

June 23, 1936.

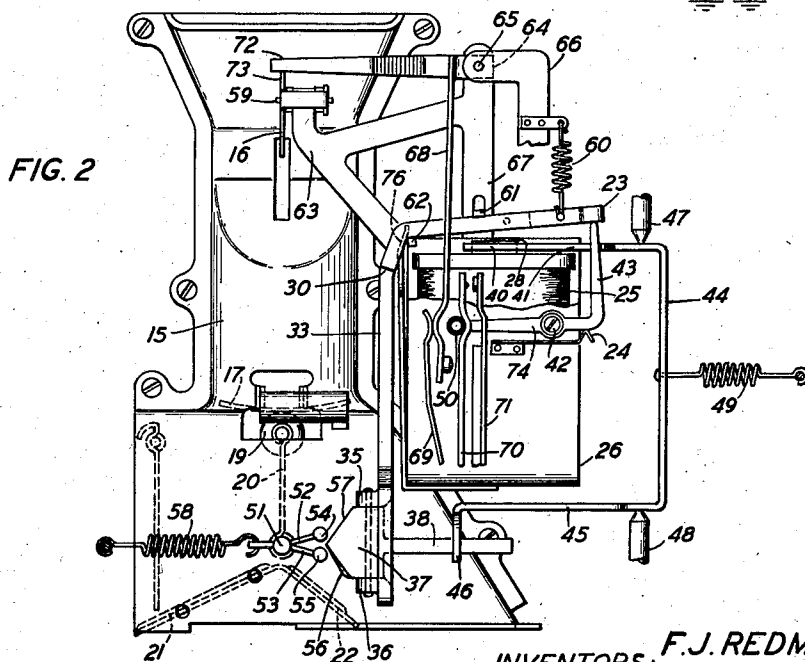
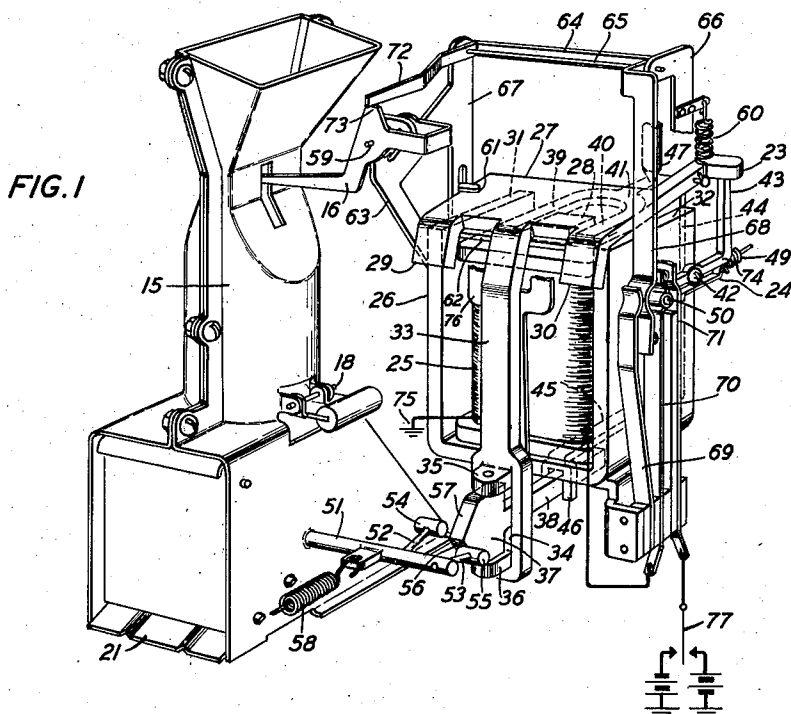
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2,045,409

