United States Patent [19]

Dawson

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[54] **OPTIONAL PREPAY COIN OPERATED TELEPHONE SYSTEM**

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[52] **U.S. Cl.** ..... **179/6.3 R**

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

[58] **Field of Search**..... 179/6.3 R, 17 C; 232/57.5, 232/57, 55

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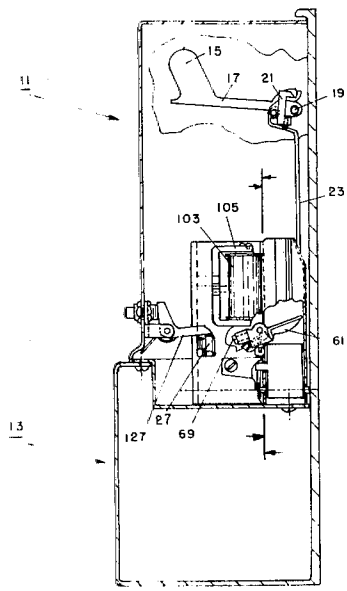
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[57] **ABSTRACT**

The system may use 48 volt battery reversal and is programmable or adaptive to all known systems. Closure of the paystation hookswitch (termed "off-hook") applies power of one polarity, (L_1 negative) which is shunted around the motor during transmission, deposit of the coins, and dialing. Upon answer, the power is reversed and the motor operates sequentially to place the vane in a collection position first, and then, release the coin trap so that the escrow money is collected. At the moment of reversal (L_1 negative becomes L_1 positive), the magnetic flux field build-up around the motor coil effects the closing of a switching arrangement designed to shunt all other apparatus within the paystation, normally employed for transmission, coin annunciator, restoring relay and dial. An actuation circuit for an SCR shunting the motor coil but with the SCR oriented to allow current flow only when triggered and L_1 positive so that triggering is made possible when both vane and coin trap sensing switches (in series to the SCR trigger) are closed, causing current to flow through the SCR causing the motor coil to be bypassed, and therefore deenergized. The now conducting SCR releases the shunt switching circuit to open and thereby remove the transmission and other equipment shunt to enable communication, while at the same time shunting the motor out of the circuit thereby eliminating associated insertion losses. Refund is effected by on-hook through a mechanical back-up fail-safe connection, and refund control is accomplished by: (a) Mechanical linkage from the switchhook to the coin distributor device. (b) Manually operated electromechanical refund lever accessible to the station user. (c) Tone control causing the breaking of continuity of the motor shunting diode . . thereby allowing current to flow through the motor coil. (d) A negative L_1 voltage exceeding 63 volts will be seen by the motor thereby effecting refund in either "on-hook" or "off-hook" condition. (e) Pulsing a delayed gate wherein the SCR gate turn on can be delayed to effect temporary flow through the motor for approximately one-tenth of a second after current turn off and on.

75 Claims, 11 Drawing Figures



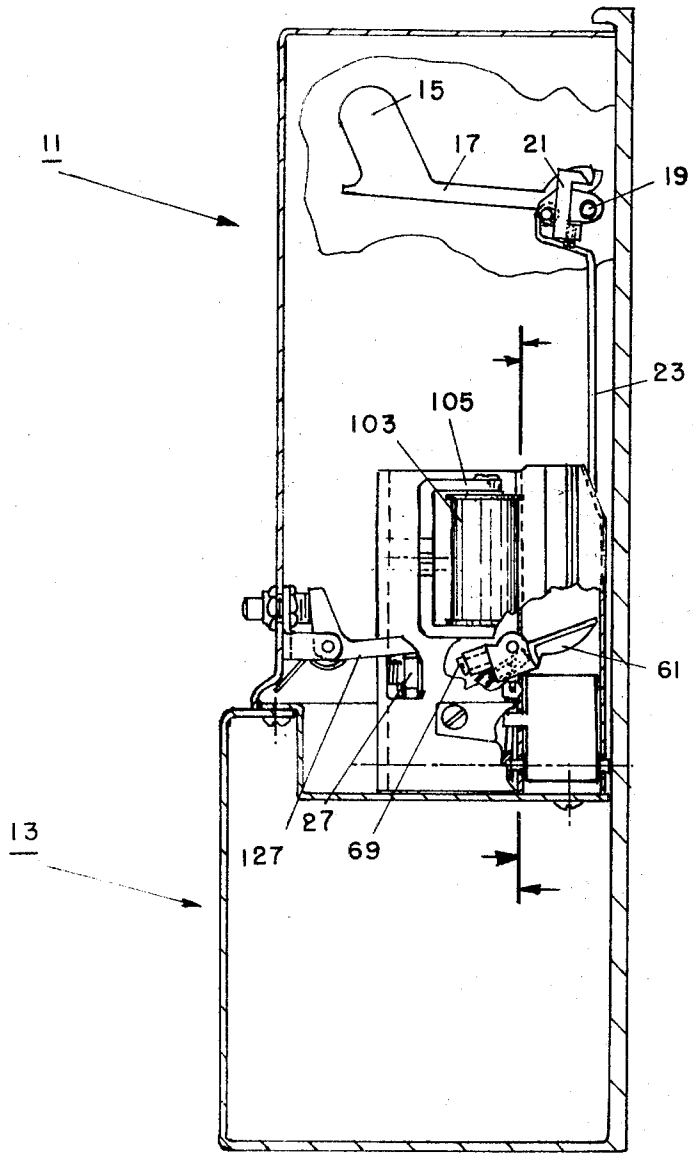


FIG 1

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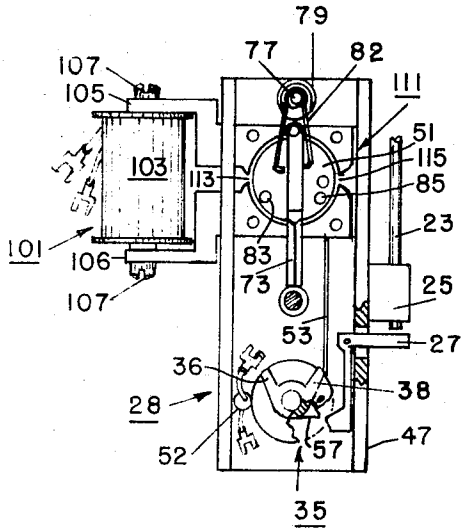


