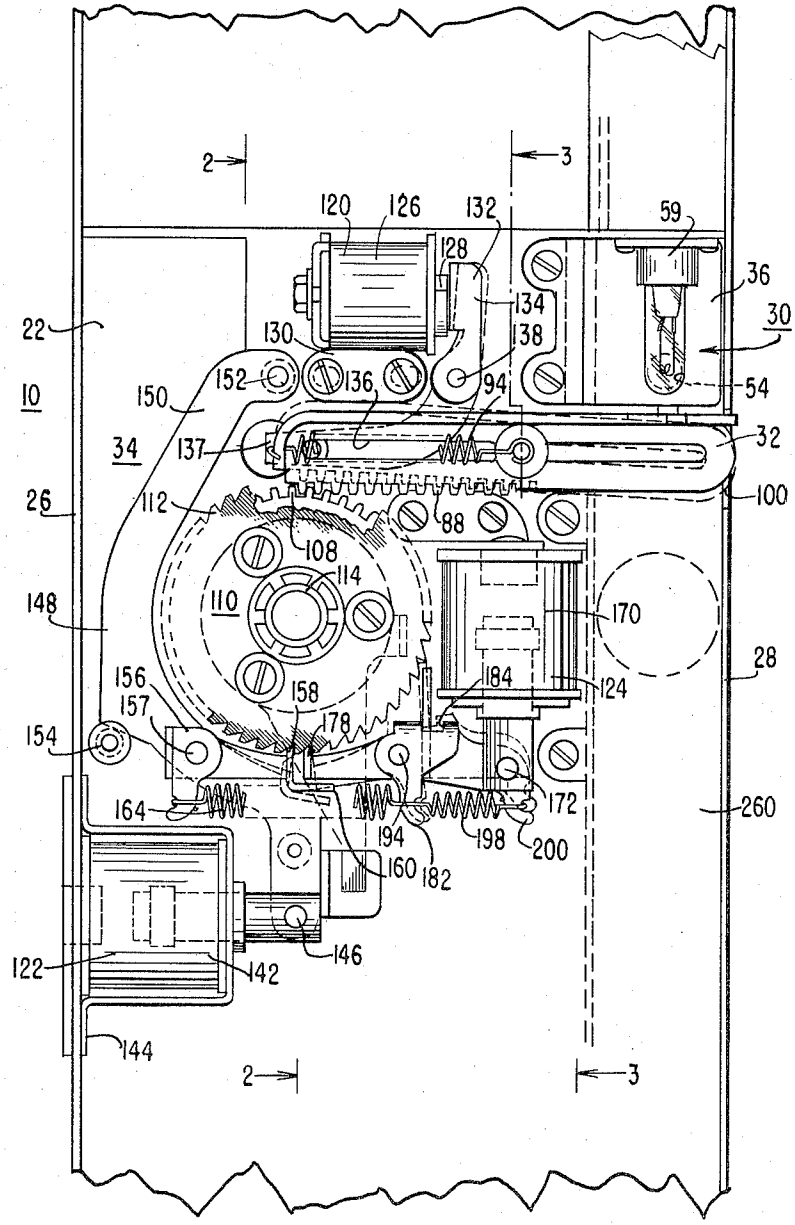
Oct. 12, 1965 D. E. HOOKER 3,211,161

COIN REGISTER

Filed Feb. 27, 1964 4 Sheets-Sheet 1

FIG. 1



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COIN REGISTER

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FIG. 2