ELECTROMAGNET

Filed March 15, 1935

3 Sheets-Sheet 1



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FIG.3

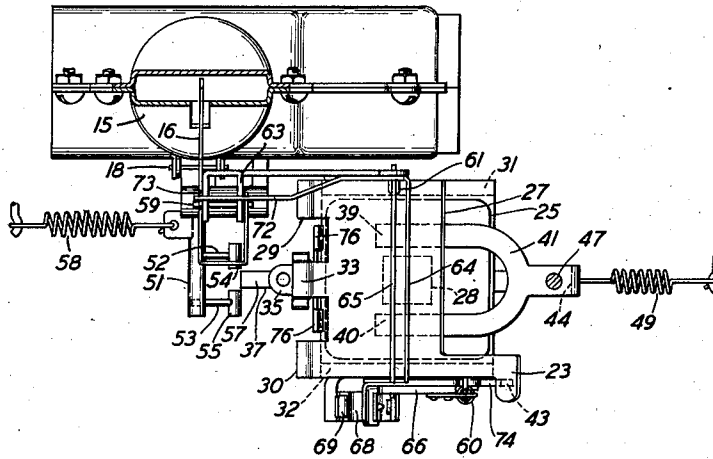


FIG. 4

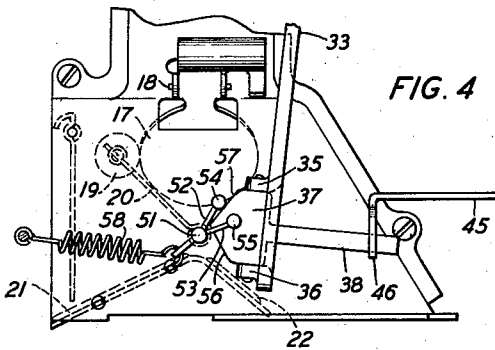
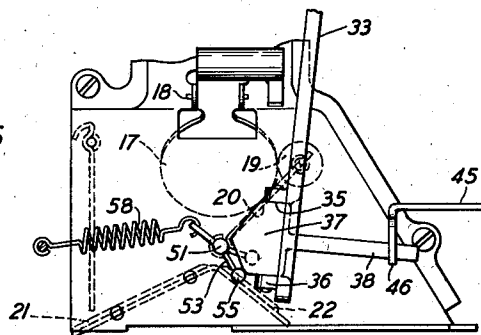


