United States Patent [19]

Main

[11] **3,758,721**

[45] **Sept. 11, 1973**

[54] **COIN SWITCH APPARATUS**

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[73] Assignee: **Bell Canada-Northern Electric Research Limited**, Ottawa, Ontario, Canada

[22] Filed: **May 23, 1972**

[21] Appl. No.: **256,111**

[52] **U.S. Cl.** **179/6.5**, 335/205

[51] **Int. Cl.** **H04m 17/02**

[58] **Field of Search** ..... 179/6.5, 6.3 R, 6.3; 194/DIG. 1, 94, 97; 335/205

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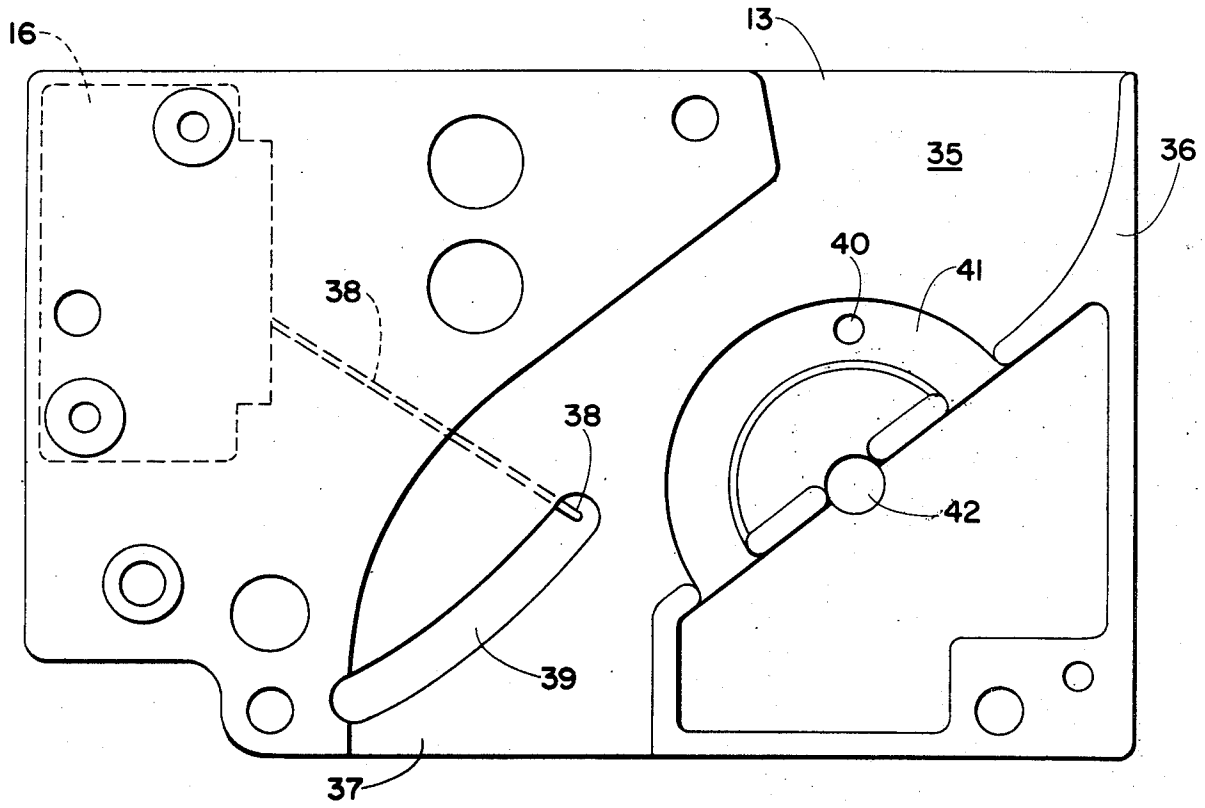
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Assistant Examiner—Kenneth D. Baugh
Attorney—Sidney T. Jelly

[57] **ABSTRACT**

Coin switch apparatus having a coin channel through which at least two coins of a common denomination must pass to permit initiation of a function, for example telephone dialling, where normally the first coin would deactivate a short circuit to permit the function. The apparatus has a magnetically operated switch and a magnet is moved into operative position by the first coin. The switch maintains the short circuit when operated. The second coin removes magnet and switch opens to permit function.