FIG. 2

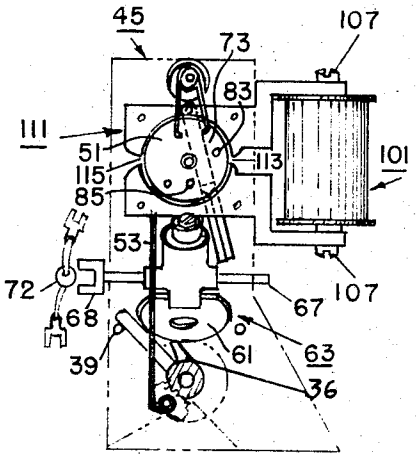


FIG. 3

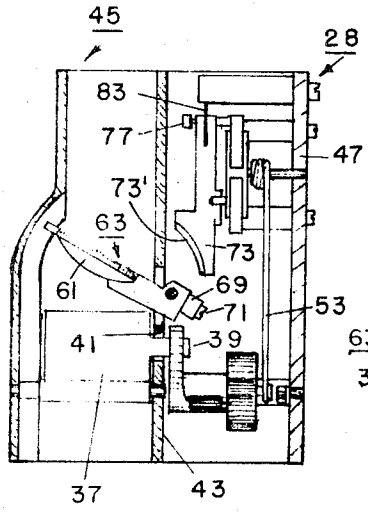


FIG. 4

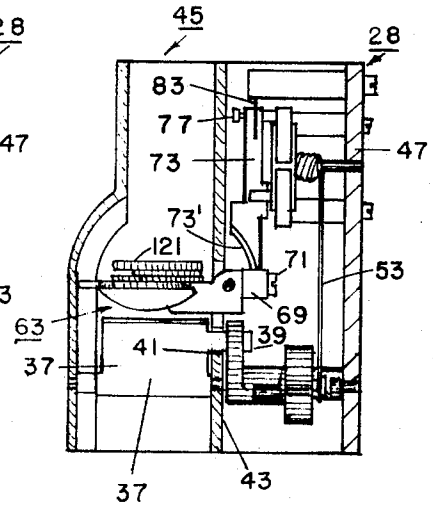


FIG. 5

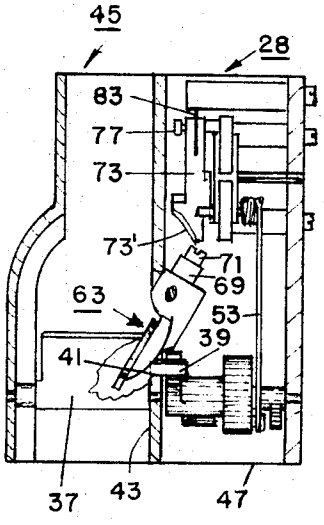


FIG. 6

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CHARLES E DAWSON

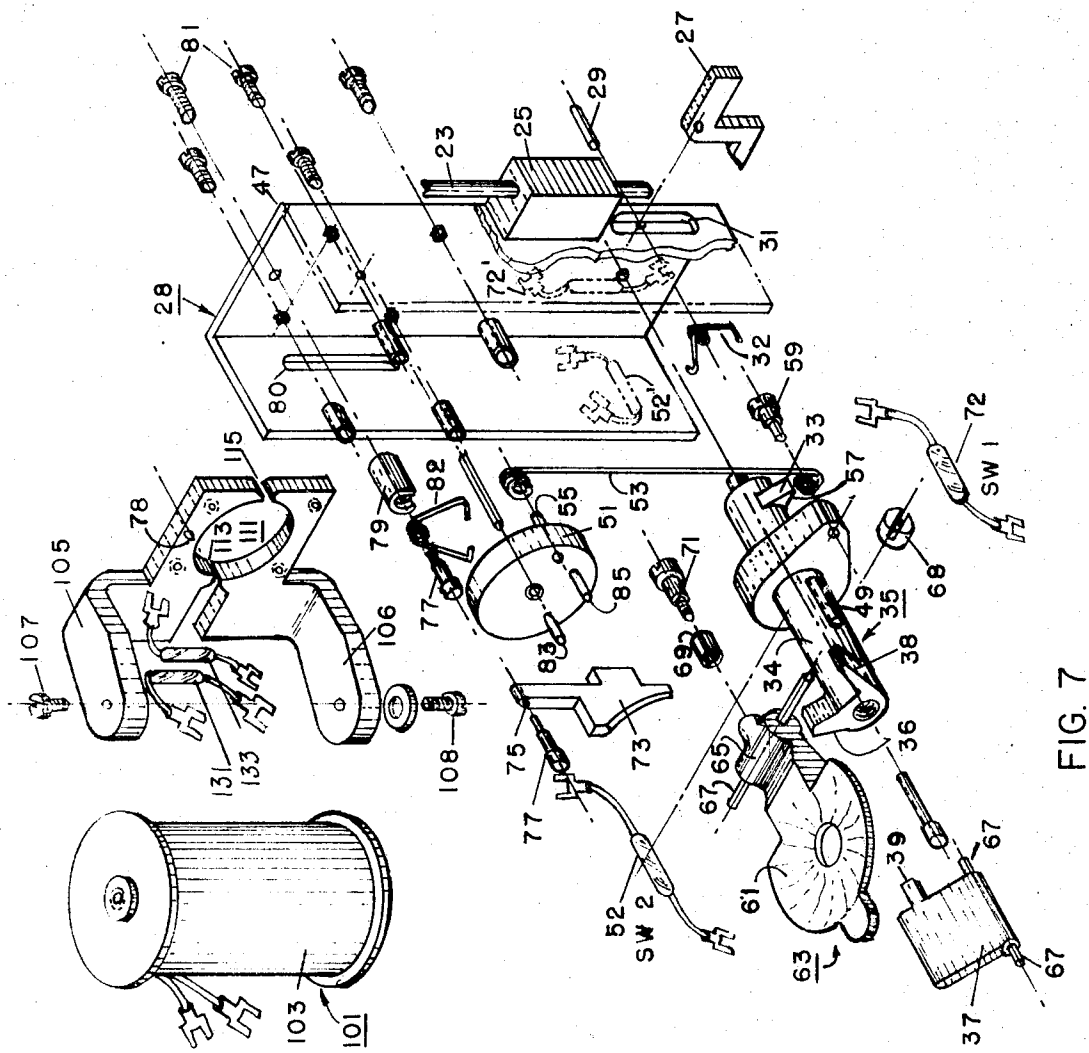


FIG. 7

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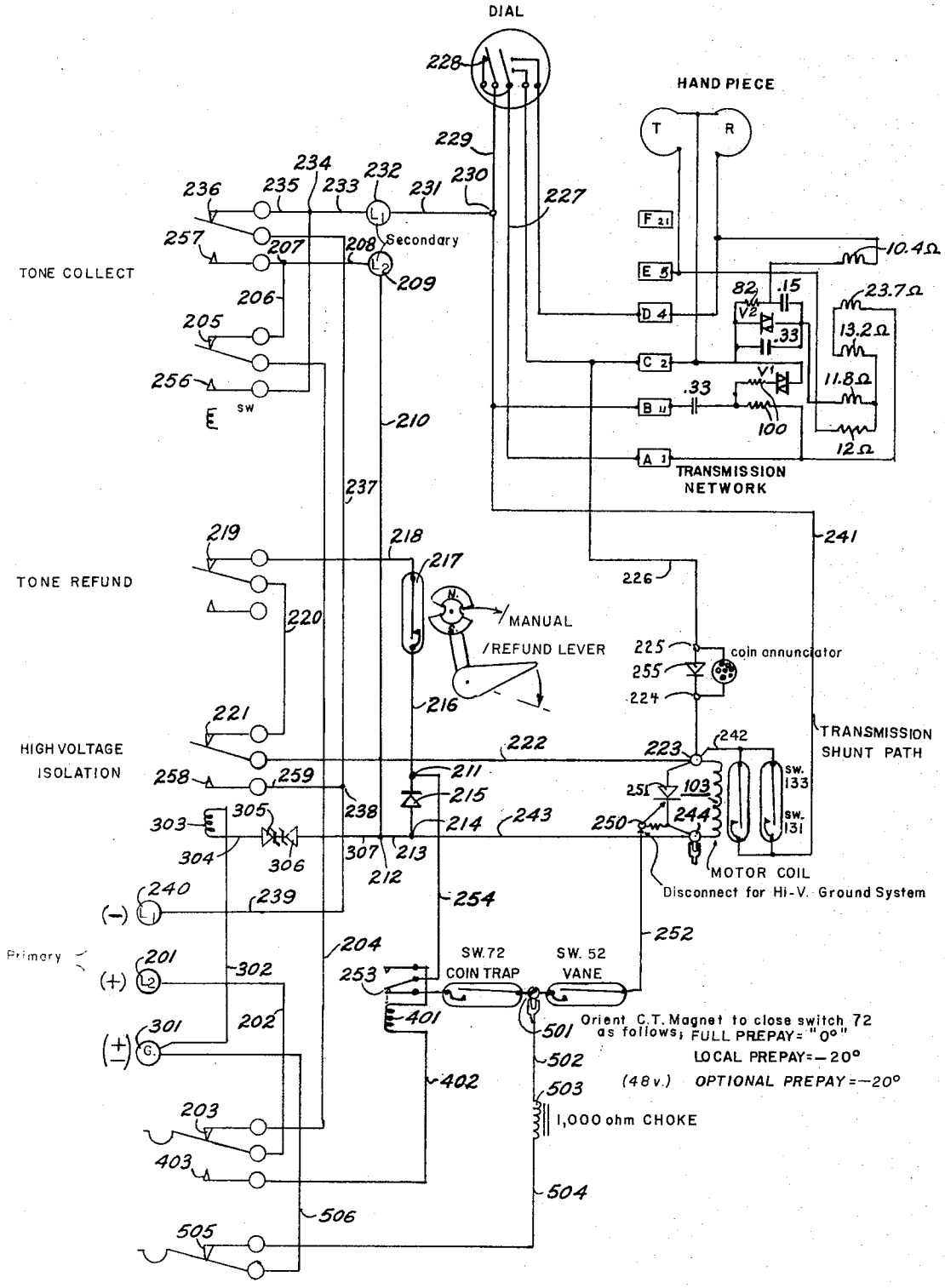


FIG. 8

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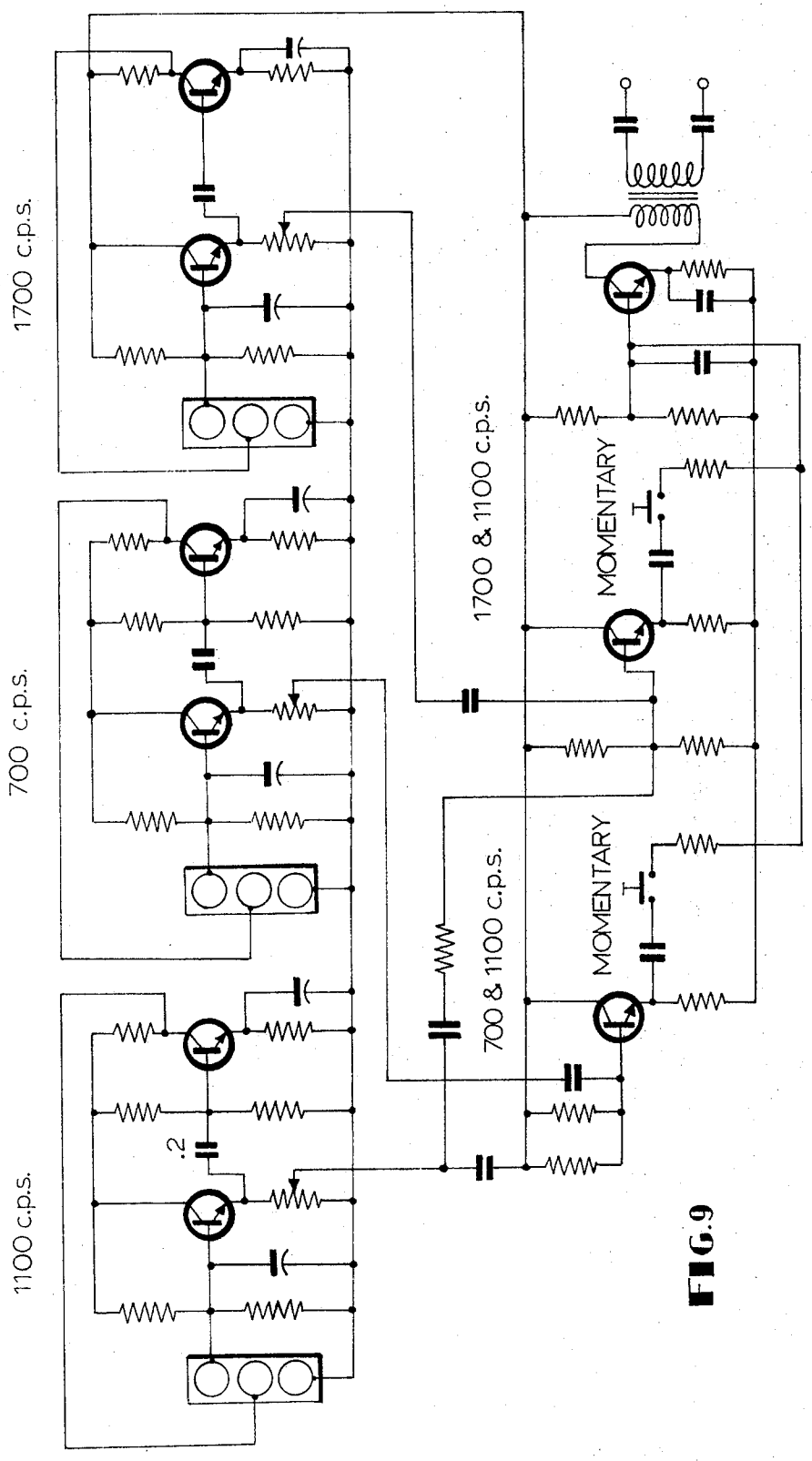

1700 c.p.s.
700 c.p.s.
1100 c.p.s.
1700 & 1100 c.p.s.
700 & 1100 c.p.s.
MOMENTARY
MOMENTARY
.2

FIG. 9

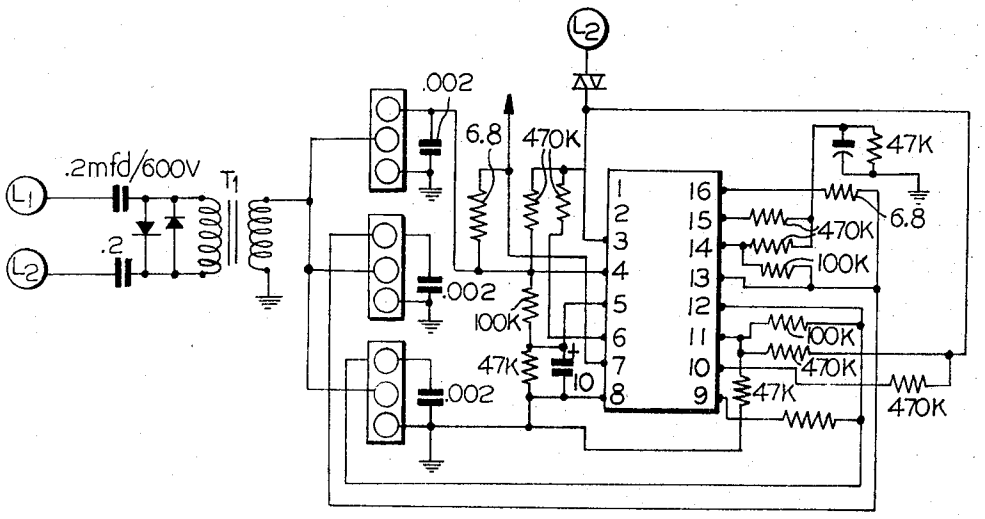

L2
.002
6.8
470K
47K
.2mfd/600V
T1
L1
.2
.002
100K
47K
10
.002
1
2
3
4
5
6
7
8
16
15
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13
12
11
10
9
470K
6.8
100K
100K
470K
47K
470K