FIG. 5



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FIG. 6

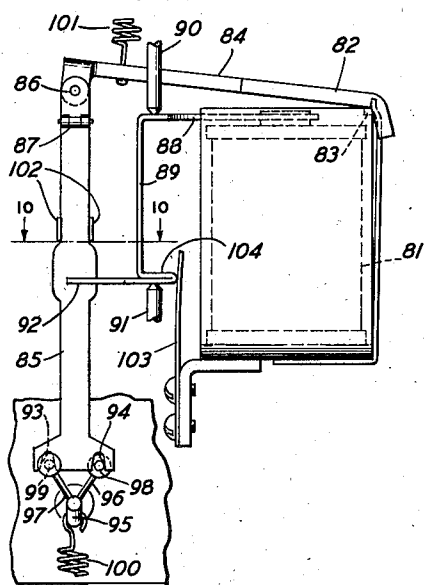


FIG. 7

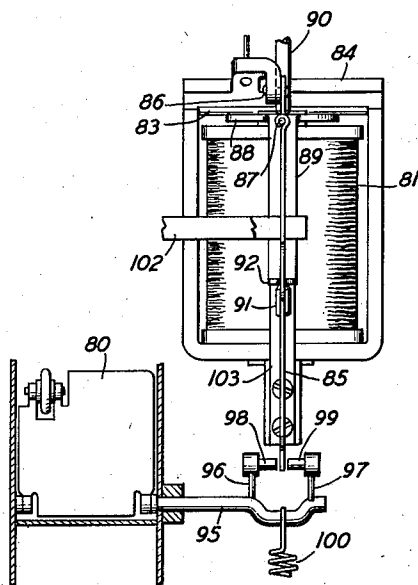


FIG. 8

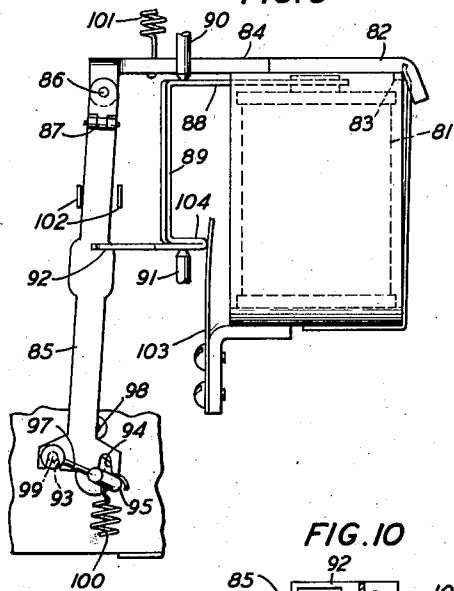


FIG. 9

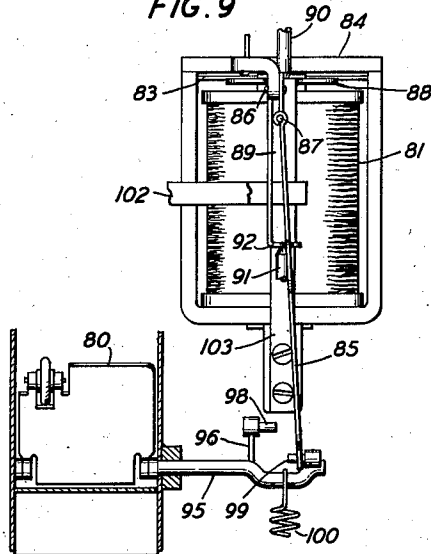
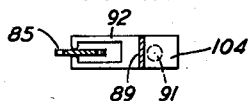


FIG. 10



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ELECTROMAGNET

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12 Claims. (Cl. 194—1)

This invention relates to electromagnets particularly for telephone coin collectors.

An object of the invention is to improve the efficiency of electromagnets and simplify their construction in securing a selective operation of their armatures depending upon the direction of current flow supplied thereto.

The electromagnet of this invention is of particular value in the operation of telephone coin collectors wherein the subscriber tentatively deposits a coin which is subsequently collected or refunded by the central office operator depending upon whether or not the desired telephone connection is obtained. Thus, in the type of telephone coin collector disclosed in O. F. Forsberg U. S. Patent 1,043,219, issued November 5, 1912 the coin deposited by the subscriber is temporarily held upon a coin trap which is supported by a pivoted vane under the control of an electromagnet. If the pivoted vane is moved by the electromagnet in one direction the deposited coin is collected, while if it is moved in the opposite direction the coin is refunded and the direction this vane is moved depends upon which direction the current is made to flow through the electromagnet. For producing such a selective actuation to control the coin collection or coin refund, an electromagnet is required which is capable of efficient operation over a wide variation in energizing current and load.

This invention as applied to telephone coin collectors of the above type preferably comprises an electromagnet having a single coil with a plurality of armatures which may be interconnected. One of the armatures comprises a permanently magnetized member which is pivoted for selective movement depending upon the direction of current flow through the coil. This selective movement is utilized to determine whether the pivoted coin vane will be deflected clockwise or counterclockwise by the actuation of the other armature which is not permanently magnetized and which is always moved in the same direction when the coil is supplied with energizing current. One way this may be accomplished is to have on the shaft of the pivoted coin vane two projections which are laterally spaced along the shaft and also angularly spaced with respect to each other. The non-permanently magnetized armature of the electromagnet carries a pivoted arm which can be actuated by the permanently magnetized member to direct the pivoted arm either towards the first or the second of the projections on the coin vane shaft. When the direction of the non-perma-

nently magnetized armature causes this pivoted arm to contact with the first pin on the coin vane shaft a counter-clockwise rotation of the coin vane may result, while a clockwise rotation of the coin vane will be produced if the described pivoted arm contacts with the second projecting pin on the coin vane shaft. Hence the collection or refunding of the deposited coin may be secured by a single coil electromagnet in which the selective operation is produced by utilizing a permanently magnetized armature.