8 Claims, 10 Drawing Figures



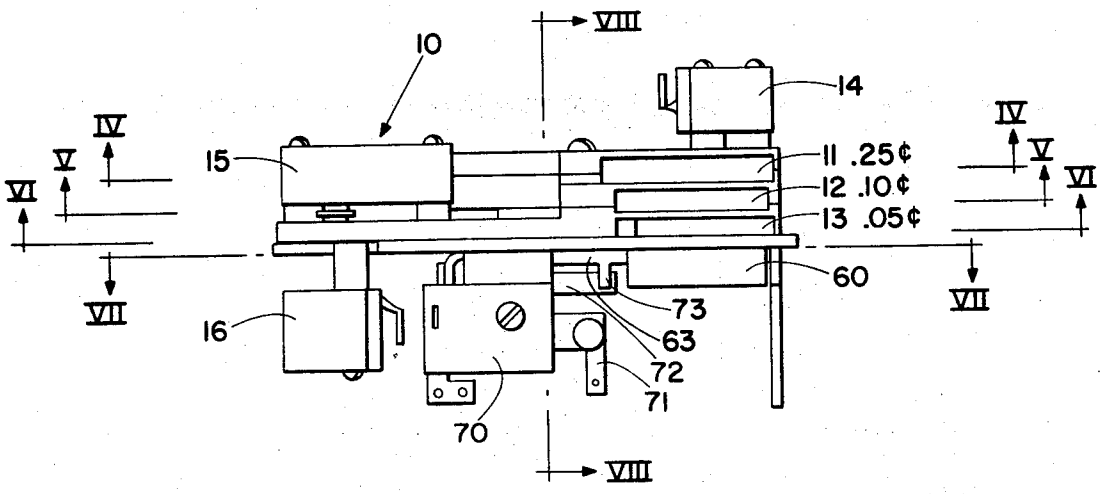


Fig. 1

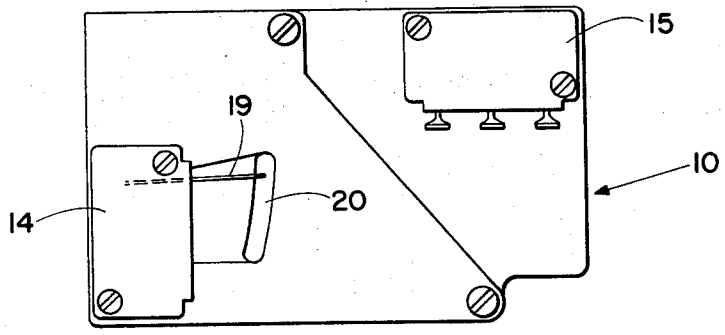


Fig. 2

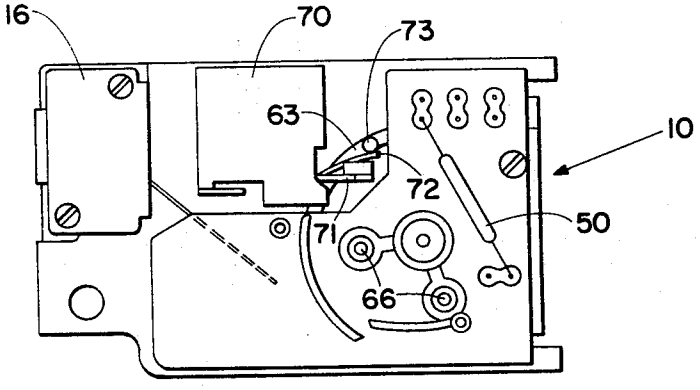


Fig. 3

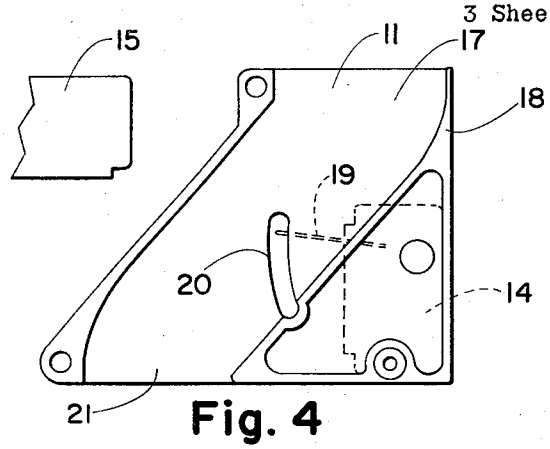


Fig. 4

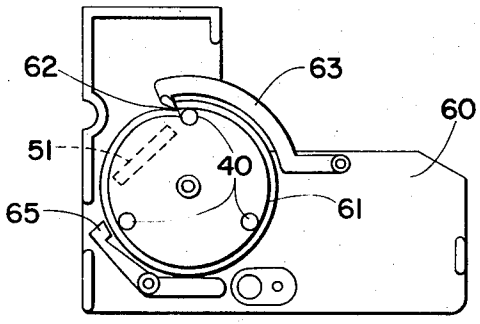


Fig. 7

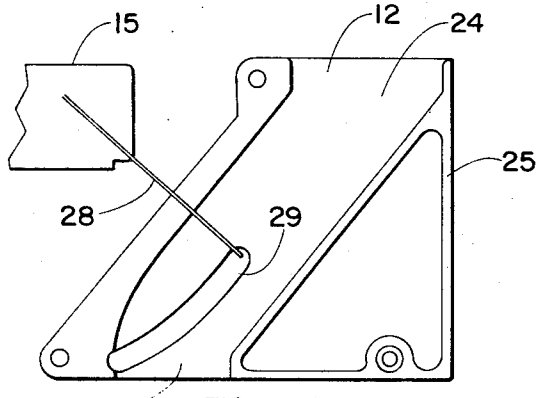


Fig. 5

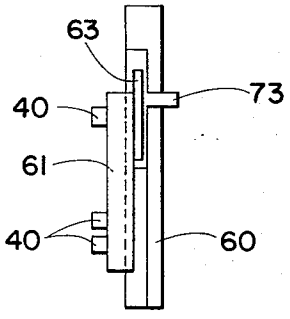


Fig. 8

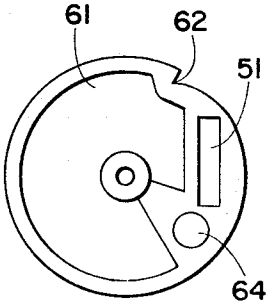


Fig. 9

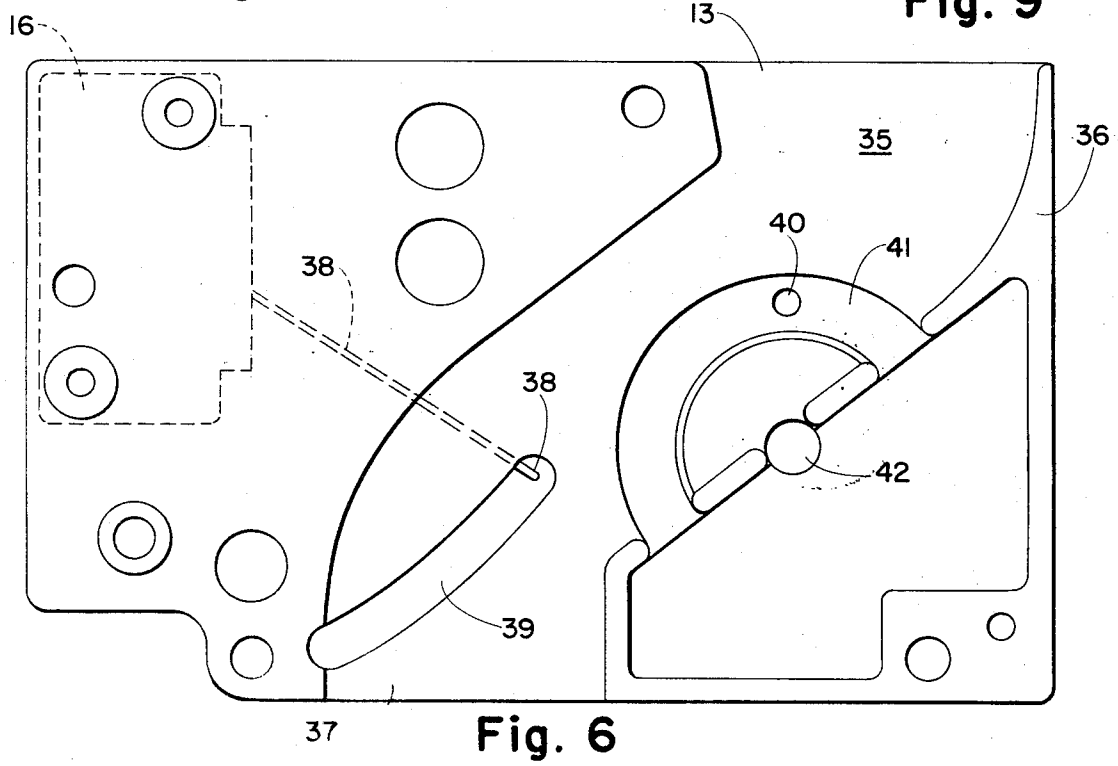


Fig. 6

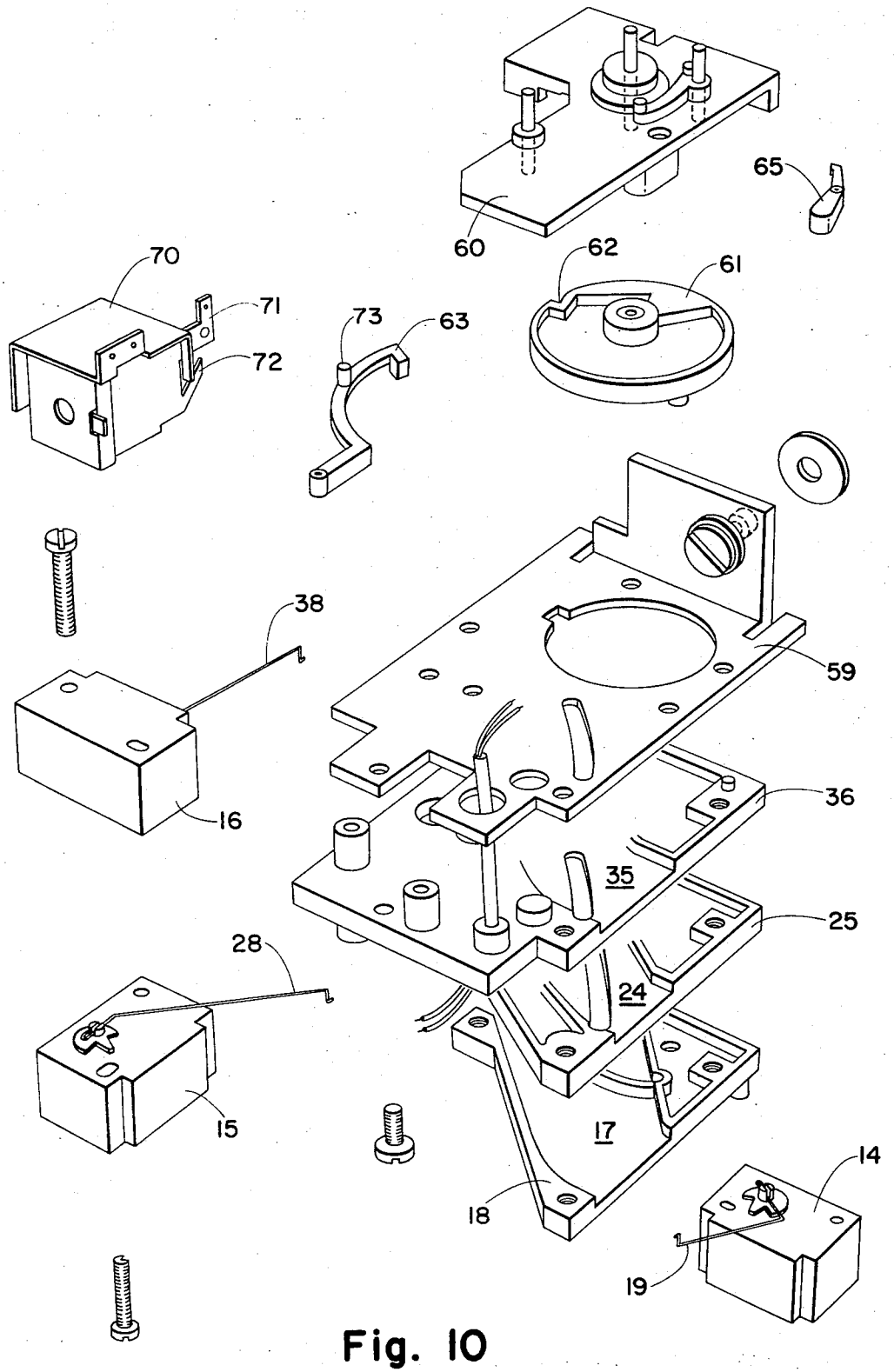


Fig. 10

COIN SWITCH APPARATUS

This invention relates to coin switch apparatus and in particular to such an apparatus having a device for actuation after a predetermined number or value of coins have