FIG.10

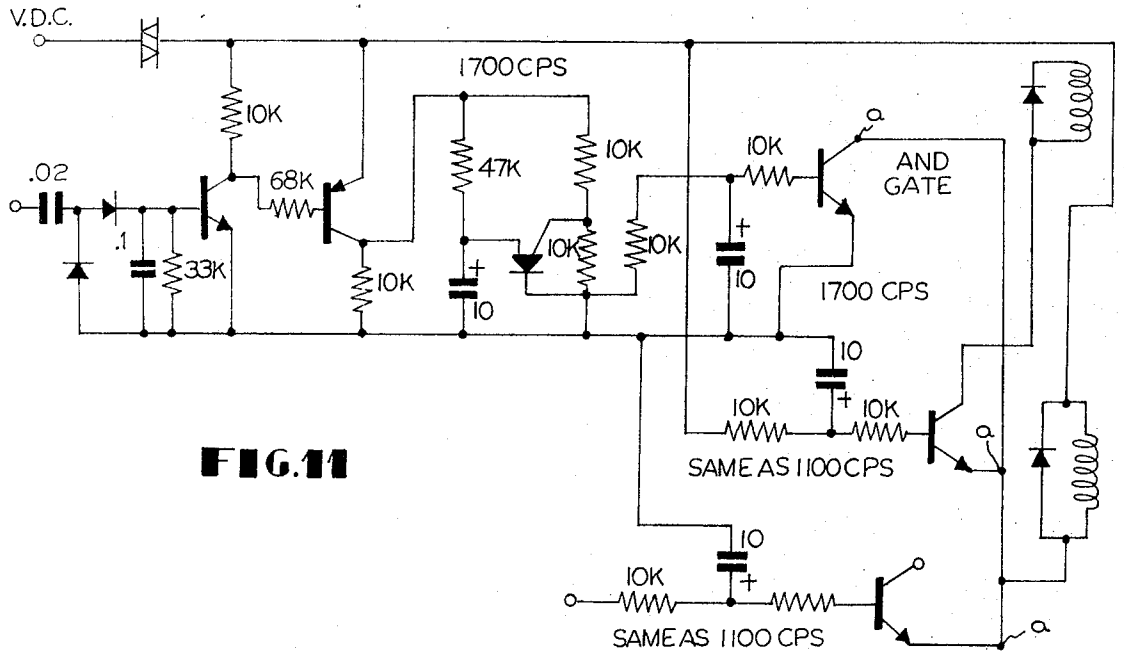

V.D.C.
10K
.02
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47K
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GATE
1700 CPS
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10K
SAME AS 1100 CPS

FIG.11

OPTIONAL PREPAY COIN OPERATED TELEPHONE SYSTEM

The present invention relates to coin telephone collection apparatus and presents an entirely new coin system which affects both inside and outside plant equipment. It enables the elimination of up to 90 per cent of the existing backup apparatus normally required for coin telephone operation, and the elimination of such equipment also eliminates the associated maintenance and replacement requirements thereof.

Briefly, the invention provides a compatible combination of components to avoid momentum of inductance so that a short pulse of substantially less energy can be used in a more reliable system to accomplish the required functions. The amount of energy required to move a mass is minimized and effective coin supervision is achieved through a rapid build-up of momentum sufficient to release the coin trap, when required. An inter-connection insures that the vane is positioned to the proper collect or refund position prior to the coin trap dropping the money. Also, an important innovation related to the correlation of electrical and mechanical timing, creates a condition otherwise unobtainable in efficiency: at the moment of reversal, the magnetic flux field builds so that within three milliseconds, switching occurs effectively shunting out all other associated apparatus within the paystation that would otherwise present an insertion loss to the operation of the motor, and the mass of the motor is so designed as to require in excess of 10 milliseconds to develop sufficient momentum as to cause a release (even if a loss of power occurred) wherein, after the first 3 milliseconds of L_1 becoming positive all energy becomes available to the motor thus further insuring its effective reliability.

All prior art coin relays require constant current designed for approximately a minimum current assurance of one-half second, which is controlled by the C.O.E. (central office equipment). The present invention automatically eliminates itself from the circuit upon receiving assurance from the SCR triggering switches that the coin deflection vane is in proper position and that the coin trap has been both released and in a minimum dump position of minus 20° below horizontal (considered 0°). A fail-safe mechanical back-up switch hook link insures refund of coins upon hanging up of the receiver if the coins had not been previously collected as per instructions. Additional electrical and mechanical refund features are also provided. Coin sensing is accomplished by the presence of a coin(s) upon the coin trap located within the coin hopper. The coin trap can be in either escrow position or in release position (minus 20° dumped position) while the coin deflection vane, located within the hopper below the coin trap was previously deflected and is sensed as being in the collect position. The coin trap is capable of providing dial shunt option, ground path, closing the loop, via sensing coin presence, and sensing coin dump, thereby providing a "programmable" device reflecting adaptive versatility to any mode of operation. The rotary motor, which enables releasing of the coin trap for dumping only need rotate 50° in either direction although it actually rotates +80° from bottom dead center. When the motor is operated from electrical energy it does not initiate electrical contacts but releases the coin trap after first deflecting the coin deflection vane within the hopper to the collect position and when operated from the mechanical energy derived from depressing the switch hook, the refund lever drives the vane deflection assembly which in turn drives the motor mechanically, and this sequence provides a hundred per cent reliability in the refund of coins because of operation totally independent of electrical energy, etc.; also, the coin deflection vane is never held in a vertical position, as is conventional, thereby avoiding reverse deflection (or) thereby providing absolute deflection sustained by "release after deflection." The device will operate in a 48 volts system or a high voltage prepay system be it loop start or ground start, or be it dial shunt or transmission shunt, or high voltage coin control via ground return. A pay station equipped with this device improves upon dial supervision because the normal 1,000 ohm leakage to ground in the loop common to existing pay stations is eliminated (or can be eliminated) depending upon the options of the telephone company. Moreover, switching is solid state controlled and no contacts are subject to environmental or human contamination. The side effects of reactance inductive "kick-back" are also eliminated. Magnetic switching, SCR controlled switching, transistor and diode switching are employed, in lieu of the cumbersome sets of cantilever arm contacts.

Present day pay stations require that special instructions be included in each pay station, if coin losses are to be avoided by the user. Most frequently, the user does not read instructions and consequently loses his deposit, becomes irate, and sometimes even causes damage to the equipment. The present invention avoids the necessity for special instructions and insures that coins are not lost, even if the pay station line has been severed, because of the mechanical fail-safe return device.

Also, the invention avoids the extremely heavy expense of returning by mail, money allegedly lost in telephones; such excessive monthly costs frequently exceed $20,000 a month and up in larger sized cities.

The invention provides the following advantages: (1) improved dial tone service; (2) optional coin free service for emergency or future type service inevitably to be used; (3) for coin free toll credit or reverse charge service and free operator access without special exchange equipment; (4) functional simplification for public acceptance automatically adapting to user habits; (5) reliability improvement based upon state-of-the-arts otherwise unobtainable in any existing system presently in use in any telephone company; (6) adaptive compatibility to 48 volt DC system in (or "as") semi postpay, full prepay, local prepay and its own optional prepay systems; (7) can function in mode compatible with full prepay but on a normal subscriber 48 volt loop where there is a shortage of dedicated or special trunks and equipment; (8) dual fail-safe refund capability; (9) the elimination of AC longitudinal ground feedback; (10) transmission improvement; (11) dial supervision improvement; (12) increased escrow capacity; (13) extends loop limits to optimum transmission limits reducing maintenance requirements to but a fraction of existing or present day costs, because of less complexities and less equipment involving a configuration of less current/volts wherein more meaningful testing apparatus is available common to normal subscriber loop equipment requirements.

With respect to dial tone service, loop start increases the availability of C.O.E. apparatus with which to secure dial tone, thus enabling faster dial tone service than possible with ground start systems or all such systems presently requiring dedicated and/or special high current and special identification. This would reflect on improved dial tone service in modern 1 and 5 crossbar operation in that this invention does not require special coin junctor circuits and trunks, etc. and special identification circuits to show up on special toll board positions. Paystation must be called (ring-back) on selected circuits in order to provide coin control, but not required in this invention - optional prepay system. The coin free service option is automatically available in that coin deposit is only required after battery reversal occurs, and it is at the option of the telephone company to void reversal for coin free operation, and which would otherwise provide transmission-receiver shunt, which is easily altered for special numbers now or in the future. It is especially pertinent to observe the increased revenue potential available from coin free operator access, DDD, TSP/TSPS including reverse charge options derived from toll, if accompanied by proper marketing techniques.

The system of the present invention is functionally simplified because no special instructions are required for the user and this accounts for the name "optional prepay" in the title thus indicating that coins may be deposited prior to removing the handpiece, or prior to dialing, or during dialing, or after completion of dialing, or after battery (or tone) reversal. The invention insures that coin loss is eliminated in all of the foregoing instances. If deposit is made after the called party "hangs up", money is refunded. Costly service calls stem from loss of coin . . . not from free service.

The enhanced reliability is tremendously important as identified by the lack of reliability provided by the present day system. The improved electro-mechanical system utilizes the principles of reduction of current and voltage requirements correlated with actuating time and when compatibly combined with the use of momentum, makes it possible virtually to see through central office malfunction phenomena by presenting a much lesser load for a much shorter time requirement. The electro-mechanical circuitry and structure, in minimizing the watt seconds of energy (normally required to enable coin release), enhances reliability by reflecting a lesser load on all relay contacts and cable connections throughout the system thereby reflecting a much cooler condition, denoting that present day technology accepts heat as an increase to degradation factor and cool as a desirable factor to life expectancy and reliability. Without this principle, it is not possible to offset central office exchange malfunction even on a coincidental basis or unrealistic preventive maintenance program.

Also, the principles employed enable the operations to be carried out in fractions of the time presently alloted, i.e., the refund/collect time normally available to present day coin release being normally one-half second per high voltage pulse wherein the voltage required to operate the release exceeds 52 volts DC. These coin releases in the associated conventional systems rely on dropping back out when the voltage goes below approximately 48 volts to insure sufficient isolation against talk voltage. Otherwise, the talk voltage could actuate or hold the actuation if of an identical polarity, because of ground potential variations, thus locking out the station from further use and of course subjecting the operating company to costly complaints. Speed is not pertinent to existing coin releases in that the speed and the coin release are designed to function because of the pulse duration of an average one-half second accompanied by a high current approximating 45 mils and 50 vdc minimum, as the initial obligation of the relay is to overcome the air gap between the armature and field without regard to momentum/time, suggesting of course that it is least efficient when needed the most.

On the other hand, the function of the present invention is to provide coin release prior to the presentation of its total load (DC resistance) to the C.O.E., thereby providing a capability of seeing through to the battery path within but a fraction of the available pulse time, e.g. within 20 milliseconds. Such operation, of course, cannot tolerate the delays normally encountered by inductive devices.

The field coil of the motor of the present invention differs in resistive load because the design principle is not contingent upon employing the usual predetermined 1k resistance (all are 1,000 ohms) coil as a ground path by which to bring up the line relay, etc. and in that the field coil is not used for that purpose nor is it required in the circuit at any time for such purposes as notifying the central exchange that a pay station is seeking service, although it can be so programmed at the option of the company to permit feasible phase out of their existing equipment.