This invention will be better understood by reference to the following detailed description taken in connection with the accompanying drawings in which:

Fig. 1 is a view in elevation of one form of this invention adapted to control coin diverting means in a telephone pay station coin chute or other coin collection apparatus;

Fig. 2 is an end view and Fig. 3 is a top view of the apparatus of Fig. 1;

Figs. 4 and 5 are detail views, scale enlarged, of the coin diverting mechanism of Fig. 1; and

Figs. 6 and 7 disclose different views of an alternative form of the invention with the electromagnet in deenergized condition;

Figs. 8 and 9 correspond respectively to Figs. 6 and 7 except that the armatures of the electromagnet are in their attracted positions; and Fig. 10 is a detail showing of one of the elements of Fig. 6.

The above mentioned drawings do not disclose a complete telephone coin collector but the general construction of one form of such a collector with which this invention may be employed may be ascertained by reference to the above mentioned Forsberg U. S. Patent 1,043,219.

As disclosed in the Forsberg patent a person wishing to use a telephone coin collector inserts a coin in a coin gauge and the deposited coin after traversing a coin chute for testing its genuineness and for signaling its deposit to the central office, drops into a coin hopper such as hopper 15 of Fig. 1 where the coin strikes a coin trigger 16 and comes to rest on a coin trap 17 extending across the coin passageway. The trap 17 which is shown pivoted at the point 18 is normally supported by a roller 19 on a vertical vane 20 pivoted at its lower end. The coin passage below trap 17 is divided into two channels, a refund chute 21 leading to an opening where coins are accessible from outside the collector housing, and a collect chute 22 leading to a cash compartment within the housing. As explained in the Forsberg patent if the vertical vane 20 55

is moved to close the collect passageway 22, the dropping of trap 17 will allow the deposited coin to fall in the refund chute 21 while if the vane 20 is moved to close refund chute 21 the dropping of trap 17 will allow the deposited coin to be diverted into the chute 22 leading to the cash compartment. The apparatus so far described is similar to that disclosed in the Forsberg patent.

This invention in the embodiment shown in the drawings is concerned with the provision of improved means whereby the operation of the vane 20 may be remotely controlled to collect or refund a deposited coin depending upon whether or not the telephone connection desired by the coin depositor is secured.

Suitably mounted adjacent the coin hopper 15 is an electromagnet comprising a single coil 25 surrounding a core of soft iron or other suitable magnetic material. A U-shaped strip 26 of magnetic material surrounding the bottom and two sides of the coil 25 completes the magnetic circuit except for the pivoted armature 27 mounted above the pole face 28 and above the upper ends of the U-shaped strip 26. Armature 27 has two downwardly turned projections 29 and 30 resting upon the corner edges of the ends 31, 32 of magnetic strip 26 to form a pivoting axis for the armature. The armature also has a downwardly projecting arm 33 the lower end of which is enlarged and provided with a slot 34. Horizontally projecting ears 35, 36 at either end of the slot serve to pivotally support the wedge-shaped member 37 which has a horizontally disposed arm 38 extending through the slot for a substantial distance. The upper and main portion of the armature 27 is, of course, of magnetic material but not permanently magnetized.

The electromagnet 25 has an auxiliary armature comprising a permanent magnet 41 of the horseshoe type having one arm 39 between pole 31 and central pole 28 and its other arm 40 between arm 32 and the central pole. This permanent magnet 41 forms one arm of a U-shaped member 44 the other arm 45 of which is located underneath coil 25 terminating in a fork 46 embracing arm 38. The U-shaped member 44 is pivotally supported for rotative movement about two pins 47, 48, as an axis. Spring 49 serves to normally bias the permanent magnet so that each arm thereof lies centrally between the center pole 28 and one side pole face 31 or 32. This permanent magnet 41 is free to move between these pole pieces without frictional contact with armature 27 or other parts of the electromagnet, pole pieces 28, 31, 32 being of sufficient height above the end of the coil 25 to provide this freedom of movement.