been presented to the $.10The invention is concerned more particularly with coin switch apparatus for pre-pay telephones but has other applications where similar requirements are met.

$10prepay coin telephones the use of the instrument is denied until a minimum value of coin has been deposited. For example a minimum of .10 may be set with coins of $.05, $10 and $.25 being capable of deposition. Thus it is necessary to prevent use of the telephone until a minimum of $.10 has been deposited in the form of two $.05 coins, one $.10 coin or one $.25 coin.

Conventionally the dial of a telephone is shorted out, as by a pair of normally closed contacts forming part of the hopper trigger switch. A coin tripping the hopper trigger switch opens the contacts. Any coin, $.05, $.10 or $.25 will trip the trigger switch and therefore, it is necessary to provide some additional feature which will provide a substitute shunt path on the deposition of the first $.05 coin, requiring deposition of a further $.05 coin before the dial is available.

The present invention provides a coin switch apparatus having a coin channel through which at least two coins must pass in succession before operation of the telephone is provided, the channel including a switch which is activated by a first coin and deactivated by a further coin. Conveniently the switch is magnetically operated and a magnet is mounted for movement into and out of an operative position by the coins.

The invention will be readily understood by the following description of one embodiment, by way of example, in conjunction with the accompanying diagrammatic drawings, in which:

FIG. 1 is a plan view of the apparatus;

FIG. 2 is a rear elevation of the apparatus of FIG. 1;

FIG. 3 is a front elevation of the apparatus of FIG. 1;

FIG. 4 is a cross-section on the line IV—IV of FIG. 1;

FIG. 5 is a cross-section on the line V—V of FIG. 1;

FIG. 6 is a cross-section on the line VI—VI of FIG. 1;

FIG. 7 is a cross-section on the line VII—VII of FIG. 1;

FIG. 8 is a cross-section on the line VIII—VIII of FIG. 1;

FIG. 9 is a view of a rotatable disc forming part of the apparatus; and

FIG. 10 is an exploded view of the apparatus.

