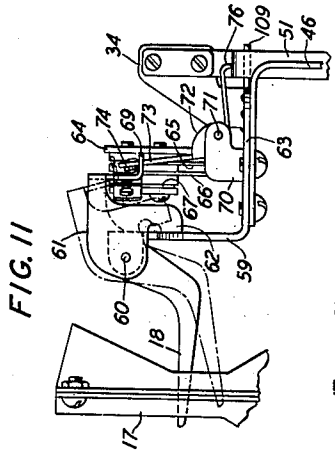

FIG. 11

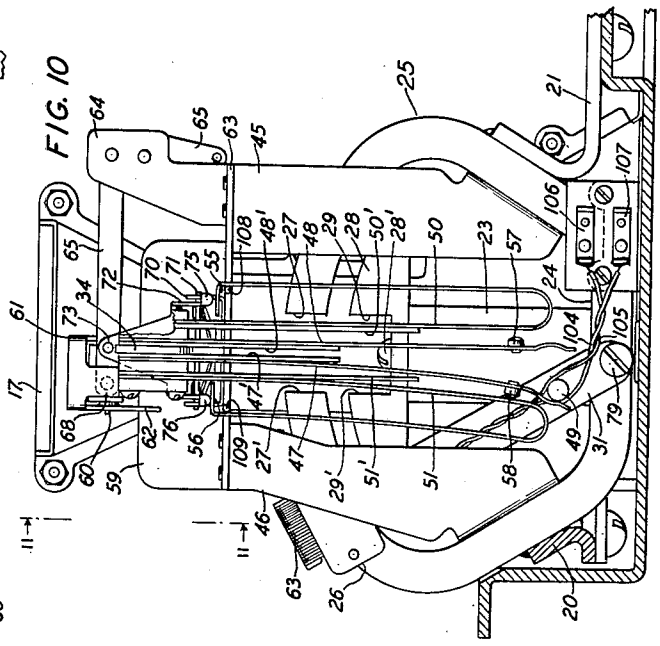

FIG. 10

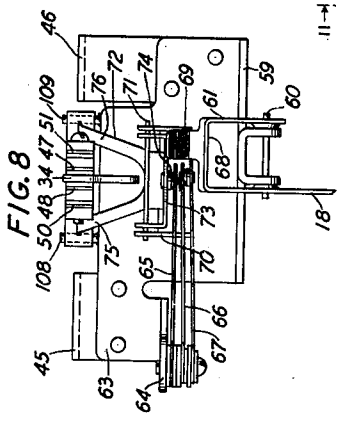

FIG. 8

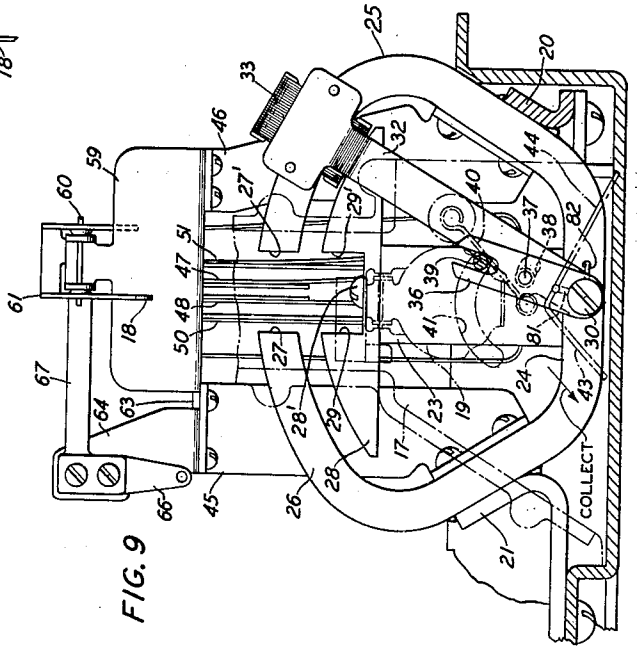

FIG. 9

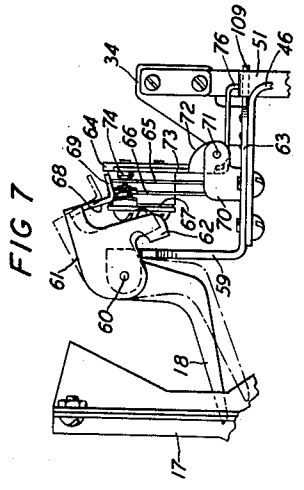

FIG 7

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COIN COLLECTOR APPARATUS

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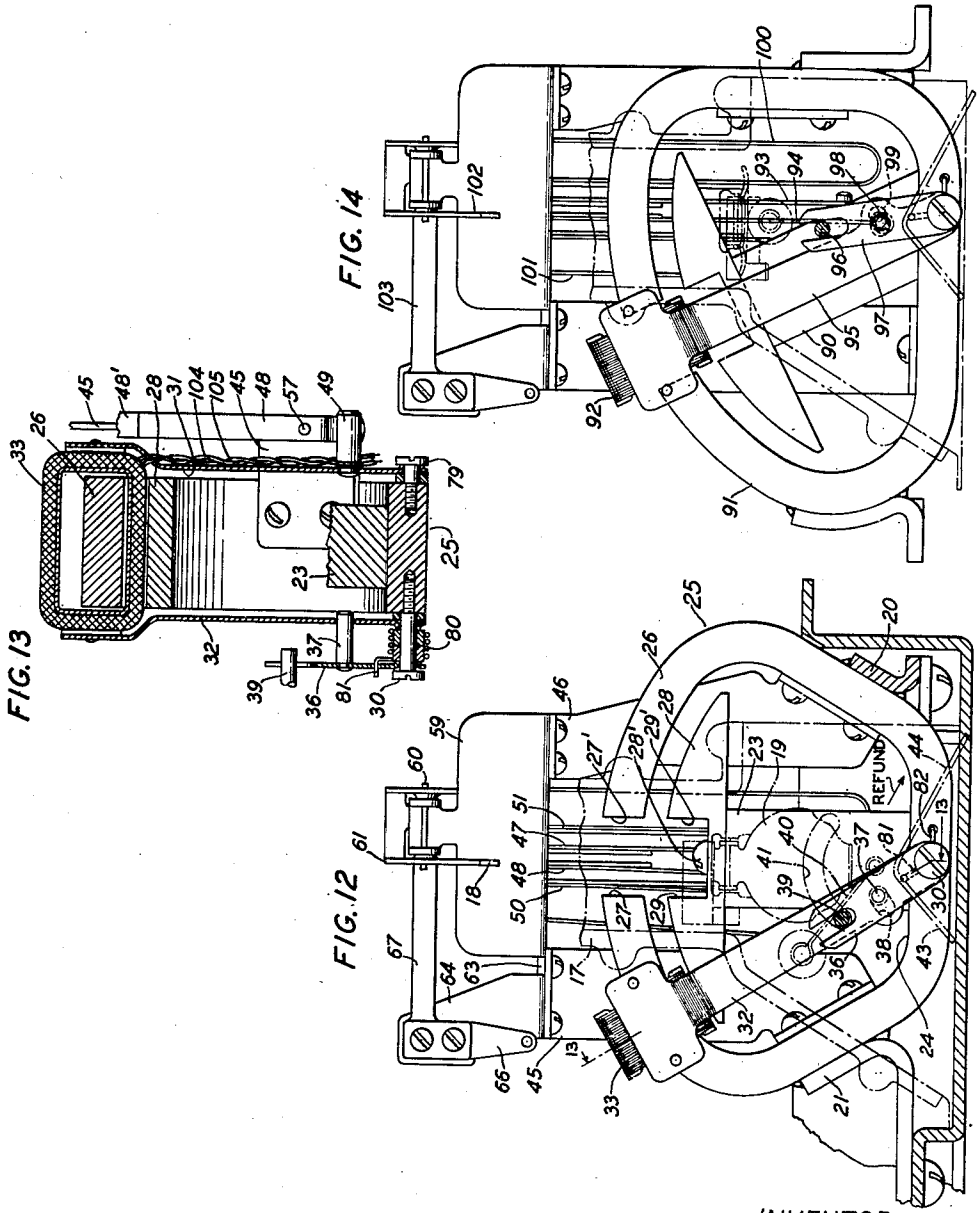

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Patented June 17, 1941

2,245,814

UNITED STATES PATENT OFFICE

2,245,814

COIN COLLECTOR APPARATUS

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Application August 19, 1938, Serial No. 225,723

4 Claims. (Cl. 175—340)

This invention relates to coin collector apparatus and more particularly to a moving coil operated coin collector system for a telephone pay station.