In the absence of current in coil 25, armature 27 is biased by a suitable spring means 60 acting between the framework 66 and extension 23 of armature 27 and against stop 61 so that the lower end of its arm 33 is relatively close to coil 25 while permanent magnet 41 with its extension 45 is in a central position about pole 28 due to spring 49. If we now assume that direct current of one polarity is applied to coil 25 permanent magnet 41 will be moved, say, clockwise, which will cause fork 46 to move wedge 37 to a counter-clockwise position and armature 27 will carry wedge 37 forwardly away from coil 25; and the application of direct current of the opposite polarity to coil 25 will cause permanent magnet 41 to be moved counter-clockwise causing fork 46 to move wedge

37 to a clockwise position and armature 27 will carry wedge 37 forwardly.

This, therefore, means that the angular position of the front face of wedge 37 with respect to its axis depends upon the direction of current flow through coil 25 and it now remains to be described how this difference in the angular position of wedge 37 in its forward movement may be utilized to selectively move vane 20 for either refunding or collecting deposited coins.

The shaft to which the vane 20 is fastened for rotative movement has an extension 51 projecting externally of the coin hopper in substantially the same horizontal plane as the central portion of wedge 37. Projecting from shaft 51 are two laterally and angularly spaced pins 52, 53 having rounded heads 54, 55 acting as cam surfaces for cam 37. These pins are spaced along shaft 51 in such a manner that in the absence of permanent magnet 41 the cam 37 when electromagnet 25 is energized would pass between heads 54, 55 towards shaft 51 without contacting therewith. The actual operation, however, is quite different due to the control exerted by permanent magnet 41 on the angular position of cam 37 as previously described. For one polarity of applied current permanent magnet 41 will be rotated clockwise to move cam 37 counter-clockwise so that when the cam 37 is brought forwardly by armature 27 its lower inclined face 56 will contact with head 55 and cause shaft 51 to be rotated clockwise causing vane 20 to close chute 22 and allow any coins on trap 17 to fall into refund chute 21. For a current of the opposite polarity traversing coil 25, permanent magnet 41 will be rotated counter-clockwise to move cam 37 clockwise so that when cam 37 is brought forwardly by armature 27 its upper inclined face 57 will contact with head 54 and cause shaft 51 to be rotated counter-clockwise to close refund chute 21 and allow any coins on trap 17 to fall into collect chute 22. When cam 37 is retracted by the absence of energizing current in winding 25, the vane 20 is restored to its normal vertical position due to a suitable biasing spring 58. Armature 27 may be biased in any desired manner to the position shown in Fig. 1 which is its position in the absence of energizing current in coil 25. Thus, a spring 60 may hold armature 27 against stop 61 in the absence of energizing current. Also the armature 27 may be held about its pivoting point in any suitable manner. For example, a square-shaped rod 62 may extend between projections 29 and 30 and a double leaf spring 76 may press against the two exposed sections of rod 62 to give the armature 27 a fixed pivot. This spring 76 is shown in Figs. 2 and 3 but has been omitted from Fig. 1 for sake of clearness.

The manner in which the electromagnet 25 may be placed under the control of the central office operator will now be described. Trigger 16 having an arm projecting in the coin chute above coin trap 17 may be utilized for closing an electrical contact to establish a connection between the coil 25 and the control equipment at the central office. Trigger 16 by projecting through a slot in a contracted portion of coin hopper 15 is adapted to be actuated by any deposited coin. This trigger 16 is pivoted at the point 59 to an upright extension of a frame 63. An angular switch actuating lever 64 pivoted along axis 65 to upright extension 66, 67 of the frame has a downwardly extending arm 68 maintained under tension by spring 69, said spring tending to cause arm 68 to close contact springs 70, 71 which

5 springs are normally separated to maintain the line circuit open. Biasing spring 69, however, is normally unable to close contact springs 70, 71 since another arm 72 of lever 64 extending forwardly of the pivoting axis 65 is latched by the shoulder 73 on trigger 16. When a coin strikes trigger 16 spring 69 is permitted to act on arm 68 and close contact springs 70, 71 since the resulting downward movement of trigger 16 will allow arm 10 72 to drop off shoulder 73.