FIGS. 1, 2 and 3 illustrate generally a coin switch apparatus or module 10 arranged for the reception, and detection, of three coin sizes, i.e. $.25, $.10 and $.05. The coins are fed, via a coin sorter not shown but of convention form, to inlets 11, 12 and 13 respectively. The coin inlets 11, 12 and 13 are at the upper ends of coin channels illustrated in FIGS. 4, 5 and 6, and described in conjunction therewith below.

Mounted on the module 10 are three micro-switches 14, 15 and 16. Switch 14 is related to the $.25 channel, switch 15 with the $.10 channel and switch 16 with the $.05 channel. Each switch has an operating arm which projects into the related channel, the arm being struck by a coin passing through the channel to actuate the switch. FIG. 4 illustrates in more detail the $.25 coin

channel 17 formed in the $.25 coin channel plate 18. The coins enter at the inlet 11. As the coins fall down the channel they strike the end of an arm 19 which is connected to the micro-switch 14. The end of the arm is bent at approximately 90° to extend across the channel 17. As the coin strikes arm 19, the arm is deflected downwards, the end of the arm moving in the arcuate slot 20. This movement actuates the switch 14 and also moves the arm out of the path of the coin. The coin procedes to outlet 21.

FIG. 5 similarly illustrates in more detail the $.10 coin channel 24, formed in the $.10 coin channel plate 25. Channel 24 has the inlet 12 at the top and outlet 27 at the bottom. An arm 28 connects to micro-switch 15 and has its end bent to extend across the channel 24. Passage of a $.10 coin down channel 24 moves the arm 28 to actuate the micro-switch 15. The end of the arm moves in an arcuate slot 29. Movement of the arm takes it out of the path of the coin, the coin passing to the outlet 27.

FIG. 6 illustrates the $.05 coin channel 35 in more detail. The channel 35 is formed in the $.05 coin channel plate 36 and has inlet 13 at the top and outlet 37 at the bottom. An arm 38 is connected to microswitch 16, the end of the arm bent to extend across the channel 35. A $.05 coin passing through the channel 35 strikes the arm 38 and actuates the microswitch. The end of the arm moves in the arcuate slot 39, and movement of the arm takes it out of the path of the coin permitting the coin to pass to the outlet 37.

To provide for the actuation of an additional switch —whereby two $.05 coins must be deposited to obtain dialling facility— a further moveable member is provided in the $.05 coin channel 35. This member appears at 40 in FIG. 6 and is one of a plurality of projections on a mounting for a moveable magnet, which magnet activates an additional switch. Formed in the wall in the $.05 coin channel 35 is an arcuate recess 41. This recess permits the moveable members or projections 40 to move about a centre 42 without rubbing against the wall of the channel 35 while enabling the projections 40 to extend right across the channel. Only one projection 40 is seen in FIG. 6 but all three projections of the present embodiment are seen in FIGS. 7, 8 and 9. The additional switch and the moveable members projections porjections 40 are described in more detail in conjunction with FIGS. 7 and 8.

Thus far the module is arranged so that a coin passing through a channel actuates a micro-switch, which in turn actuates an electronic circuit to produce a tone indicative of the value of the coin passing through the module. On leaving the module the coin, or coins, passing into a hopper trigger position to actuate a switch which opens normally closed contacts and applies dialling access to the telephone. This is acceptable for deposition of a $.25 coin or a $.10 coin, when the minimum is $.10, but is not acceptable for a single $.05 coin.