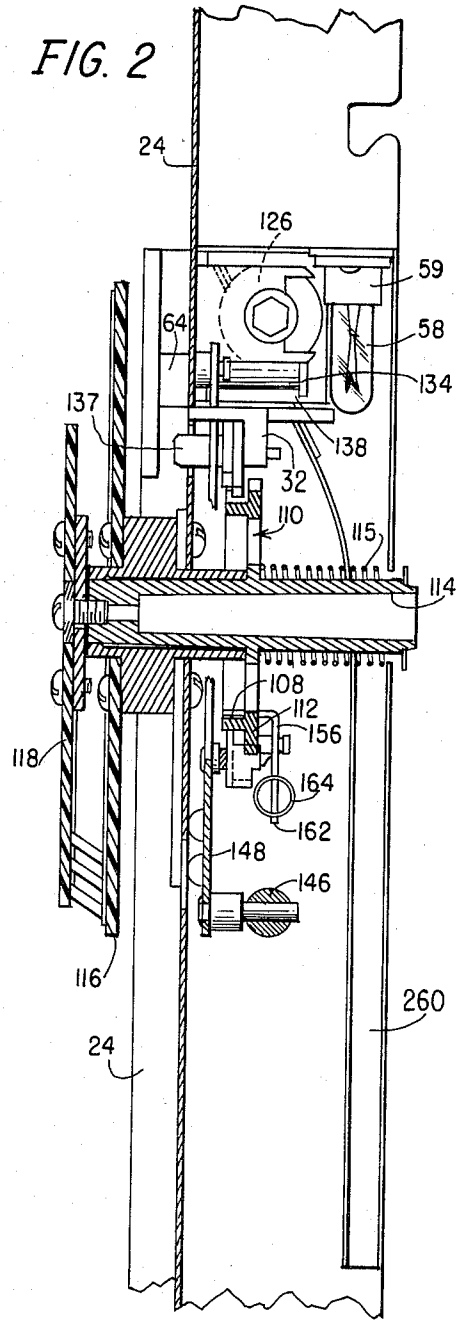
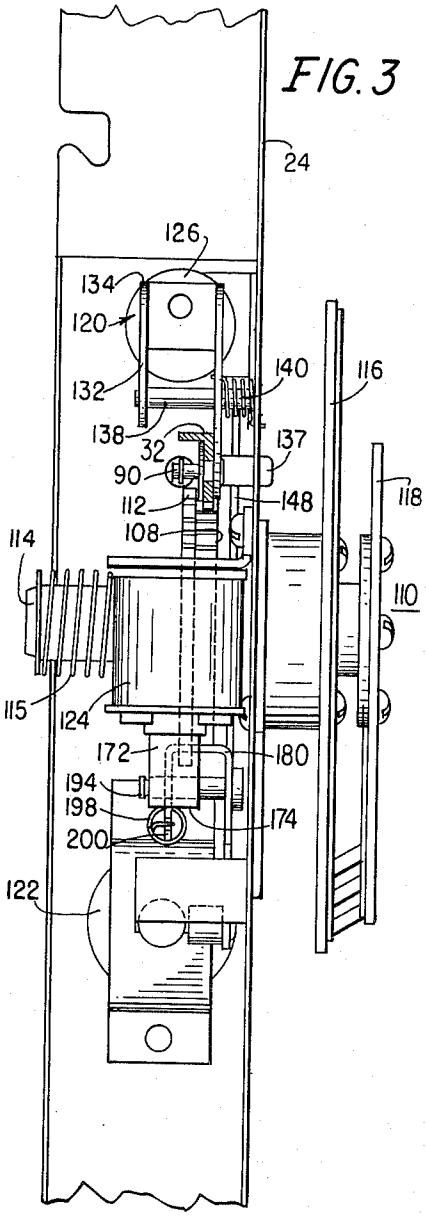


FIG. 3



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COIN REGISTER

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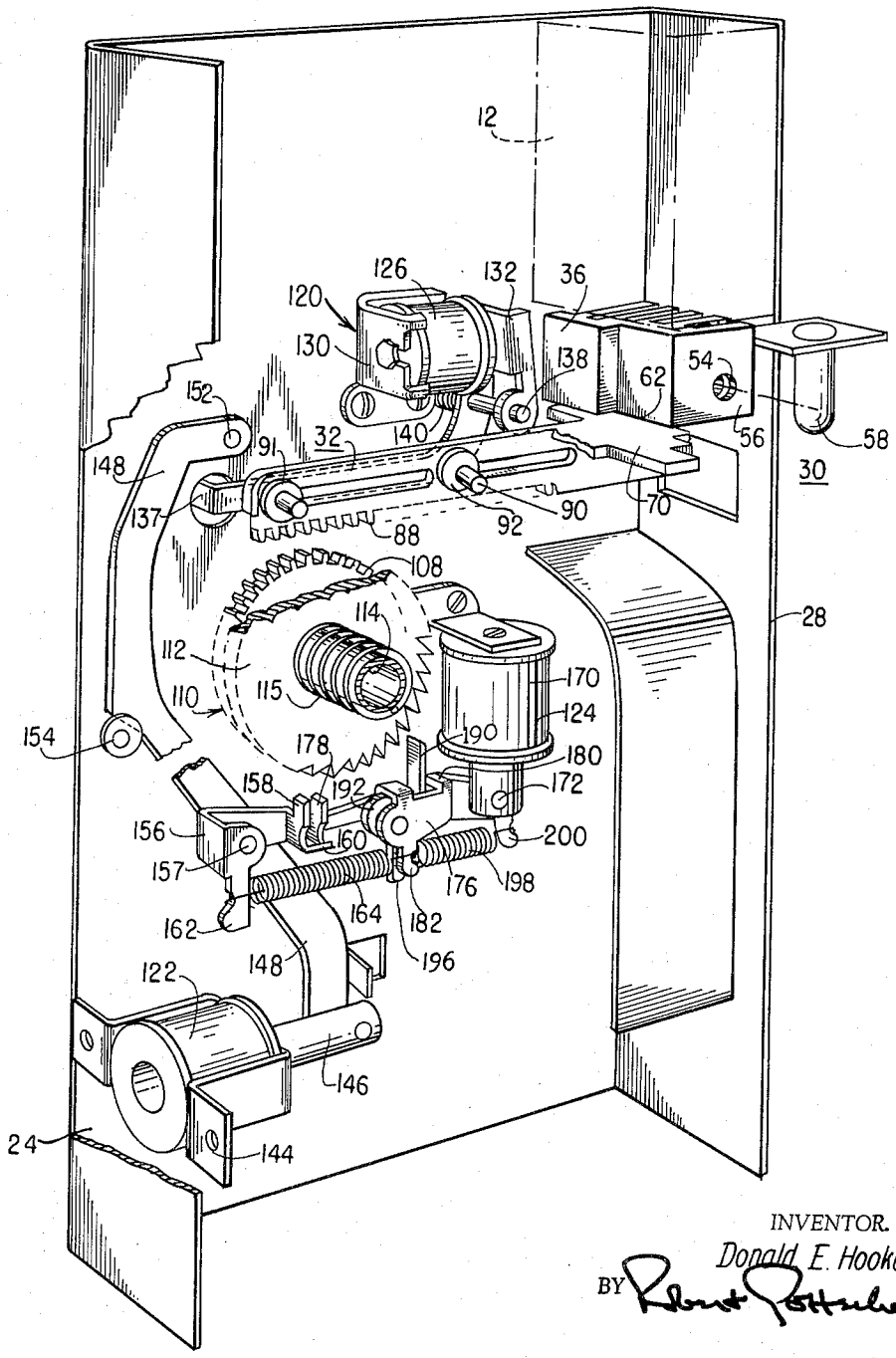
FIG. 4