In order that contacts 70, 71 will remain closed while relay 25 is energized an angular lever 74 pivoted to the framework at the point 42 has an upwardly extending arm 43 for actuation by extension 23 of armature 27 and at its other end carries an insulating roller 50 normally resting in a recess in spring 70 and biased to that position by spring 24. Upon the energization of relay 25, extension 23 moves lever 74 clockwise to cause 20 roller 50 to ride out of said recess in spring 70 and, acting on arm 68, elevates the end 72 to allow trigger 16 to recover its normal horizontal position while still maintaining pressure on spring contacts 70, 71 to keep them closed. Upon the deenergization of magnet 25, spring 24 will restore 25 roller 50 to its normal position of Fig. 2 allowing arm 72 to drop upon shoulder 73 to latch the lever 64 again and separate the contact springs 70, 71. The function of coin trigger 16 is quite similar to the coin trigger of the above mentioned Forsberg patent to which reference is made for 30 further details of its construction and operation.

The circuit connections by means of which electromagnet 25 may be placed under control 35 of the central office operator when contact springs 70, 71 are closed are well-known in the art and require no detail description of this application. A schematic showing of these connections has been made in Fig. 1 where one end of the winding of relay 25 is shown grounded at the point 75 and the other end of the winding is connected to spring 70. The other spring 71 is shown connected to a switch 77 which may be employed to connect positive or negative battery to the relay 40 winding.

The above description applies to Figs. 1, 2 and 3 without further explanation. Fig. 4 shows cam 37 in its extreme actuated position where its upper face 57 has contacted with head 54 to drive vane 50 20 clockwise to the position shown in dotted lines in Fig. 4. The coin trap 17 has, therefore, dropped to discharge its coins into collect chute 22. A similar view is shown in Fig. 5 where cam 37 is in its extreme actuated position but where its lower face 56 has contacted with head 58 to drive vane 20 clockwise to drop coin trap 17 and discharge the coin into refund chute 21. By comparing Figs. 3 and 4 with Fig. 1 it will be noted that extension 38 of cam 37 is free to slide back and forth in fork 46. When the electromagnet has been energized to cause cam 37 to assume its position in Fig. 3 or Fig. 4 the subsequent deenergization of magnet 25 will, of course, allow cam 37 to assume its normal position of Fig. 65 1 due to the restoring force supplied by biasing spring 49.

In the operation of the above described apparatus, it is preferable that the permanent magnet armature 41 when attracted should complete its movement before there has been substantial movement of the main armature 27, that is, the wedge 37 should reach its maximum angular position before it has been moved forwardly to any substantial extent. This may be realized by making the path of travel of permanent magnet 41 75

shorter than the path of travel of main armature 27 and by making armature 27 the heavier armature so that there is greater inertia to overcome in its movement.

Figs. 6 to 10 disclose a modification of the apparatus of Fig. 1 for producing the desired selective control of a coin deflecting vane 80, it being assumed that vane 80 is located in a coin hopper similar to that of Fig. 1 and forming a part of the coin collector of the type generally disclosed 10 in the above mentioned Forsberg patent. The electromagnet 81 is of the single coil type as in Fig. 1 with a magnetic circuit of substantially the same construction. Its armature 82 is pivoted about the point 83 in the same manner as armature 27 of Fig. 1. Armature 82 has an offset extension 84 to which a downwardly extending arm 85 is pivoted about two axes 86 and 87 at right angles to each other to permit arm 85 to have a to-and-fro motion as well as a sideways 20 movement. The electromagnet 81 also has an armature comprising a permanent magnet 88 having an angular extension 89 pivoted between supports 90, 91 and terminating at its lower end in a fork 92 embracing the vertical arm 85. 25 When the permanent magnet 88 is moved due to the energization of coil 81, fork 92 will move arm 85 about its pivoting axis 87 and for this purpose the inner face of fork 92 which contacts with strip 85 may be ball-shaped or otherwise rounded 30 as shown in Fig. 10 to permit an angular displacement of fork 92 as strip 85 is moved in a plane at right angles to the plane of the drawings without causing any twisting of strip 85.