The invention is particularly suitable for use in a telephone pay station of the type illustrated in the O. F. Forsberg U. S. Patent No. 1,043,219, issued November 5, 1912, wherein a deposited coin is temporarily held upon a pivoted coin trap after actuating a coin trigger for causing the operation of a signal at the central office to indicate that communication is desired and for establishing an energizing circuit for a coin relay utilized subsequently in the disposition of the deposited coin. At the termination of the conversation, battery at the central office may be applied to energize the coin relay whereby the actuation of its armature serves to collect the coin if the applied voltage is of one polarity and to refund the coin if the applied voltage is of the opposite polarity. The coin trap upon which the coin is temporarily held may be supported by a pivoted coin vane controlled by the relay to release the trap and direct the coin into the desired collect or refund channel. The operation of this relay also serves to restore the coin trigger to normal thereby reopening the electrical contacts controlled thereby.

An object of this invention is to simplify the construction and cost of manufacture of the coin relay and associated switching mechanism while providing for efficient operation over a wide range in energizing current and load.

In accordance with the preferred form of this invention the coin relay comprises a coil rotatable in the field of a permanent magnet in such a manner that only one side of the coil lies in the air-gap of the magnetic circuit. For example, the relay may comprise a permanent magnet and a return path joined to one end of the magnet but with an air-gap between the free end of the magnet and said path. The portion of the return path adjacent the free end of the magnet is preferably arcuately shaped and is encircled by a movable coil pivoted about the axis of the arcuately shaped portion. Special means are provided for causing the movement of the coil when traversed by current to control the disposition of any deposited coin and to reset the coin trigger for the purpose previously described.

Referring to the drawings,

Fig. 1 is a view partly in section of the central portion of a telephone coin collector employing a coin relay of the moving coil type;

Fig. 2 illustrates a telephone coin collector substation circuit employing the apparatus of this invention;

Fig. 3 is a side view partly in section of the coin hopper and the coin relay with all parts in normal position;

Fig. 4 is a rear view of the coin relay taken along the line 4—4 of Fig. 3;

Fig. 5 is a front view of the coin relay taken along the line 5—5 of Fig. 3;

Fig. 6 is a top view of the coin relay of Fig. 3;

Fig. 7 is a side view of the coin trigger and associated spring contacts with the coin trigger occupying its coin actuated position;

Fig. 8 is a top view of the coin trigger and associated spring contacts with the coin trigger in coin actuated position;

Fig. 9 is similar to Fig. 4 except that the moving coil of the relay is in its coin collecting position;

Fig. 10 is similar to Fig. 5 except that the moving coil of the relay is in its coin collecting position;

Fig. 11 is a side view of the coin trigger and associated apparatus taken along the line 11—11 of Fig. 10 and shows the spring contacts in position to permit the coin trigger to be restored to normal;

Fig. 12 is a view of the coin relay similar to Fig. 4 except that the moving coil is in coin refunding position;

Fig. 13 is a sectional view of the moving coil and associated mechanism taken along the line 13—13 of Fig. 12; and

Fig. 14 illustrates a modification of the coin relay of the earlier figures.

Fig. 1 shows only a portion of a telephone coin collector of a type disclosed in the above-mentioned Forsberg patent to which reference is made for further details as to its general construction and methods of operation. A coin deposited by a subscriber, after passage through a coin chute 15 in upper housing 16, drops into a coin hopper 17, actuates a coin trigger 18 and is temporarily retained upon a pivoted coin trap 19. The present invention is concerned with an electromagnetic structure or relay particularly adapted for use in a collector of the Forsberg type for controlling the collection or refund of the deposited coins.

Referring more particularly to Figs. 3 to 5, brackets 20, 21 suitably supported within the lower housing 22 serve to support a coin relay having a magnetic circuit comprising a straight bar magnet 23 mounted vertically upon the base portion 24 of a D-shaped return path 25 of magnetic material. The upper portion 26 of this return path is arcuate shaped and preferably has a centrally located air-gap 27, 27' of substantial width, for a purpose to be described later. Mounted on the upper free end of permanent magnet 23 by means of screw 28' is a pole-piece 28, the upper face of which is curved to form with return path portion 26 an air-gap of substantially constant width except that the pole-piece has a

centrally located slot 29, 29' which may be of substantially the same width as gap 27, 27'.