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COIN REGISTER

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FIG. 8

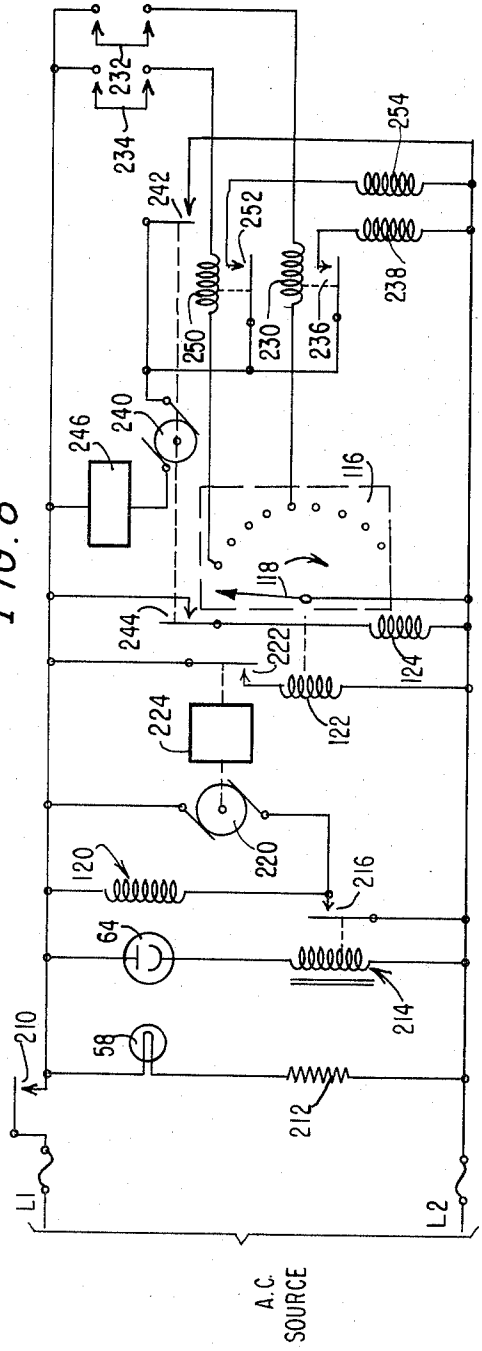


FIG. 5

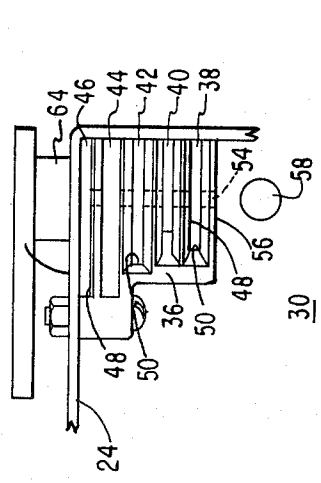


FIG. 6

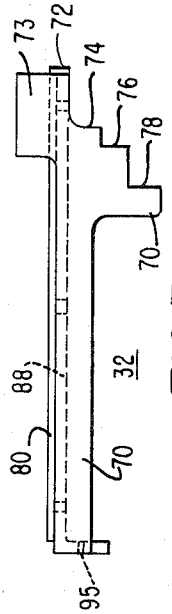
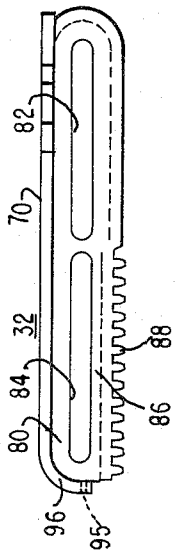