Thus, the coil winding may be designed with optimum ampere-turns efficiency relative to the variations of source energy available under normal and subnormal operating conditions. The system of this invention is thus not restricted to any specific DC coil resistance in establishing service for the pay station. Nor is it used as an inductive device where the system employs a loop start (closing of the loop to bring up the exchange service). Some C.O.E.'s are loop start but require temporary grounding to supply dial shunt removal wherein the coin trap magnet is adjusted to close at zero degrees and the 5 cent mechanism is wired in series to avoid continuity until the second 5 cents has been deposited.

In full prepay systems, ground is present as a functional requirement stemming from the hybrid high voltage/current for control of existing coin relays, also for refund collect "hung coin" the alarm is initiated if ground has not been released after supplying the energy to disburse the coin(s), whereas this invention does not require that the motor be in the ground circuit except during those times high voltage is applied, if in the event it is required, to function in a full prepay mode wherein the operating company chooses to program the invention to a dial shunt operation and electronic switching, as an integral part of the invention, re-adjustment to the coin trap magnet to maintain a permanently closed reed prior to receiving the coin will shunt the dial or provides ground path. Actually, the basic transmission (talk and receive) system does not require ground in that it is operational below 48 volts whereas present day coin relay circuitry must be isolated and requires an abundance of hybrid equipment to ascertain control over the pay station and its related coin control apparatus (as an example) . . . In a simple stepping office, refund/collect battery path drops off

with the mechanical chance of seeing the same battery path twice in the successive calls being approximately 10,000 to 1. There is no present testing equipment available that, even if a malfunction was observed, could hold that path, i.e., stop the line from being dropped. Thus, if it cannot be held, the course of the malfunction cannot feasibly be located and consequently the sequential variation in the refund/collect battery path through the seven or eight relays involved is compounded by the number of operations in a coin system. Contact resistance interface problems frequently combine sequentially (in ever changing cycles) to effect or contribute to malfunction which, of course, is why it is virtually impossible to locate. A comparison with the primary underlying problem of coin control is with the amount of current required, while general transmission in pay stations requires very little attention, as the current requirements are less and therefor reflect less degradation to the relay contacts, cable connections, etc. Optional prepay coin control requires far less current than transmission. The system therefore is designed to not collect much under 20 to 22 mils of current to avoid collecting when transmission is likely to be less than acceptable.

The adaptive compatibility of the present invention to all known systems is important because it will operate compatibly with existing prepay systems. For example, where there is a shortage of dedicated facilities, optional prepay with tone in lieu of high voltage and ground) may be added to normal subscriber loops (48V), thus avoiding the cost of installing additional special or dedicated facilities. Also, obsolete or worn out equipment may be dropped from the system whenever expedient, thus providing a practical financial program to phase out old and phase in optional prepay. The compatibility includes loop start and ground start options, ground operation refund/collect options, and loop operation, refund/collect options, and 110 to 150 volts or 48 volt options, 24 volt carrier options over coin control, and of course combinations of these options.

Moreover, high voltage refund/collect employing coin junctor, etc. is compatible technically and functionally with the add-on 48 volts which would take over the immediate expansion requirements. Also, presently conventional to 48 volt optional prepay made possible by the present invention requires no central office alterations other than the avoiding of tone "wash out" or the inclusion of tones in lieu of reversal and refund discrimination (notching filters) between coin phone and remote toll.

In full and local prepay systems, ground feedback (hum) is eliminated by eliminating ground during transmission. There is no ground to eliminate where final conversion from postpay is accomplished.

The availability of more current for transmission or dialing is accomplished by eliminating ground potential during those periods. This relates to either ground start systems or loop start systems requiring a high voltage refund/collect.

The elimination of the coin trigger, conventionally located at the upper portion of the coin hopper, eliminates a consistent "hung coin" condition from an accumulation of too many coins stacked around the trigger when the operator does not remember to limit the deposit per collection. This coin trigger also is used to announce a "hung coin" to the C.O.E. if ground is not released.. which need has been effectively eliminated via the mechanical clearance feature actuated by the on-hook hand piece weight. Thus, by eliminating the coin trigger, the escrow capacity is increased and this availability is provided because of the increased electromechanical efficiency. Conventional coin trigger assembly mechanical release spring tension on contacts are exposed to environmental and human contamination whereas this invention incorporates hermetic and solid state switching. The sensing via the coin trap position does not release spring tension or induce same, nor is the center of gravity altered because of the uniqueness of design. Conventional coin traps are required to raise the entire load of coins before the latch can be moved out of the way. Whereas by employing a low friction roller assembly it is possible to provide a roll-off release simply by slightly striking the pendulum latch in the release mechanism presented by the present invention, nor is spring tension required to return the coin trap to the initial (empty) position.

With the foregoing in mind, the invention will be better understood from a reading of the ensuing detailed description, when taken in conjunction with the drawings, wherein:

FIG. **1** is a view partly broken away of a telephone pay station;

FIG. **2** shows apparatus of the invention in a holding state;

FIG. **3** shows a portion of such apparatus in a collect state;

FIG. **4** shows the components in a normal empty state;

FIG. **5** shows these components in an escrow state;

FIG. **6** shows the invention in a dump/collect state;

FIG. **7** is an exploded perspective view of the many components of the invention;

FIG. **8** is an electrical circuit diagram for the system of the invention;

FIG. **9** is an electrical circuit of the tone supply source;

FIG. **10** is the basic dual tone receiver and logic circuitry, and

FIG. **11** shows the analog version.

In FIG. **1** there is shown a conventional pay station housing **11** having a lower housing **13** for the money collection box (not shown), and a hook **15** for a handpiece (not shown), arm **17** and other conventional pivot structure, shown at **19.** Hook **15** and arm **17** comprise a hook arm. To this available equipment, there is added a clamp **21** which pivots with the arm **17** and carries a depending refund linkage or push rod **23,** extending vertically downward. This rod is guided for vertical movement by a refund linkage guide **25** (best seen in FIGS. **7** and **8**). The rod **23** is adapted to pivot a bell crank arm or refund drive lever **27,** pivotally connected to the channel or frame **28** (FIG. **7**) by pin **29,** with the outer end of the bell crank **27** protruding from slot **31** to permit vertical movement thereof by rod **23,** causing the opposite end of the crank **27** to engage the cam **33,** which is a portion of, or is formed integrally with, the vane deflection rocker assembly **35.** Thus, the beveled lower end of bell crank **27** engages the underneath side of cam **33** to rock the vane deflection rocker assembly **35** in a counter-clockwise direction, as viewed in FIG. **7.** This is, of course, a clockwise direction as viewed by a person facing this telephone pay station, but in either

event a refund condition (vane tilted to the left as seen in FIG. 7) is established by this movement.

A purpose of the rocker assembly **35**, when driven mechanically is, to move the vane **37** (see FIG. 3) to the refund position. This is accomplished by the ears or extension arms **36** and **38** of the rocker assembly **35**, Ear **38** engages the vane extension arm **39** to tilt the vane to a predetermined position. The arm **39** extends through a slot **41** (FIGS. 4 and 5) of the front outer wall **43** of the hopper **45**, channel or frame **47** being affixed thereto as is best seen in FIGS. **4–6**. The ends of this slot ensure stops for the vane extension **39** acting as a mechanical position memory to hold the vane in either of its respective two positions.

The rocker assembly **35** is interconnected with the armature **51** by a mechanical link **53** which is flexible piano wire or the like because link **53** serves as an interconnecting driving link between the motor armature **51** and the rocker assembly **35**.

Link **53** is adapted to be fixed to armature **51** by a pin or screw **55** at one end and affixed to a radial arm or extension **57** of the shaft **34** of rocker assembly **35** by screw **59** (FIG. **2**). Thus, rocker movement imparted in either a counter-clockwise or a clockwise direction to assembly **35** serves to turn armature **51** in similar directions. It has been found that reliable operation is attained using approximately 55° of armature movement in either direction from its home position to obtain optimum momentum and which corresponds to approximately 40° rotation of the shaft **34** in either direction from the home or neutral position, shown in FIG. **7**.

Thus, while the mechanical connection of hook linkage **23** is provided to produce a coin return disposition of vane **37**, through bumper pin or ear **38** engaging tab **39** and shifting vane **37** to the position shown in FIG. **7**, it will be appreciated that, electrically, armature **51**, when driven in a clockwise direction as seen in FIG. **7**, causes link **53** to move downwardly (and actually inwardly toward shaft **34**) to enable ear **36** to engage tab **39** of vane **37** and move it to the collect position. The rocker assembly **35** is mounted in channel or frame **28** for pivotal movement.

A reed switch **52** (FIG. 7 and FIG. 2) is provided at a location **52'** (FIG. 7) on the inside of frame **28** to be influenced by permanent magnet **49** carried at the bottom (for balance reasons) of shaft **34** when the shaft is rotated to the collect position, thereby placing the magnet **49** close enough to the contacts of the reed switch **52** to close same. This switch is one of two series switches (**52** and **72**) which are electrically connected in series so that when both are energized, the motor will be de-energized, as will be further explained.

The deposited coins are held in escrow on coin trap **61** which is part of an assembly, generally shown at **63**, comprising a pivot extension **65** receiving pivot pin **67**, a latch roller **69** of friction free material, such as are used as needle bearing rollers, and a retaining screw **71** therefor.

The pin **67** is affixed to and rotated in the hopper **45** (FIG. **3**) such that the coin trap blocks the hopper chute so as to provide an escrow or coin holding position.

Pin **67** also carries circular slotted permanent magnet **68** (FIG. **3**) adjacent to vertically fixed reed switch **72** (coin trap series switch) such that, with the magnet **68** in the position shown in FIG. **3**, the contacts of the reed switch are closed. Reed switch **72** is one of the switches (**52** and **72**) which is normally open but which must be closed to effect turn-off of the motor after reverse polarity has been applied to energize the motor.

The coin trap latch **73** (best seen in FIG. **7**) is provided with an aperture **75** at its upper end so that it may be suspended in pendulum fashion by screw or pin **77** passing through aperture **78** of pole piece **105**, in turn spaced from the rear wall of frame **28** by spacer **79**, held in place by rear screw **81**. This latch assembly also carries a two-arm (hair pin type) spring **82** on pin or screw **77**, the purpose of which is to center latch **73**, relative to the latch roller **69**, as an offset to inadvertent tilting of the entire pay station. This is accomplished by criss-crossing the arms of pin **83** to grip the opposite sides of latch **73**. Pins **83** and **85** are pivotally spaced apart **110°** such that movement in either a clockwise or counter-clockwise direction of armature **51** through an angle of approximately 53° is sufficient to cause one of the bumper pins to strike latch **73** and knock it off of the top surface of latch roller **69**.

The coin trap assembly **63** is weighted on the outside opposite coin trap **61**, by differing materials and mass, or otherwise fixing a predetermined amount of weight thereto, such that the center of gravity of the assembly is located to return coin trap **61** to approximately +15° above horizontal position in the absence of any coin weight. This weight bias is approximately 40 per cent of a 10 cent piece which insures optimum advantage in the sensing of minimum coin weight without incurring losses resulting from altering the centered gravity (as) in mercury, or wires which vary in torque with environmental temperature changes, spring tensions normal to leaf spring contact requirements. Thus, with latch **73** spring biased to center position, regardless of whether the pay station is slightly out of level, the coin trap **61** will automatically return to latched position after the coins have been dumped.