Suitably pivoted about bearings 30, 79 fastened in base portion 24 are two spaced arms 31, 32 which at their upper ends serve to support a coil 33 which encircles the magnetic return path 26. Since portion 26 of the return path is curved about the axis 30, 79 as a center, it follows that coil 33 can move freely in either direction from its normal position of Fig. 4 with one side of coil 33 lying in the air-gap between pole-piece 28 and return path 26. It is therefore obvious that when current traverses coil 33 the coil will be deflected from its neutral position in a direction determined by the direction the current flows through the coil.

Independently pivoted on the same bearing pin 30 as coil arm 32 but spaced from arm 32 in the direction of coin hopper 17 is an arm 36 which a short distance above its pivoting axis carries stud 37 extending laterally into slot 38 in arm 32. The upper end of arm 36 is forked to embrace a pin 39 which forms a part of coin vane 40 and projects through an arcuate slot 41 in side wall 42 of coin hopper 17. Vane 40 is similar to the corresponding vane in the Forsberg patent and normally lies in a vertical position supporting coin trap 19, but when the vane is deflected one way or the other any coin on the trap will be discharged into a collect chute 43 or a refund chute 44. In order to center arm 36 and vane 40 in their normal neutral position, a light helical spring 80 (Figs. 4 and 13) is coiled around the bearing pin 30 with one end 81 passing through a hole in arm 36 and the other end 82 passing into a hole in magnetic member 25.

Spring means are provided for biasing coil 33 to its position of Fig. 4 and for restoring the coil to that position after it has been deflected due to the passage of current therethrough. Suitably supported at the upper ends of the supporting arms 45, 46 is a bracket 34 to which are clamped two springs 47, 48 biased to occupy the parallel positions shown in Fig. 5 with their lower ends bowed slightly outwardly to receive a stud 49 mounted on coil supporting arm 31 at a point a short distance above the pivoting axis of arm 31. Springs 47, 48 are only lightly tensioned against their stops 47', 48' as their main purpose is to merely bring the coil exactly to its neutral position after the coil has reached its approximate neutral position by other spring means. The main restoring force exerted on the coil when in a deflected position is due to one of the two U-shaped springs 50, 51 which are biased against their stops 50', 51'. One end of each of these U-shaped springs is clamped in fixed position in block 34 while the free ends of these springs terminate in horizontal tab portions 55, 56. The inner vertical arms of springs 50, 51 are normally spaced a short distance from studs 57, 58 carried by springs 47, 48. Hence with coil 33 in its neutral position of Fig. 4 or 5 where it is maintained by springs 47, 48, the heavy springs 50, 51 exert no pressure on the coil supporting arms. But when the coil 33 is moved from the position of Fig. 4 or 5 to the position say of Fig. 10, the pin 49 on coil arm 31 will first deflect spring 47 and the deflection of spring 47 will then cause stud 58 on spring 47 to contact with the inner portion of spring 51, thereby deflecting springs 47, 51 to the positions shown in Fig. 10.

This deflection of the U-shaped spring 51 will cause its tab portion 56 to be raised upwardly, as will be shown by comparing Fig. 5 with Fig. 10. This raising of spring end 56 when the coil 33 is moved counter-clockwise, as viewed in Fig. 5, or the corresponding lifting of spring end 55 when coil 33 is moved clockwise, as viewed in Fig. 5, is utilized to control electrical contacts adapted to be connected in circuit with coil 33.

In order to prevent any substantial lateral movement of the ends 55, 56 of springs 50, 51 when either spring is deflected by coil 33, stationary pins 108, 109 are provided with the outer half of spring 50 lightly tensioned against pin 108 and the outer half of spring 51 lightly tensioned against pin 109 when the springs are in normal position.

The upwardly extending supporting arms 45, 46 support several brackets, one of which (bracket 63) has a vertical member 59 having spaced apertured lugs for supporting the pin 60 about which the coin trigger 18 is pivoted. The normal position of the coin trigger 18 is shown in Fig. 3, and while it is biased in a clockwise direction by its counterweight 61, the coin trigger is held in the position shown in that figure due to trigger projection 62 contacting against stop 59.