In the embodiment illustrated the additional switch is provided related to the $.05 coin channel, this switch being activated to a closed condition when a first $.05 coin is deposited. This switch is in parallel with the switch at the hopper trigger position. The first $.05 coin deposited hits a moveable member or projection 40 which in turn causes a magnet to actuate the additional switch. This additional switch is closed and bypasses the switch at the hopper trigger position. Thus

although the first $.05 coin will actuate the switch at the hopper trigger position to an open condition, it will also have closed the additional switch on passage through the $.05 channel. A second $.05 coin will de-activate the additional switch and then a dialling facility is available.

The additional switch, as stated, is magnetically operated. In the present example a magnetically operated reed switch is provided, seen at **50** in FIG. **3.** The switch **50** is actuated by a small magnet **51,** seen in FIGS. **7** and **9.** FIGS. **7** and **8** illustrate the mounting for the projections or moveable members **40** and the magnet **51,** the magnet seen more clearly in FIG. **9.**

FIG. **7** is a view of support plate **60,** in the face which cooperates with and is in contact with a front plate **59** which in turn is in contact with the $.05 coin channel plate **36.** The support plate **60** is generally of L-shape and effectively covers the position occupied by the channel **35.** The plate **60** rotatably supports a disc **61** which carries three projections **40** substantially equally spaced circumferentially. Adjacent one projection **40** is formed a detent **62** into which a pawl **63** can rest. The disc **61** is adapted to be rotated clockwise as seen in FIG. **7.** The magnet **51** is mounted in the disc **61** between two of the projections **40.** The positioning of the magnet is such that it is in a cooperative position with the magnetically operated switch **50** when the pawl **63** is in the detent **62.** Normally, before deposition of a $.05 coin, the magnet is at the bottom with the pawl **63** riding on the periphery of the disc **61.** The first $.05 coin passing down channel **35** hits one of the projections **40** and causes the disc to rotate approximately 120° at which position pawl **63** drops into the detent **62** and prevents the disc from rotating backwards, as seen in FIG. **7.** A further $.05 coin deposited hits another projection **40** and rotates the disc a further approximate 120°. The weight of the magnet, plus a further weight mounted on the disc —indicated at **64** in FIG. **9**— causes the disc to continue rotating until the magnet is again at the bottom position.

As the disc is freely rotatable on its mounting in the support plate **60,** and in the $.05 coin channel plate **36,** and its return to the inoperative position with the magnet **51** at the bottom produced by gravity, it is desirable to provide some means for ensuring a consistent rest position. This is obtained by a further pawl **65** mounted on the support plate **60** beneath the disc **61.** Pawl **65** is arranged to locate in the detent **62** when the disc is in such a rotative position that the magnet **51** is at the bottom

Also, as the velocity and exact path of a falling coin cannot be controlled, there is considerable variation of the impact with which a coin strikes a projection **40.** It is possible that the disc will rotate so far on an impact by a coin that the magnet goes past the actuating position and the disc is not latched by the pawl **63** engaging in detent **62** on the insertion of a first $.05 coin. Even if correctly positioned after passage of the first coin it is possible that the second coin could cause the disc to rotate past its normal rest position —completing a full revolution— and again becoming latched by the pawl **63** engaging in the detent **62.** To reduce the possibilities, damping can be provided. In the present example two steel screws **66,** in FIG. **3,** are positioned adjacent the path of the magnet **51.** By adjusting the distance between the inner ends of the screws and the magnet, when at their closest positions, it is possible to vary the damping effect and provide acceptable limits to the rotational movements of the disc and the related latching and unlatching function.

If only a single $.05 coin were to be deposited, and then the call abandoned, this coin would be refunded. However, the disc **61** would have been rotated by the passage of the coin to bring the magnet **51** into actuating position and the switch **50** would be activated. By redepositing the returned coin, the disc would then be further rotated, switch **50** de-activated and dial access provided. A call would thereby be obtained by the use of a single $.05 coin.