The motor assembly, with the exception of the armature **51**, is shown at **101** in FIG. **7** wherein a coil **103** is assembled with pole pieces **105** and **106**. Screws **107** and **108** hold the coil **103** in the pole pieces. Armature **51** neatly fits within the circular pole piece opening **111** to leave a small (e.g. one-thirty second inch) gap between the armature and the pole pieces with the pole pieces being diametrically separated by air gaps **113** and **115** of the same or less spacing. The right hand extensions of pole pieces **105** and **106** extend into channel or frame **78** via slot **80** and the assembly is suitably mounted to the frame in that orientation. The right hand extension arms **105** and **106** (as viewed in FIG. **3**) of the pole pieces extend through slot **80** of frame **28** as viewed in FIG. **7**.

The armature **51** is polarized north and south substantially at diametrically opposite regions, located on the horizontal plane polarized on the diameter so that the north and south poles will respectively seek the gaps **113** and **115**, in the absence of motor coil **103** energization, to provide a homing or balanced positioning of armature **51**. This insures that the bumpers **83** and **85** of the armature are sufficiently spaced from latch **73** to enable armature **51** to gain sufficient momentum (from a minimal load starting load at home position) prior to striking the latch **73** from either side, as determined by the polarity applied to the motor coil **103**. Thus, a very great electro-mechanical gain is available to release latch **73** using only a small amount of power because momentum does the work rather than electri-

cal torque. It would not operate at 5 × power without the impact resulting from momentum on 10 cents amplified many times by increasing the coin load. Any wheel tends to appear frozen to a surface if torque is gradually applied whereas striking or bumping tends to break the "freeze" caused by known frictional design considerations.

The motor coil **103** is energized upon answer by a signal incorporating reverse polarity to position the vane **37** in the collect position through movement of armature **51,** link **53,** rocker arm **57,** such that ears **36** and **38** come into play to insure that the vane is in the collect position or they move it to the collect position, through ear **36** contacting tab **39.** This is the only initial load on the motor and it is minimized because, spring **32** mounted on pin **29,** maintains the bell crank **27** in an inoperative position, i.e. with its lower edge away from cam **33,** during off-hook. The refund lever or bell crank **27** cannot engage if collect polarity is initiated because the cam rotates down in an "out of the way" position should the refund lever be moved. Both cam lobe and refund lever are pointed to void locking of cam by lever at the point of "go/no-go" refund/collect whereby the refund lever will actually assist the collect rotation upon reaching the precise degree of "no-go" (approximately 20°). This feature serves to prevent fraudulent intent as well as avoid locking up which could result in possible damage.

Further rotation of armature **51** (following vane movement) then causes bumper **83** to strike release latch **73** and permit the weight of the coins **121** (see FIG. **5** to dump the coin trap **61** so that the coins are collected.

While the motor coil **103** remains energized, bumper **83** remains against latch **73** because the motor is holding the bumper in position during the time required to drop all coins held by the coin trap, the roller **69** being in a tilted position, presses against latch **73,** thereby preventing its return. In the event the motor is turned off the release is maintained mechanically by the contour of **73** (note **73'**) until there are no more coins present; otherwise the bumper holds the latch aside until coins are deposited which causes the flux field to collapse as the motor is turned off. Thus, the unique configuration of the latch **73** includes a reduced lower contacting extremity for riding on the friction free roller **69** and an arcuate widening portion, represented by edge **73'**, provided to permit the roller **69** to ride up the latch **73** while being maintained in contact therewith. It should be noted that the coin trap **61** will have immediately returned to its position to be latched, once the weight has been removed because of the intentional location of its center of gravity to achieve automatic return.

After the collect operation is insured, the motor is de-energized to permit the latch **73** to return to its vertical condition for future escrow latching. This is achieved by closing the two series switches **52** and **72** to fire SCR **251** which shunts the power from motor coil **103.** The physical locations of these switches on frame **78** are shown at **52,** and **72** (FIG. 7), switch **72** being mounted in the vertical as shown by dotted outline **72.** Series switch **52** is closed first, by magnet **49** when ears **36** and **38** of the rocker assembly **35** assure that vane **37** is in the collect position which occurs during the initial movement of armature **51.** Thereafter, following release of latch **73** by bumper **83,** coin trap **61** is depressed to cause its permanent magnet **68** to close switch **72,** thereby providing a path of positive voltage to the gate of SCR **251** causing it to conduct, in turn causing de-energization of the motor coil **103.** Orientation of magnet **68** relative to switch **72** readily programs the apparatus for various modes of operation. Upon de-energization, the armature **51** returns to its home position as a result of its polarization seeking the pole piece gaps **113** and **115,** but SCR **251** remains conducting until the potential across it is reduced to zero or is reversed. Thus, the motor does not restart although switches **52** and **72** are opened.

Also, during energization of the motor coil **103,** a pair of shunt switches **131** and **133** are actuated because the switches are positioned within the field of motor coil **103.** These switches are preferably of the reed type and may be either taped or epoxied to coil **103,** affixed to pole pieces **105** and **106,** or otherwise strapped or held within the influence of coil **103,** or operated as a result of energization of coil **103.** Their function is to provide a shunt across the transmit and receive terminals to insure that there are no insertion losses from the hand piece or any other equipment during operation of the motor, thereby adding to the reliability by insuring optimum available energy is fully received by coil **103,** thereby inversely insuring the requirement of minimal power in accomplishing the dump and collection operations. Restoring is available without power commitment because of the center of gravity of the coin trap assembly **63,** polarization of armature **51** and centering spring **82.**

FIGS. **2** through **6** illustrate the apparatus in various stages of performing its functions.

In FIG. **2** the structure is shown in its holding position for retaining the money in escrow. It may be noted that the ears **36** and **38** comprising the tab moving structure are in their home position because armature **51** is in its home position and connecting link **53** insures that the vane moving or rocker structure **35** is in its home position wherein the vane **37,** as shown in FIG. **7,** will remain at rest against ears **36** or **38** – not vertical. Also, the pendulum supported latch **73** is in a vertical position and midway between bumpers **83** and **85,** being retained there by centering spring **82.** Thus, the coin trap is latched in position by latch **73** resting on coin trap latch roller **69.** Also, as can be noted from this view, bell crank **27** is in its home or negative position, being biased away from and out of contact with rocker assembly **35.** Thus, the telephone receiver is off-hook and the standard hook spring (not shown) is retaining the hook switch refund linkage or rod **23** in its upper position, out of contact with bell crank **27.**

In FIG. **3** the mechanism is shown in the collect position with coin trap **63** down and the coins which were previously being held by coin trap **63** have been deflected by vane **37** to the collect chute for repository in the coin box. It may be noted that ear **36** of the rocker assembly **35** is retaining vane **37** in the collect position. In FIG. **2,** the view is from rear and the ear **36** is on the viewer's left. In FIG. **3** the vane is counter clockwise, thus illustrating collect causing coin deflection to the right, the ear seen is **36.**

In FIG. **4** the apparatus is shown just after it has completed a dumping operation with the cointrap **63** returning upwardly slightly above its normal position because of its center of gravity. The latch **73** has been re-

leased by the handpiece being removed from the hook.

In FIG. 5 as viewed from the left, the apparatus is shown with the money 121 being escrowed and thus, roller 69 pushes upon latch 73 and the vane 37 is at rest in the collect position with switch 52 open as assembly 35 is at zero deflection.

In FIG. 6 also viewed from the left the apparatus is shown in collect position because the vane 37 has been pivoted in a direction outward from the paper requiring a cut away view of the vane to see that the coin trap 63 is in its depressed position.

In FIG. 8, the electrical circuitry is shown for achieving the functions described. The motor coil is depicted at 103, so upon going "off hook" the transmission path extends from now positive L2, (identified as terminal 201), with the connection being over lead 202, via closed hook switch contacts 203, lead 204, normally closed tone collect contacts 205, lead 206, terminal 207, lead 208, terminal 209, then over lead 210, terminal 212, lead 213, to terminal 214, through forward conducting diode 215, terminal 211 and over lead 216, through contact (manual refund) 217, lead 218, through tone refund contacts (now closed) 219, over lead 220, and through the high voltage isolation, now closed contacts 221, and over lead 222 to terminal 223, then terminal 224, through the coin annunciator to terminal 225, over lead 226 and in terminal "C" of the transmission network, then out terminal "A" of the transmission network, over lead 227, through the dial pulsing contacts 228 and over lead 229 to terminal 230, over lead 231 to the now negative secondary L_1 terminal 232, over lead 233, terminal 234, lead 235 and tone collect contacts 236, lead 237, terminal 238, lead 239 and finally terminating on the negative L_1 terminal 240.

At the moment of line reversal "caused at the C.O.E. or C.D.O.," L_1 terminal 240 becomes positive while L2 terminal 201 goes negative, the transmission path is shunted, thereby voiding possible communication. Shunting of the transmission network is carried out as follows: beginning on the now positive L_1 terminal 240, over lead 239, terminal 238, over lead 237, through tone collect contact 236, lead 235, terminal 234, lead 233, over the now positive secondary L_1 terminal 232, over lead 231, terminal 230, where the "transmission shunt path" begins, over lead 241, through the now closed contacts 131, 133 and over lead 242, thereby terminating a total bypass to the dial, transmission network and coin annunciator, thus completing the "transmission shunt path" on upper motor terminal 223. The "transmission shunt path" is made possible upon closing contacts 131 and 133, which in effect provide a direct path from positive L_1 terminal 240 to the upper motor terminal 223. This path is caused by energizing coil 103 and building up a flux field sufficient to close contacts 131 and 133 within 3 milliseconds. Within another 15 milliseconds, the flux build-up activates motor armature magnet 51 into a "collect" mode, causing transmission shunt for so long as the current flows from terminal 223 through coil 103 in the direction of lower motor terminal 244, which coil is shunted by SCR 251 (presently not conducting) so that current continuity from lower terminal 244 is maintained over lead 243, terminal 214, lead 213, terminal 212, lead 210, through the now negative secondary L2 terminal 209 and then over lead 208, terminal 207, lead 206, tone collect contact 205, lead 204, hook switch (not closed) contact 203, and over lead 202, terminating on the now negative primary L2 terminal 201.

Shunt removal is effected by causing SCR 251 to conduct between terminals 223 and 244 of the motor coil 103, causing a collapse of the magnetic flux field and opening of the previously closed shunt contacts 131 and 133. It is necessary to trigger gate 250 of the SCR 251 causing the SCR to conduct, which effectively shunts the motor coil. Triggering of gate 250 is accomplished by applying positive voltage from terminal 223 to the gate. The firing path is as follows: beginning on gate 250 over lead 252 through the now closed series vane switch 52, series coin trap switch 72, and the nickel mechanism contacts of 253, over lead 254 and terminal 211 via the "diode shunt path" lead 216, switch 217, lead 218, contacts 219, lead 220, contacts 221, lead 222, back to point 223 thus providing a positive voltage path from the upper end of coil 103 terminal 223. Note noting that contacts 133 and 131 open with the collapse of the motor coil flux field, effectively removing the "transmission shunt path" between motor coil terminal 223 and terminal 230, thus creating a new path continuing from the now positive terminal 230, over lead 229, through dial pulsing contacts 228, and over lead 227, to terminal "A" and out terminal "C" of the transmission network, then over lead 226, terminal 225, and through the now conducting diode 255 (shunting the coin annunciator), to terminals 224 and 223, through the now conducting SCR 251, to lower motor coil terminal 244 (effectively bypassing coil 103) and flowing over lead 243, terminal 214, lead 213, terminal 212, lead 210, to the now negative secondary L2 terminal 209 and over lead 208, terminal 207, lead 206, collect contacts 205, lead 204, through closed hook switch contacts 203 and finally over lead 202 connected to the now negative primary L2 terminal 201.