The lower end of arm 85 is of increased width 35 and on its bottom edge has two spaced notches or slots 93, 94 which are employed in selectively actuating the vane 80. Shaft 95 on which vane 80 is mounted bears two laterally and angularly spaced spokes 96, 97 with right angle studs 98, 99. 40 These studs are directed generally towards each other as shown in Fig. 7 but are sufficiently separated that the lower end of armature 85 when thrust downwardly by armature 84 in the absence of permanent magnet 88 would lie between the 45 ends of the studs 98, 99 without contacting therewith, this alignment being shown in Fig. 7. The angular spacing of the stud 98, 99 about shaft 95 is such that stud 99 is aligned with but slightly below the upper end of slot 94 and stud 98 is 50 aligned with but slightly below the upper end of slot 93 although neither stud is positioned in one of these slots when the electromagnet is deenergized. This normal condition of the studs 98, 99 is maintained by a biasing spring 100 exerting a 55 pull on an offset portion of shaft 95.

If we now assume a direct current through coil 81 in one direction, permanent magnet 88 will be turned about its axis 90, 91, for example, to place slot 94 over stud 98 and the actuation of its non- 60 permanently magnetized armature 82 will thrust arm 85 downwardly, giving shaft 95 a clockwise movement as viewed in Fig. 6 and thereby giving vane 80 a corresponding movement. On the other hand if the current is applied in the opposite direction, permanent magnet 88 will be moved to place slot 93 over pin 99 and the actuation of armature 82 will thrust arm 85 downwardly, giving shaft 95 and vane 80 a counter-clockwise motion. The arrangement of Figs. 6 70 and 7, therefore, will permit electromagnet 81 to swing vane 80 clockwise or counter-clockwise depending upon the direction of the energizing current. Means for normally biasing the armature 84 in its upper position may be provided by a 75

spring 101. Arm 85 may be maintained in proper alignment for movement about axis 87 by two leaf springs 102. The permanent magnet 88 is biased to give arm 85 its central position between studs 98, 99 by another leaf spring 103 pressing against projection 104.

Fig. 8 corresponds to Fig. 6, and Fig. 9 corresponds to Fig. 7 except that in Figs. 6 and 7 the relay is assumed to be in a deenergized condition while in Figs. 8 and 9 the electromagnet is energized. The current flow through electromagnet 81 in Figs. 8 and 9 is assumed to be in such a direction that permanent magnet 88 has been moved counter-clockwise to throw arm 85 immediately above pin 99 so that the downward movement of arm 85 produced by armature 82 results in contact with pin 99 and causes shaft 95 to be rotated through a substantial angle sufficient to cause vane 90 to allow the associated coin trap to drop and to direct deposited coins into one of the chutes below the trap. Thus, by comparing Figs. 6 and 8 it is seen that pin 99 is in slot 93 and arm 85 is in its extreme lower position. It is obvious that if the current through the electromagnet is in the opposite direction the permanent magnet 88 would be swung clockwise so that arm 85 in its downward movement would contact with pin 98 and cause a clockwise movement of shaft 95 and the associated vane 80.

The coin trigger, the contact spring operating lever and associated parts, similar to trigger 16 and lever 64 of Fig. 1, have been omitted in Figs. 6 to 10 for sake of clearness but it will be apparent that the arrangement for controlling the spring contacts in the energizing circuit of relay 81 may correspond exactly to that shown in Fig. 1 for relay 25. Thus spring 101 may correspond to spring 60 of Fig. 1 and armature 82 may have an extension arm (not shown) similar to extension 23 Fig. 1 for controlling the contact springs and a switch actuating lever similar to lever 64.

The embodiments of the invention described above are considered to be typical of this invention but other embodiments are in contemplation as will be apparent from the scope of the appended claims.

What is claimed is:

1. A coin operated machine comprising an electromagnet having an armature comprising a permanently magnetized member mounted for movement about one axis and having a second armature comprising a non-permanently magnetized member mounted for movement about a different axis and coin diverting means jointly controlled by said members.