To prevent obtaining of calls by one $.05 coin it is necessary to ensure that the disc is unlatched at the abandonment of a call, or at the completion of a call if it should be that a further odd number of $.05 coins had been inserted after dialling. This is obtained, in the present example, by providing an electromagnet to lift pawl **63** out of any engagement with detent **62.** This electromagnet is seen at **70** in FIGS. **1** and **3.** Electromagnet **70** has an armature **71** extending laterally, the armature having an extension **72** which is positioned beneath a protrusion **73** formed on the pawl **63.** Actuation of the electromagent occurs on completion or abandonment of a call, when a signal from the central office momentarily causes energization of the coil of the electromagnet. Armature **71** is lifted and the extension **72** lifts the pawl **63,** freeing the disc **61.** The disc then rotates freely until the magnet **51** is at the bottom.

The cooperation and relative positioning of the various items forming the apparatus as described above can readily be appreciated from FIG. **10.** It will be seen that the apparatus is of a sandwich construction built up of successive layers comprising the $.25 coin channel plate **18,** the $.10 coin channel plate **25,** the $.05 coin channel plate **36,** a front plate **59** and support plate **60.** The disc **61,** pawls **63** and **65,** micro-switches **14, 15,** and **16** and electromagnet **70** can also be seen.

What is claimed is:

1. Coin switch apparatus comprising:

a coin channel through which coins of a common value can pass in sequence;

a disc mounted for rotation about an axis normal to the plane of the coin channel;

a plurality of projections extending in an axial direction from one face of the disc, the projections spaced circumferentially around the disc and extending one by one into the coin channel, coins passing through the channel striking said projections sequentially to rotate said disc stepwise; and

a switch actuated to a first condition on a first rotational stepwise movement of said disc and to a second condition on the next rotational step.

2. Apparatus as claimed in claims **1,** including:

a magnet mounted on said disc for rotation therewith;

said switch a magnetically actuated switch positioned adjacent said disc, said first rotational movement of the disc actuating the switch by said magnet, the next rotational movement of the disc deactivating the switch.

3. Apparatus as claimed in claim **2,** including a pawl; and a detent in said disc, said pawl engaging in said detent to retain said disc in the first movement step position.

4. Apparatus as claimed in claim **3,** the disc freely rotatable, the magnet acting to rotate the disc to a posi-

tion where said magnet is at the bottom of the disc and a further pawl positioned to engage said detent when the magnet is at the bottom to locate the disc, the pawl disengaged from the detent on rotation of the disc by a coin.

5. Apparatus as claimed in claim **3** including an electromagnet engaging with said pawl, said electromagnet arranged to move the pawl out of engagement with the detent.

6. Coin switch apparatus for a prepay telephone, comprising:

a plurality of coin channels in parallel side-by-side array, each channel adapted to the passage of coins of a common value,

a plurality of switches, a switch related to each coin channel;

an operating member extending across said channel, each operating member attached to the switch relating to the particular channel, the arrangement such that passage of a coin through a channel moves the related operating member to actuate the related switch;

moveable means extending into the coin channel for the coins of the lowest value, said moveable means comprising a disc mounted for rotation about an axis normal to the planes of the coin channels, and a plurality of projections extending in an axial direction from one face of the disc, the projections spaced circumferentially around the disc and extending one by one into said coin channel for said coins of the lowest value, coins passing through the channel striking said projections sequentially to rotate said disc stepwise to a magnet mounted on said disc for rotation therewith; and

a magnetically operated switch, said switch actuated by a first stepwise rotation of the disc, the next rotational movement step of said disc deactivating said switch.

7. Apparatus as claimed in claim **6,** including a pawl, and a detent in said disc, said pawl engaging in said detent to retain said disc in the first movement step position, and an electromagnet engaging with said pawl, said electromagnet arranged to move the pawl out of engagement with the detent.

8. Apparatus as claimed in claim **7,** the disc freely rotatable, the magnet acting to rotate the disc to a position where said magnet is at the bottom of the disc and a further pawl positioned to engage said detent when the magnet is at the bottom to locate the disc, the pawl disengaged from the detent on rotation of the disc by a coin.

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