FIG. 10 discloses the tone circuitry located with the paystation which effectively controls line reversal within the paystation. Power is drawn from L_1 and ground during "on hook" time, and is stored for drain during "off hook" time, so as to avoid degradation to transmission or coin control operation. Upon receiving the combination of 700 and 1100 cps a polarity reversal occurs of the "secondary" L_1, L2 terminals (relative to the "primary" L_1, L2 terminals) as accomplished per FIGS. 10 and 8, in the following manner; discrimination of a minimum duration from 600 to 800 milliseconds continuous tone burst consisting of 700/1100 cps ± 6 cycles, thereby securing time discrimination by employing piezo electric resonant filters, and offering important additional security to the 700/1100 cps frequencies. This effectively activates the opening of relay contacts 205 and 236 (FIG. 8) while closing relay contacts 256 and 257 simultaneously, showing that the negative "primary" L_1 terminal 240 finds a path through the new contacts 257 via terminal 207 and lead 208 to the "secondary" L2 terminal 209, which now becomes negative, creating a reversal of current flow through the circuit to effect "collect" operation. The positive L2 terminal 201 finds a new path from the now closed contact 256 to secondary L_1, thereby causing the secondary L_1 terminal 232 to become positive. By breaking contact 205 and 236 and making contact 256 and 257, an effective line reversal is displayed between the secondary and primary L_1, L2 terminals. Having

discriminated the collect tones, the circuit remains intact for approximately a half second duration longer than the tone burst, thereby providing a feedback tone to the operator confirming collect. At the instant of reversal the aforementioned collect and "transmission shunt path" become identical to that of a normal line reversal path created by the C.O.E. between the secondary L_1, L2 terminals. The availability of latching these relay contacts is at the option of the operating company, when direct distance dialing occurs on a station-to-station basis, whereby the operator is brought in to observe coin count, she may immediately release the dial memory bank and drop off of the line without waiting for the called station to answer to secure collection, automatic collect on answer may be programmed via normal supervisional signals that activate the toll clock. Paystation supervision in the form of a collect tone burst can be activated with the toll clock. While collection in this instance would occur at that moment, present day high voltage ground systems supply memory with instructions to collect refund upon "hang-up" which is also recognized as the same general form of internal supervision to be incorporated in the future with T.S.P.S.

Refund path is altered in the 48 volt optical pay system by breaking the continuity of motor shunting diode path (diode **215**) thereby causing motor coil **103** to conduct from motor terminal **244** to motor terminal **223** beginning with the now positive L2 terminal **201,** then over lead **202,** switch hook contact **203,** lead **204,** tone collect contact **205,** lead **206,** terminal **207,** lead **208,** through the now positive secondary L2 terminal **209,** over lead **210,** terminal **212,** lead **213,** terminal **214,** where it does not follow the diode **215** shunt path but instead finds a new path over lead **243,** through the lower motor coil **103,** terminal **244** and through the coil in the direction towards the upper motor terminal **223,** where after having energized coil **103** the path is further altered so as to bypass the coin annunciator, transmission network and dial by passing over lead **242,** through the now closed leaf contacts **131** and **133,** over lead **241,** terminal **230,** lead **231** and to the "secondary" now negative L_1 terminal **232,** continuing to the now negative "primary" L_1 terminal **240,** thereby eliminating all insertion loss normally resulting from other components which have been bypassed upon closing switch contacts **131** and **133,** so that upon opening "Manual Refund" contacts **217** or tone refund, contacts **221** break the diode shunt path and causes current flow through the motor coil **103.**

"Optional" Prepay, when converted to "Adaptive" Full Prepay, must be capable of coin control via ground and L2 wherein **110** volts to **130** volts battery originates at the central office for time periods of ½ second at a time rate of 60 pulses per minute where more than one high voltage pulse is employed to disperse coin(s) to refund or collect as determined by the polarity of ground. "Ground" start or "loop" start adaptive capability results by providing an earth ground connection to paystation ground terminal **301** over lead **506,** contacts **505,** lead **504** and through a 1000 ohm hum bucking choke **503,** by connecting lead **502,** to terminal **501** and disconnecting lead **252** from the SCR gate **250** and by also orienting coin trap magnet **68** so that when the coin trap is depressed from +15° to the latched escrow position of 0°, magnet **68** will cause switch **72** contacts to remain closed. This provides further continuity through the nickel mechanism switch contact **253,** lead **254,** terminal **211,** continuing over the diode shunt path to the now positive upper motor terminal **223** and through the coin annunciator, the transmission network, dial contacts, to the secondary L_1 terminal **232** and continuing the path terminating on the primary L_1 terminal **240,** thereby closing the ground loop and causing current to flow which brings up the line relay (ground start system) or removes the C.O.E. dial shunt in a loop start system. Note that disengaging the mechanical hookswitch linkage is required in that most "full" prepay systems provide refund or collect after completing the call and "hanging up" the handpiece, wherein the high voltage path originating on ground terminal **301** passes over lead **302** and through coil **303** which causes contact **258** to engage the armature. The voltage in excess of **63** volts causes an avalanche of zener **306** (having first passed through the forward conducting zener **305**) and over lead **307,** terminal **212,** lead **213,** terminal **214,** lead **243,** terminal **244,** through motor coil **103** in the direction of its upper terminal **223,** thereby creating a flux field imposed upon magnet **51** and causing it to rotate in a refund direction as the current continues to flow over lead **222,** now closed contact **258,** lead **259,** terminal **238,** lead **239** and completing its path through the now negative L_1 terminal **240.** Observe that the "collect path" is identical, accepting the reverse direction and noting that SCR **251** is in a forward but nonconducting position and that its gate **250** was disconnected from lead **252** at time of converting the paystation to "adaptive" prepay.

In programming a C.O.E. exchange for "adaptive" full prepay, it is feasible to expand to a point of 100 percent full prepay, then convert all paystations to the far more advantageous system favoring "fail-safe" backup mechanical refund, coin free emergency or toll options, loop start, transmission shunt of the 48 volt "line reversal" mode of Optional Prepay because of its greater security advantage accompanied by less electrical load which is identifiable with increased life expectancy, less maintenance and less C.O.E. equipment to accomplish coin control reflecting upon a noticeable reduction in plant investment and thereby greatly improving upon yield. The 5 cent switch **253** is mechanically opened on the first nickel deposit, effectively breaking the SCR gating path until deposit of the second nickel in lieu of which the restoring coil **401** becomes activated via lead **402,** hookswitch contact **403** then (closed upon hanging up receiver), over lead **202** from the positive L2 terminal **201,** thereby restoring contacts **253.**

Of the three present day systems, POST PAY, LOCAL PREPAY AND FULL PREPAY, there is no compatibility or interchangeability yet the uniqueness of this invention by reason of the aggregate of sensitivity, friction free characteristics and circuit versatility, adaptability to any of the three present day systems including all of their variations is both practical and possible, but more importantly, it is also capable of operating in the ultimate mode of OPTIONAL PREPAY representing a real technological break-through to the operating companies and a tremendous improvement in convenience and reliability to the user. For so long as there is need for hard lines and/or energy limitations imposed upon the station apparatus, Optional Prepay will serve as the ultimate and optimum system and in-

deed is an entirely new frontier in the annals of Telephone history.

What is claimed is

1. In coin control apparatus for use in connection with a coin operated telephone system wherein a station employing a hook arm and handpiece and including a hopper enclosed in a housing wherein vane means and releasable coin trap means are adapted to be positioned to refund or collect coins held in escrow within the hopper, the invention comprising, in combination a coin trap latch for maintaining the coin trap means for escrow of the coins or for releasing the coin trap means for collection or refund of the coins; a mechanical connection from the hook switch hanger arm for insuring positioning of the vane means and coin trap latch in positions for refund while the handpiece is in the on-hook condition and for enabling latching of the coin trap latch when the handpiece is in the off-hook condition; electro-mechanical sequencing means operative in response to electrical signal energy received at the telephone station in accordance with answer supervision for insuring that the vane means is positioned in position to collect the coins and then releasing the coin trap means via the latch to drop the coins; said coin trap means comprising a coin trap, pivot means and an extension extending from the pivot means in a direction different from the coin trap means; said latch comprising a pivotally mounted trigger adapted to engage the extension and maintain the coin trap in a coin holding position until disengaged by the sequencing means in response to said signal and said vane means comprising a vane pivotally mounted for movement through an arc.

2. In coin control apparatus for use in connection with a coin operated telephone system wherein a station employing a hook arm and handpiece and including a hopper enclosed in a housing wherein vane means and releasable coin trap means are adapted to be positioned to refund or collect coins held in escrow within the hopper, the invention comprising, in combination a latch for maintaining the coin trap means for escrow of the coins or for releasing the coin trap means for collection or refund of the coins; a mechanical connection from the hook switch hanger arm for insuring positioning of the vane means and coin trap latch in positions for refund while the handpiece is in the on-hook condition to effect coin return and for enabling latching of the coin trap latch when the handpiece is in the off-hook condition; electrical sequencing means operative in response to electrical signal energy received at the telephone station in accordance with answer supervision for insuring that the vane means is positioned in position to collect the coins and then releasing the coin trap means via the latch to drop the coins; said coin trap means comprising a coin trap and pivot means therefor; said sequencing means comprising motor means; said latch retaining the coin trap in a coin holding position by engagement with the pivot means therefor and said motor means positioned for dislodging said latch by engagement therewith; said latch being adapted for holding the coin trap in a coin holding position and said motor means being connected to move said vane means to its collect position and thereafter actuate said latch to dislodge the coins from the coin trap for collection.

3. In coin control apparatus for use in connection with a coin operated telephone system wherein a station employing a hook arm and handpiece and including a hopper enclosed in a housing wherein vane means and releasable coin trap means are adapted to be positioned to refund or collect coins held in escrow within the hopper, the invention comprising, in combination a latch for maintaining the coin trap means for escrow of the coins or for releasing the coin trap means for collection or refund of the coins; a mechanical connection from the hook switch hanger arm for insuring positioning of the vane means and coin trap latch in positions for refund while the handpiece is in the on-hook condition and for enabling latching of the coin trap latch when the handpiece is in the off-hook condition; electrical sequencing means operative in response to electrical signal energy received at the telephone station in accordance with answer supervision for insuring that the vane means is positioned in position to collect the coins and then releasing the coin trap means via the latch to drop the coins; the coin trap means comprising a trap pivotally mounted from the housing and the latch comprising trigger means pivotally mounted from the housing for normally maintaining the trap in a coin retaining position, and the sequencing means comprising motor means for sequentially operating the vane means to a position to collect the coins and the latch to an inactive position by striking the same to permit the trap to depress and drop the coins for collection.