Plate 63 supported by arms 45, 46 has a vertical extension 64 for supporting a horizontally disposed spring pile-up comprising two horizontally disposed contact springs 65, 66 and a biasing spring 67, the latter of which is biased in a direction to close contacts 65, 66 but is restrained from so doing when the coin trigger 18 is in its normal position, as in Figs. 3 and 6, where it will be noted that the counterweight 61 has a downwardly extending arm 68 normally interposed between biasing spring 67 and contact springs 65, 66 whereby the biasing spring is made ineffective to close the contacts. It will be noted from Fig. 6 that biasing spring 67 is substantially longer than springs 65, 66 so that only the end of spring 67 lies in the path of trigger extension 68. This downwardly extending arm 68 has a horizontally disposed tab 69 projecting away from the trigger pivot 60, but this tab 69 performs no function as long as the coin trigger 18 is in its normal position, but after the coin actuation of trigger 18 this tab 69 is utilized for a certain purpose to be described later. When the trigger 18 is actuated by a deposited coin it initially moves to the dotted line position of Fig. 7, whereby its arm 68 is moved out of the path of spring 67 thereby enabling the free end of spring 67 to move away from the coin hopper and close the contacts 65, 66 as shown in Figs. 7 and 8. After the passage of the coin the counterweight 61 tends to restore the trigger 18 to normal but it is restrained when the tab 69 on arm 68 comes to rest on the top of the displaced biasing spring 67, as shown in the full line position of the coin trigger in Fig. 7.

The apparatus for resetting coin trigger 18 and reopening contacts 65, 66 will now be explained. Mounted upon plate 63 is an upwardly extending bracket 70 having spaced apertured lugs for supporting a pivoting pin 71 for an angular lever 72. Lever 72 has a vertical arm 73 bearing a stud 74 against which the springs 65, 66 are pressed by biasing spring 67 when the coin trigger 18 is in its coin actuated position. Lever 72 also has two spaced horizontal arms 75, 76 with the end of arm 75 resting on the tab 55 of

U-shaped spring 50 and the end of arm 76 resting on the tab portion 56 of the U-shaped spring 51.

It has been previously described that when coil 33 is moved from its neutral position of Fig. 4 to the deflected position of Fig. 9 or 10, the resulting deflection of spring 51 serves to elevate the upper end portion 56 of that spring. Since lever 72 has one of its horizontal arms resting on tab portion 56, it follows that the raising of tab 56 will move lever arm 76 upwardly, which will move the vertical arm 73 of angular lever 72 towards the coin hopper; and since the free end portion of spring contact 65 lies against stud 74 carried on the upper end of vertical arm 73, it follows that the movement of vertical arm 73 towards the coin hopper will cause the ends of springs 65, 66, 67 to be deflected towards the coin hopper 17 a distance sufficient to remove spring 67 from beneath tab 69 so as to enable arm 68 of the coin trigger to freely drop down on the side of biasing spring 67 remote from the hopper, where it was located originally before the coin actuation of the trigger. However, as long as coil 33 remains in its deflected position of Fig. 9 or 10, spring contacts 65, 66 will remain closed due to the pressure thereon exerted by lever arm 73, which remains in its deflected position of Fig. 11 as long as coil 33 remains in its deflected position.

As shown in the substation circuit of Fig. 2, the closing of contacts 65, 66 establishes a circuit from line conductor 77 through coil 33 to ground whereby when battery at the central office is applied to conductor 77, coil 33 will be deflected in a direction dependent upon the polarity of the applied voltage.

The method of operation of the apparatus of Figs. 1 to 13, inclusive, may be briefly reviewed as follows. The apparatus is shown in normal position in Figs. 3, 4, 5 and 6. When a coin is deposited in coin hopper 17 it first actuates the coin trigger 18 to the dotted line position of Fig. 7 and after the passage of the coin, counterweight 61 tends to restore the trigger to normal but is temporarily stopped in the full line position of Fig. 7 where projection 69 strikes the top edge of biasing spring 67 which has now moved over to close contacts 65, 66. In the meantime, the coin has come to rest on coin trap 19.