2. In combination, an electromagnet having an armature comprising a permanently magnetized member mounted for movement about one axis and having a second armature comprising a non-permanently magnetized member mounted for movement about a different axis and means simultaneously actuated by said members.

3. In combination an electromagnet having an armature comprising a permanently magnetized member and having a second armature comprising a non-permanently magnetized member mounted for movement about different axes and a pivoted device subjected to a clockwise movement by said armatures when direct current is applied to said electromagnet in one direction and subjected to a counter-clockwise movement by said armatures when direct current is applied to said electromagnet in the opposite direction.

4. A telephone coin collector comprising an electromagnet having an armature comprising a

permanently magnetized member and having a second armature comprising a non-permanently magnetized member mounted for movement about different axes, coin actuated means for establishing an energizing circuit for said electromagnet, means for receiving a deposited coin, a pivoted vane for diverting said coin and means jointly operated by said members for actuating said vane.

5. A telephone coin collector comprising an electromagnet having an armature comprising a permanently magnetized member mounted for movement about one axis and having a second armature comprising a non-permanently magnetized member mounted for movement about a different axis, a coin hopper, a coin deflecting vane in said hopper, an extension arm on said vane projecting externally of said hopper and means controlled by both of said members for moving said arm when said electromagnet is supplied with energizing current.

6. A telephone coin collector comprising an electromagnet having a permanently magnetized armature mounted for movement about one axis, and a non-permanently magnetized armature mounted for movement about an axis substantially at right angles to said first axis, a coin hopper for receiving a deposited coin, a pivoted vane in said hopper for guiding deposited coins, an extension arm on said vane projecting externally of said hopper, a plurality of angularly spaced projections on said arm and cam means operated jointly by said armatures for contacting with one of said projections when energizing current traverses said electromagnet in one direction and for contacting with another of said projections when energizing current traverses said electromagnet in the opposite direction.

7. A telephone coin collector comprising an electromagnet having an armature comprising a permanently magnetized member and having a second armature comprising a non-permanently magnetized member mounted for movement about different axes, coin actuated means for establishing an energizing circuit for said electromagnet, means for receiving a deposited coin and a pivoted support for said means controlled jointly by said members.

8. A telephone coin collector comprising an electromagnet having an armature comprising a permanently magnetized member and having a second armature comprising a non-permanently magnetized member mounted for movement about different axes, coin actuated means for establishing an energizing circuit for said electromagnet, a coin hopper having means for receiving a deposited coin, a pivoted vane for supporting said means, a shaft projecting externally of said hopper and secured to said vane in alignment with its pivot, a plurality of spaced pins projecting substantially at right angles to said shaft, said pins being angularly spaced from each other around said shaft, cam means, means controlled by said first member for directing said cam means towards one of said pins and means controlled by said second member for causing said cam to contact with said one of said pins.

9. A telephone coin collector comprising an electromagnet having an armature comprising a permanently magnetized member and a second armature with a non-permanently magnetized member, spaced electrical terminals, coin actuated means for closing said terminals, means controlled by said second member for subsequently

opening said terminals and coin controlling means controlled jointly by said members.

10. A telephone coin collector comprising a single coil electromagnet having a permanently magnetized armature pivoted for limited rotative movement, a coin hopper having coin controlling means therein and means controlled by said armature for actuating said coin controlling means.

11. A telephone coin collector comprising an electromagnet having a permanently magnetized armature pivoted for limited rotative movement, a non-permanently magnetized second armature, a coin hopper for receiving a deposited coin, a refund chute, a collect chute, means for directing a coin deposited in said hopper into one of said

chutes and means jointly controlled by said armatures for actuating said directing means.

12. In a telephone coin collector, a single coil electromagnet, an armature for said electromagnet comprising a permanently magnetized member mounted for movement about one axis, a second armature for said electromagnet comprising a non-permanently magnetized member mounted for movement about an axis substantially at right angles to the first axis and coin controlling means jointly controlled by said members.

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