4. In a coin operated telephone set having a handpiece and hook arm and comprising a vane movable to a collect position to insure that coins are collected and movable to a refund position to insure that coins are refunded and coin trap means for normally holding the coins in escrow, the combination comprising motor means including a single coil for sequencing the operation of the vane and the coin trap means; bypass means connected across the coil for shunting current around the coil in response to the application of a first polarity of voltage to the coil, and switch means connected to open said bypass means and permit said first polarity of voltage to energize the motor means while the handpiece is released from the hook arm whereby the coin trap means and vane are electrically positioned to refund any previously deposited coins.

5. The apparatus of claim **4** further comprising polarity sensitive controllable means connected across the motor coil to shunt current produced by the application of polarity opposite to the first polarity when actuated; an actuation circuit for said controllable means comprising a first switch adapted to be actuated in accordance with movement of the vane to the collect position; and second switch means in series with said first switch adapted to be actuated by movement of the coin trap means toward a position to release the coins from escrow whereby said motor coil is shunted when said controllable means are actuated to permit general transmission with a called party.

6. The apparatus of claim **5** wherein said switch means comprise a switch, and permanent magnet means associated with the switch to operate the same.

7. The apparatus of claim **5** further comprising further switch means adapted to block the transmission so long as said coil is activated, through energy derived from the field of the coil.

8. An electrical circuit for use with a coin operated telephone paystation using battery reversal which station includes a handpiece, a hook arm and hook switch

means, a coin trap for holding coins in escrow and delivering them for collection or refund, and a vane for determining if the coins will be collected or refunded, comprising motor means including a single coil for sequencing the operation of the vane and coin trap upon energization by battery reversal polarity voltage; shunt means normally preventing energization of the coil upon application thereto of a first polarity voltage opposite to battery reversal polarity; said first polarity being applied upon actuation of the switching means by removal of the handpiece from the hook arm; triggerable unidirectional means also shunting the coil to pass current in the opposite direction when triggered; means responsive to energization of the motor means to shunt transmission; said unidirectional means bypassing the coil current upon triggering when the coil money has been directed for collection, thereby removing the shunting and enabling transmission.

9. Coin handling apparatus for predetermining the disposition of coins comprising, in combination, means for escrowing coins; means latching the escrowing means in a predetermined position; means for releasing the latching means, said releasing means comprising rotatable polarized armature means and a single coil for imparting either of opposite directional motions to the armature means in accordance with the polarity of voltage applied to the coil; and switching means for applying voltage of a first polarity to said coil to effect armature rotation.

10. A latch mechanism for coin supervision comprising, in combination, pivotal means comprising a coin trap mounted for pivotal movement through the horizontal as a result of a change in the center of gravity of the pivotal means; said pivotal means adapted to occupy at least a first position prior to latching, a latched position or an unlatched position; latching means for bearing against a part of the pitovtal means other than the coin trap thereof for latching the pivotal means in said latched position; a motor comprising a single coil and a rotatable rotor; and means carried by the rotor for striking the latching means for either of opposite directions to unlatch the pivotal means; said coil causing rotor movement in one direction upon application thereto of voltage of a first polarity, and causing rotor movement in the opposite direction upon application of voltage of polarity opposite to said first polarity.

11. The latch mechanism of claim **10** further comprising support means for pivotally supporting the latching means in pendulum fashion.

12. The latch mechanism of claim **10** wherein said pivotal means is normally to return to said first position.

13. The latch mechanism of claim **10** further comprising coin supervision switch actuating means carried by said pivotal means and pivotal therewith.

14. The latch mechanism of claim **10** wherein said pivotal means comprises roller means carried thereby in spaced relation to the coin trap and said latching means for the pivotal means bearing against said roller means.

15. The latch mechanism of claim **14** wherein said latching means comprises a flat surface bearing against said roller means and an arcuate surface contiguous with and extending upwardly from the flat surface; and further comprising pivotal means supporting said latching means in pendulum fashion.

16. The latch mechanism of claim **10** wherein said means carried by the rotor comprise at least a pair of spaced apart bumpers respectively adapted to bump said latching means upon partial rotation of the armature means in either direction; the spacing between said bumpers exceeding the width of said latching means.

17. The latch mechanism of claim **10** comprising means for supporting said latching means in pendulum fashion and further comprising spring means insuring said latching means to be in a position to bear against the pivotal means until said coil is energized.

18. The latch mechanism of claim **10** wherein said pivotal means comprises a counterweight spaced from the coin trap for returning the pivotal means to said first position in the absence of coins on the trap.

19. The latch mechanism of claim **10** wherein said motor comprises pole pieces and said rotor is disc shaped and is supported substantially between the pole pieces for rotation in opposite directions.

20. The latch mechanism of claim **19** wherein said pole pieces form air gaps at opposite diametrical locations of the rotor, and said rotor is diametrically polarized to define a home position with the rotor poles aligning to the pole piece air gaps respectively.

21. The latch mechanism of claim **19** wherein said latch mechanism further comprises vane means disposed beneath the pivotal means and adapted to be moved to one of two different positions independently of the pivotal means.

22. The latch mechanism of claim **21** further comprising vane moving means; and means interconnecting the vane moving means and the rotor.

23. The latch mechanism of claim **22** further comprising manually operable mechanical link reans for moving said vane moving means.

24. The latch mechanism of claim **23** for use in a telephone paystation having a handpiece carried by a hanger arm wherein said manually operable means comprises mechanical linkage means adapted to be displaced when the hook arm of the telephone paystation is depressed as by hanging up of the handpiece to position the vane moving means in a predetermined position and to unlatch the pivotal means.

25. The latch mechanism of claim **24** for use in a telephone pay station comprising a first coin supervisory switch operable when the vane means are moved to a predetermined position and a second coin supervisory switch operable when the pivotal means occupies said unlatched position.

26. The apparatus of claim **1** comprising means for supporting the vane in a collect position at an angle between the horizontal and vertical to one side of the vertical independent of the coin trap, and means for supporting the vane in a refund position at an angle between the horizontal and vertical to the other side of the vertical independent of the coin trap whereby gravity maintains the vane in the position last placed until moved therefrom.

27. The apparatus of claim **1** wherein the extension comprises a roller for engagement with the latch to reduce friction of engagement therebetween.

28. The apparatus of claim **1** further comprising counterweight means urging the coin trap upwardly and the extension downwardly.

29. The apparatus of claim **1** further comprising a permanent magnet oriented to different positions by movement of the coin trap, and coin supervisory switch

means supported from the housing for operation by the magnet as it is oriented.

30. The apparatus of claim **1** wherein the electromechanical sequencing means comprises a single coil motor capable of operation in opposite directions.

31. The apparatus of claim **30** wherein said motor comprises a permanent magnet rotor.

32. The apparatus of claim **31** wherein the motor comprises pole pieces fixed from the housing and symmetrical relative to the rotor.

33. The apparatus of claim **32** wherein the rotor is pivotally mounted for movement in clockwise and counter-clockwise directions, and further comprises a pair of spaced apart bumpers protruding therefrom for engagement with the latch.

34. The apparatus of claim **33** wherein the rotor is circular and the pole pieces define a substantially circular opening around the rotor with a substantially constant air gap between said pole pieces and the rotor.

35. The apparatus of claim **34** wherein the rotor is polarized diametrically oppositely and the pole pieces are disposed relative to the rotor to define a home position to which the rotor magnetically returns when the motor is de-energized.

36. The apparatus of claim **35** wherein the rotor bumpers are spaced laterally apart a distance greater than the width of the latch; said latch being straddled thereby such that partial rotation of the rotor is necessary to cause either bumper to strike the latch thereby incorporating momentum build-up for latch release.

37. The apparatus of claim **36** wherein the vane means comprises means for moving the vane and further comprising a relatively rigid connection between the rotor and the means for moving the vane.

38. The apparatus of claim **26** wherein the vane means comprises vane mover means for selectively positioning the vane in the collect position or the refund position; said vane mover means comprising spaced apart members pivotally mounted for bi-directional arc-like movement to move the vane to collect position by contact of the vane by one of said members with the members moving in one direction and to refund position by contact of another of said members with the vane with the members moving in the opposite direction.

39. The apparatus of claim **38** wherein the electromechanical sequencing means comprises a motor having a rotor mounted for at least partial rotation in opposite directions, and a mechanical connection between the rotor and the vane mover means to serve as a drive connection therebetween.

40. The apparatus of claim **39** wherein the motor comprises a single coil for driving the rotor in opposite directions upon the application of opposite polarities to the coil.

41. The apparatus of claim **40** wherein the rotor comprises a pair of spaced apart bumpers protruding therefrom and disposed respectively on opposite sides of the latch and spaced therefrom.

42. The apparatus of claim **41** wherein the spacing of said bumpers relative to said latch and the spacing of said vane moving members relative to the vane is mutually related to insure positioning of the vane substantially to the selected position prior to release of the latch.

43. The apparatus of claim **42** comprising terminals for applying one polarity voltage or the reverse polarity voltage to said coil wherein rotation of the rotor in one direction by said reverse polarity voltage substantially positions the vane in the collect position, if not already there, and then releases the latch, and rotation of the rotor in the opposite direction by said one polarity voltage substantially positions the vane in the refund position, if not already there, and then releases the latch.

44. The apparatus of claim **43** comprising an SCR connected across said coil to bypass current therefrom, said SCR having a gate, and a plurality of coin supervisory switches connected in series with said gate and a source of firing potential whereby closure of all of said switches causes firing of the SCR to establish the bypass across the coil.

45. The apparatus of claim **44** wherein said mechanical connection is connected to the vane mover means.

46. The method of coin paystation control from the time of the telephone handpiece being taken off-hook through the time of the telephone handpiece being placed on-hook using transmission bypass, coin escrow capability, and reverse supervision applied to the paystation, comprising the steps of:

responding to a first applied voltage at the paystation upon off-hook to establish transmission capability, and concurrently establishing coin escrow capability upon off-hook;

establishing an option of electrical release of escrow of any deposited coins for the period that the first voltage is applied;

responding to a different applied voltage at the paystation upon answer as a result of reverse supervision being passed back to the paystation to establish a coin collect path and a transmission bypass;

detecting the presence in the paystation of the toll during the application of said different applied voltage;

then removing the transmission bypass upon said detecting; and,

establishing a refund path upon on-hook.

47. The method of telephone paystation operation via a switching station enabling proper coin distribution relative to transmission through the use of predetermined coin paths and a pivotal coin trap without requiring predetermined time of coin deposit, comprising the steps of:

notifying the switching station that the paystation is in off-hook condition by drawing current therefrom in response to a first polarity voltage applied to the station on going offhook;

establishing an escrow capability upon off-hook without changing the coin path;

using a voltage of polarity reverse to said first mentioned voltage as answer supervision following dialing to determine coin and transmission control over the paystation;

said using step comprising initiating sensing for the following conditions:

1. presence of the toll;
2. the required establishment of a path for collection of the toll; and
3. the coin trap being in a predetermined position for dumping of the toll into the established collection path; and

establishing transmission with the dialed party if all three conditions are simultaneously satisfied while said voltage of reverse polarity is effective at the paystation.