The closure of contacts 65, 66 applies ground on one side of the line through coil 33 and thereby actuates a signal at the central office to indicate that a telephone connection is desired. At the termination of the conversation battery may be applied to conductor 77 to dispose of the coin on trap 19 either by directing the coin into collect chute 43 or to refund chute 44. If the polarity of the voltage is such that coil 33 is deflected from its position of Figs. 4 and 5 to its position of Figs. 9 and 10 the coin will be discharged into collect chute 43. As previously explained, trap 19 is held in its normal position by pivoted vane 40, and vane 40 has a projecting pin 39 held in place by an arm 36 which is deflected with the deflection of coil 33. The only load initially acting against the deflected coil is due to the light pressure exerted by one of the springs 47, 48, since neither spring 50 or 51 is effective in the initial portion of the deflection and the coin vane load is not picked up immediately because pin 37, carried by vane arm 36, is not rigidly fastened to coil arm 32 but projects into a small arcuate slot 38 in arm 32. However, after coil 33 has moved through a small angle towards its completely deflected position of Fig. 9, the U-shaped spring 51 will be picked up and deflected and the pin 37 will also be picked up to actuate coin vane 40 to the position shown in Fig. 9 with vane pin 39 striking the end of slot 41. With vane 40 in its deflected position coin trap 19 is free to discharge any coins thereon into collect chute 43 whereupon the counterweight of the coin trap 19 serves to restore the trap to its horizontal position as shown in Fig. 3.

The actuation of coil 33 from its position of Fig. 4 or 5 to its position of Fig. 9 or 10 will also tilt angular lever 72 towards the coin hopper to move biasing spring 67 towards the hopper far enough to permit the coin trigger, due to its counterweight, to move from the dotted line position of Fig. 11 to the solid line position of that figure so that the extending arm 68 now lies in the path along which spring 67 will tend to move as soon as the pressure on the spring pile-up, due to lever 72, has been removed.

When collect battery at the central office is disconnected from line conductor 77 the deflected restoring spring 51 acting through spring 47 on pin 49, will exert sufficient force to restore coil 33 from its position of Fig. 9 or 10 to its position of Fig. 4 or 5, the final centering of the coil 33 in its neutral position being due to spring 47. The restoring of spring 51 to its normal position will lower its free end portion 56 from the position of Fig. 10 to the position of Fig. 5, thereby allowing angular lever 72 to be restored to its normal position of Fig. 5 whereupon the electrical spring contacts 65, 66 are free to separate under their own tension since pressure thereon through angular lever 72 has been removed and since biasing spring 67 is now restrained by arm 68 of the coin trigger. It will also be obvious that coin vane 40, under the restoring force of spring 51, will be restored from its deflected position of Fig. 9 to its normal vertical position of Fig. 4 to maintain trap 19 in a coin supporting position until the coil 33 is again traversed by energizing current after the next closure of contacts 65, 66.

It will be obvious after a deposited coin has caused the closure of contacts 65, 66 that the coin may be refunded if the voltage applied to line conductor 77 is of the opposite polarity to that employed for collection. In such an event, coil 33 will be deflected from its neutral position of Fig. 4 to its refund position of Fig. 12 whereby vane 40 is deflected to the left as shown in Fig. 12 and the coins on the coin trap are discharged into refund chute 44. The refund movement of coil 33 also deflects the U-shaped spring 50 to lift its upper free end 55 and since arm 75 of angular lever 72 rests on this spring end 55, it follows that lever 72 will be tilted in the same manner as heretofore described to restore coin trigger 18 to normal and to permit contacts 65, 66 to be reopened by the movement of coil 33 from its refund position of Fig. 12 to its neutral position of Fig. 4.

The leads 104, 105 for coil 33 may be taken off in any suitable manner and connected to terminals 106, 107 to enable the moving coil to be connected in the substation circuit in the manner shown in Fig. 2.

With respect to the coin relay disclosed as part of the above-described apparatus, it will be apparent that only one side of the moving coil 33 lies in the air-gap of the magnetic circuit since the coil encircles the return path and the air-gap is located between the free end of permanent magnet 23 and the curved portion of the

return path 25. Provision for play in the linkage between the coil arm 32 and the coin vane 40 enables coil 33 to move through a small initial angle against a fixed spring tension due to one of the springs 47, 48 before picking up the coin load. This has the desirable feature of providing a close margin between operate and non-operate voltages since it eliminates the effect of variations in the coin load in determining operate voltage whereby the operate condition for the coil is controlled solely by a fixed spring tension acting on the coil at its neutral position.

It is also desirable that the pull exerted by coil 33 increase sharply from its value in the neutral position to that applying at the coil position where the coin trap load is picked up. Such a pull characteristic may be obtained by slotting the pole face and by providing a gap in the return path at the neutral position of the coil. In the drawings, the slot 29, 29' in the pole face and gap 27, 27' in the return path are shown as substantially equal widths with the actual length of coil 33 somewhat less than the length of the gap or slot. This break in the return path 26 at the coil neutral position increase the force developed by the coil after its initial movement. This action is due to the fact that in consequence of this break when the coil is moved away from neutral position the flux of the leading turns of the coil passes through the remaining turns into the pole face, follows the magnetic path of the permanent magnet and back up the arm of the return path into which the coil arm is moving; and this additional flux is always such as to aid motion in the direction away from neutral position and therefore increases the effective torque acting on the coil arm. The effect of the gap in the return path is to greatly reduce the flux acting in the coil neutral position so that the coil can be held in this neutral position by a pair of light tensioned springs. When the current traversing the coil produces a pull sufficient to overcome the initial tension, the coil and its arms move and the pull increases until the coil lies wholly between the return path and the full section of the pole face.

The use of two pairs of springs, one pair 47, 48 acting to tension the coil 33 in its neutral position while the other pair 50, 51 acts to return the coil to neutral position when the energizing current has been removed, facilitates their separate adjustment to meet the operate and release requirements for the relay.

It will be noted that the pivoting axis for coil 33 is at a substantial distance below the pivoting axis of coin vane 40 so as to decrease the arc through which the coil 33 must move in either direction to obtain a full deflection of the coin-vane.

While it will generally be preferable to employ the symmetrical magnetic circuit of Figs. 1 to 13, space requirements may make it desirable in some instances to employ a non-symmetrical arrangement as shown in Fig. 14, where the permanent magnet 90 is at a substantial angle from the vertical and the return path 91 is shaped to conform with the angular position of the magnet. In Fig. 14 the movable coil 92 is shown in its neutral position, in which position it is normally maintained by the tension springs 93, 94 functioning in the same manner as springs 47, 48 of the earlier figures. The same loose coupling between the coil arm 95 and the coin vane pin 96 is employed as in the earlier figures, since arm 97 embracing vane pin 96 has a stud 98 working in a slot 99 in the coil supporting arm 95. The two U-shaped springs 100, 101 perform the same functions as in the earlier figures to restore coil 92 to its normal position after it has been deflected in either direction and to reset the coin trigger 102 and reopen the spring contacts 103.

Except for the above-described change in the magnetic circuit, the coin relay of Fig. 14 operates in the same manner as the coin relay previously described.

What is claimed is:

1. In a coin collector, a relay comprising a substantially closed path of magnetic material having an arcuate-shaped portion, an arm of magnetic material joined at one end to said path with an air-gap between its other end and said arcuate portion, said material including means for producing a magnetic potential therein, said arcuate portion having an air-gap at an intermediate point adjacent said arm, a movable coil encircling said arcuate portion with one side of said coil between said arm and said arcuate portion, and means for biasing said coil to a neutral position surrounding the air-gap in said arcuate portion.

2. In a coin collector, a relay comprising a substantially closed path of magnetic material having an arcuate-shaped portion, a permanent magnet joined at one end to said path, a pole-piece on the other end of said magnet with an air-gap between said pole-piece and said arcuate portion, said pole-piece being slotted at a point adjacent an intermediate point on said arcuate portion, said arcuate portion having an air-gap at said intermediate point, a solenoidal coil encircling said arcuate portion, and means for biasing said coil to a neutral position surrounding said air-gap in said arcuate portion, the length of said coil being less than the width of said slot and less than the length of said air-gap in said arcuate portion.

3. In a coin collector, a relay comprising a magnetic circuit including a permanent magnet and a D-shaped return path of magnetic material, one end of said magnet being joined to the straight portion of said path, a pole-piece on the free end of said magnet with an air-gap between said pole-piece and the curved portion of said path, said curved portion having an air-gap at an intermediate point thereof adjacent said pole-piece, said pole-piece extending for a substantial distance in both directions from the air-gap in said curved portion, a movable coil encircling said curved portion, and means for biasing said coil to a neutral position with said coil surrounding said air-gap in said curved portion.

4. In a coin collector, a relay comprising a permanent magnet, a coil adapted to be traversed by an electric current and positioned in the field of said magnet, means pivoted on a horizontal axis for supporting said coil for movement along a curved path having a radius of curvature substantially greater than the diameter of said coil, a rotatable member pivoted about a substantially horizontal axis, and means for coupling said member to said coil supporting means, the pivoting axis of said member lying in a horizontal plane between said coil and the pivoting axis of said coil whereby the deflection of said coil through a given angle produces a greater angular deflection of said member.

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