48. The method of telephone paystation control from off-hook to on-hook wherein a refund path is established upon on-hook and a coin trap is pivotally movable into the refund or a collect path comprising the steps of:

establishing a first polarity voltage from central office at the paystation upon off-hook demand;

maintaining said refund path at the paystation during the first polarity voltage;

establishing an escrow capability upon off-hook without changing said refund path;

changing the first polarity voltage in response to answer supervision from central office to a second polarity voltage at the paystation to establish a collect path for the toll;

and effecting collection and providing a transmission path if the coin trap is detected in the collect path during the presence of the second polarity voltage.

49. The method of claim **48** including the further step of:

making a refund of any deposited coins available at the paystation upon operation of a switch by the user while the first polarity voltage is effective at the paystation.

50. The method of claim **48** including the further step of:

providing on-hook refund capability at the paystation during the first polarity voltage.

51. The method of telephone toll paystation control from off-hook to on-hook, through the use of a polarity sensitive motor having a polarized rotor mounted for rotation in one direction in response to the application of voltage of a first polarity to the motor to insure the positioning of a vane by the motor through vane mover means to provide a refund path, and for rotation in the opposite direction in response to the application of voltage of polarity opposite to said first polarity to insure the positioning of the vane to provide a collect path; said rotor having a home position to which it returns in the absence of voltage of either polarity and any restraining forces due to a mechanical linkage means between the paystation hanger arm and the vane mover means and between the vane mover means and the, thereby rotor to permit latching of a coin trap for coin escrow, comprising the steps of:

establishing the first polarity voltage at the paystation on off-hook demand;

establishing escrow capability during the prewence of the first polarity voltage upon off-hook by relieving the restraining forces and permit the rotor to assume its home position;

making a refund option available at the paystation during the presence of the first polarity voltage;

providing on-hook refund capability through the mechanical linkage means regardless of request at the paystation during the presence of the first polarity voltage;

remotely changing the first polarity voltage to the opposite polarity voltage at the paystation to establish a collect path for the toll by operation of the motor; and

effecting collection by operating the motor to unlatch the coin trap and to provide a transmission path if the coin trap is detected in the collect path during the presence of opposite polarity voltage.

52. A two wire method of telephone paystation operation via a central office switching station enabling proper coin distribution relative to, and by way of, two wire transmission without requiring predetermined time of coin deposit, and using a single coil motor for bi-directional rotor drive, transmission being shunted when the motor is energized, comprising the steps of:

signalling the switching station that the paystation is in off-hook condition by drawing current therefrom under a first polarity voltage supplied by the switching station upon off-hook;

shunting the coil to said first polarity voltage to prevent rotor drive;

said first polarity voltage driving the rotor in a first direction to establish a refund mode whenever the shunting of the coil is removed;

providing the option of removing said shunting of the coil;

changing the first polarity voltage to a second polarity voltage at the paystation to effect coin and transmission control over the paystation in response to answer supervision from the switching station following dialing of a number;

said second polarity voltage driving the rotor in a direction opposite to the first direction to establish a collect mode; and,

sensing for:

1. presence of the proper toll,
2. channelling of a path for collection of the toll, and
3. dumping of the toll into the channel; to establish transmission by shorting the coil and thereby removing the transmission shunting if all three of the above are sensed.

53. The two wire method of claim **52** comprising the further step of:

establishing a refund mode upon on-hook.

54. In a pay telephone system of the type having a hanger arm extending from a housing for holding a hand set when hung up, coin control vane means comprising a single two position vane positionable to either of collect or refund rest positions only, and coin trap means including a coin trap for escrowing coins and for releasing the coins when tripped, the improvement comprising mechanical linkage means extending between the hanger arm and the vane means to assure positioning of the vane in refund position when the hand set is hung up; and a connecting means between the vane means and the coin trap means to insure that the coin trap is tripped when the hand set is hung up to effect return of any deposit.

55. The improvement of claim **54** wherein the vane means comprises a vane with a memory for each either of the two said rest positions, further comprising means supported by the housing to engage and support the vane to define the refund position, further means supported by the housing to engage and support the vane to define the collect position, and said vane means further comprising means to engage the vane and move it to one of said positions; said means to engage and move the vane being ineffectual to move the vane if the vane is already in the one position.

56. The improvement of claim 55 further comprising a frame pivotally mounting the vane for movement between said positions by pivoting through the vertical, said frame carrying the means to engage the vane in said positions.

57. In a pay telephone system of the type having a hanger arm for holding a hand set when hung up, coin control vane means positionable to collect and refund positions, and coin trap means for escrowing deposited coins until tripped, the improvement comprising a frame; mechanical linkage means extending between the hanger arm and the vane means for insuring that the vane means is in the refund position for any deposited coins when the hand set is hung up; said vane means comprising a memory vane pivotally carried by the frame for pivotal movement through the vertical between the collect and refund positions; means carried by the frame for engagement with the vane to define the collect position; further means carried by the frame for engagement with the vane to define the refund position; said vane means comprising movable means for engaging the vane and moving it to either the collect or refund position; said coin trap means comprising a coin trap pivotally mounted from said frame and a latch for the coin trap; means for releasing the coin trap latch; and a mechanical connection between the means for releasing and the movable means for engaging the vane.

58. The improvement of claim 57 comprising a vane extension carried by the vane, and wherein the movable means for engaging the vane and moving it comprise a rocker assembly pivotally suspended by the frame; said assembly carrying spaced apart ears to engage the vane extension and pivot the vane to either position.

59. The improvement of claim 58 wherein the rocker assembly comprises a camming surface, and said mechanical linkage means cams the rocker assembly on hang up to drive said ears in the direction of the vane refund position to insure that the vane is in said refund position.

60. The improvement of claim 59 wherein the means for releasing the coin trap latch comprise polarity sensitive motor means for driving the rocker assembly to either of said positions via the mechanical connection to insure selective positioning of the vane; said motor means comprising a permanent magnet armature mounted for at least partial rotation relative to the frame, and means for imparting rotation to the armature.

61. The improvement of claim 60 wherein the armature is disc shaped and is polarized oppositely at substantially diametrically opposite locations whereby the armature is at least partly rotatable in one direction from a home position in response to the application of voltage of a first polarity to the means for imparting rotation and is at least partly rotatable in the opposite direction from the home position in response to application of voltage of a polarity opposite to the first polarity but returns to the home position upon removal of the voltage.

62. The improvement of claim 61 further comprising means suspending the latch from the frame for pendulum-like movement; and means carried by the armature for striking the latch to release the coin trap as a result of armature rotation in either direction.

63. The improvement of claim 62 wherein the spacing between the ears relative to the pivotal movement of the vane to transfer positions is predetermined relative to the armature movement necessary to release the coin trap latch to insure selected positioning of the vane at least to the selected side of the vertical prior to coin trap release.

64. The improvement of claim 63 wherein the coin trap is pivotally supported from the frame and the coin trap means comprises in addition to the coin trap, a pivot extension, and a latch roller; said latch bearing on the latch roller in said pendulum supported fashion between the striking means of the armature.

65. The improvement of claim 64 wherein the system comprises a transmission network, and a two wire circuit for transmission, signalling, and operation including operation of the means for imparting rotation to the armature; said means for imparting rotation comprising a single coil.

66. The improvement of claim 65 further comprising unidirectional current carrying switch means in the circuit for connection across the coil; second unidirectional current carrying switch means in the circuit for connection across the coil and oriented oppositely to the first mentioned unidirectional switch means; said first mentioned unidirectional switch means shunting the coil to voltage of said first polarity until opened, and said second mentioned unidirectional switch means shunting the coil to voltage of said second polarity until opened.

67. The apparatus of claim 57 wherein the means for releasing the latch comprises a single coil motor and rotor supported from the frame for partial rotation of the rotor in opposite directions; means carried by the rotor for striking the coin trap latch to trip the coin trap by movement of the rotor in either of said directions; and said mechanical connection between the rotor and the vane engaging means insuring movement of both the rotor and vane engaging means when either of them is driven.

68. The apparatus of claim 67 further comprising means for shunting the single coil to a voltage of a first polarity applied to the paystation upon going off-hook;

means for opening the shunting means to drive the vane to a refund position and trip the coil trap during the presence of said first polarity;

second means connected in shunt with the coil and normally open to voltage of a second, opposite polarity applied to the single coil by answer supervision;

means for closing said second means to shunt the coil to voltage of said second polarity; and

said means for closing comprising means for sensing movement of the vane engaging means to the collect position.

69. A coin paystation supervision control apparatus partly operable under control of a handpiece carried by a hanger arm outside the paystation housing wherein a coin trap is positioned above a pivotal coin deflecting means, and independent thereof, for escrowing the coins until a latch therefor is released by momentum impact, the combination comprising, a vane positioning means; said deflecting means comprising a vane; latch release means; means interconnecting the vane positioning means and the latch release means; and electromagnetic means for operating the vane positioning

means upon hang up to drive the vane to a refund position and to release the coin trap to drop any coins escrowed thereon.

70. The apparatus of claim **69** wherein the latch release means and the electro-magnetic means comprise a coil winding, a permanent magnet armature supported by the housing for rotary movement under control of the winding, a mechanical connection extending from the hanger arm to the vane positioning means, and a further mechanical connection between the armature and the vane positioning means whereby the armature may drive the vane and release the coin trap or the mechanical connection may drive the vane positioning means and the armature to move the vane and release the coin trap.

71. The apparatus of claim **70** further comprising a pair of spaced apart bumpers carried by the armature; said latch being pivotally supported adjacent one end thereof from the housing to hang its lower end between said bumpers, and the spacing of said bumpers exceeding the width of the latch whereby the armature may build up momentum in either direction before a bumper will strike the latch.

72. The apparatus of claim **71** wherein the vane positioning means drives the vane through a delayed contact engagement therewith, said delayed contact engagement and said spacing between the bumpers being related to insure proper placement of the vane prior to coin trap release.

73. Coin control apparatus for a telephone paystation having a hand set, a hanger arm therefor extending out of a housing, a coin trap, a vane and a transmission network, comprising, in combination motor coil means, a unidirectional current carrying switch connected across the coil, a second unidirectional current carrying switch connected across the coil and oriented oppositely to the first mentioned unidirectional switch, motor armature means; means mounting the armature in the housing for two directional movement; a coin trap latch; means suspending the latch for pendulum-like movement; means carried by the armature means for striking the latch to release the coin trap as a result of armature means movement in either direction; means for applying potential of a first polarity to the motor coil means on pick up of the hand set when the hand set is removed from the hanger arm; said first mentioned unidirectional switch shorting said first polarity; refund switch means in series with the first mentioned unidirectional switch for interrupting the shorting of said first polarity to energize the motor means and drive the armature means in a first direction; means for applying potential of a second polarity to the motor coil means upon answer; transmission bypass means responsive to energization of the motor coil means; and a mechanical connection means between the vane and the armature means for supervising the vane position to insure that the vane is in a refund position as a result of movement of the armature in the first direction and in a collect position as a result of movement of the armature in the other direction; said second mentioned unidirectional switch being normally open; and means for closing the second switch to establish transmission.

74. The apparatus of claim **73** wherein the motor coil means comprises a single coil.

75. The apparatus of claim **74** wherein the armature means comprises a permanent magnet.

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