FIG. 7



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United States Patent Office 3,211,161 Patented Oct. 12, 1965

3,211,161

COIN REGISTER

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Filed Feb. 27, 1964, Ser. No. 347,757
15 Claims. (Cl. 133—8)

The present invention relates to coin actuated mechanisms and more particularly to those applicable for use in sensing the value of inserted coins and storing credit based on these values.

The devices generally used to provide the function of sensing inserted coins and storing credit based on the coin values, herein generally called the registering function, comprise a series of lever arms which are physically deflected by the passage of coins. These lever arms most frequently are individual wire spring members extending across each of the coin chutes or channels and these lever arms are positioned to be tripped by a passing coin to actuate a credit storage mechanism.

Alternatively, the received signal may be used to emit one or more electrical impulses or to prepare an escapement mechanism for indirectly causing the impulse or impulses to be counted and stored. This storage of credit or totalizing of these coin values is generally accomplished by stepping a ratchet mechanism in the form of a rotary stepper or linear rack a number of steps corresponding to the value of the coin actuating the lever. It should be noted that the use of a slug rejector mechanism is assumed; the slug rejector passing only valid coins into separate passages indicative of the coin value.

In such systems there are a number of inherent problems which to date have been partially compensated for, but not completely solved. In the lever type systems, which heretofore have comprised virtually all the commercially successful devices, the mass of the inserted coin must trigger or trip the lever arm to its operated position to provide credit commensurate with the coin value. With nickels, quarters, or half-dollars, the mass of the coin and its momentum in the chute is sufficient to fully deflect the lever arm. When dimes and more particularly worn or thin dimes are inserted, the mass of the coin becomes a serious and critical problem. The loading of the lever must be such that the lever will trip to actuate its output mechanism on sensing the dime, yet the adjustment of the lever must not be so delicate that the lever arm may be accidentally tripped by a jarring of the machine or other like occurrences.

In direct drive mechanical registering systems, the problem of mass proved very difficult and stubborn, leading to the use of indirect escapement drives and electrical switch actuation consequent to the lever tripping. Even with one of these improved forms, the coin mass remains a problem, although possibly to a slightly lesser degree. Further, there remains the problem of providing a total of five steps (in 5¢ increments) in response to a twenty-five-cent piece and ten steps in response to the deposit of a fifty-cent piece. Delay devices, multiple switches, or other intricate mechanisms must be provided to effect the plural stepping for coins of a value in multiples of the single step (5¢) value. (Needless to say, 1¢ or 10¢ may be taken as the single step or single increment value, but more universally 5¢ is taken as the present base or standard increment.)

Another disadvantage of the tripped lever systems occurs when one of these systems is to be converted for use in a foreign country and for actuation by the local coinage. The levers must be adjusted to be actuated by a coin of the proper mass, and in some cases, the foreign coins to be accepted have even less mass than a U.S. dime.

Again, plural stepping for coins of values in multiple of the base value must be effected by the registering mechanism, requiring complex or intricate mechanisms.

Other systems have been tried and patented—such as resistive or capacitive coin sensing, and such as multiple photocells per track. These devices have proved less than successful commercially, resulting in the present condition in which virtually all of the commercial coin registration systems in use employ lever arms within the chutes, as previously described.

It is, therefore, the major object of the present invention to provide an improved coin registering system.

It is a further object of the invention to provide a new and improved coin sensing apparatus for triggering a credit storage mechanism.

It is another object of the invention to sense the presence of an inserted coin and in response to the coin value to store credit in the amount commensurate with the coin value, the sensing and credit storing being unaffected by the mass of the inserted coin.

It is still a further object of the invention to provide a coin sensing mechanism which utilizes photo electric cells to sense the presence of a coin in one of a multiplicity of chutes and which stores credit equal to the value of the coin and thereafter passes the coin to the coin collection area.

Other objects, features, and advantages of the invention will be apparent from the detailed description of a presently preferred embodiment thereof, read in connection with the accompanying drawings in which:

FIGURE 1 is a side view in elevation of a registering mechanism utilizing the present invention;

FIGURE 2 is a sectional view taken along line 2—2 of FIGURE 1;

FIGURE 3 is a sectional view taken along line 3—3 of FIGURE 1;

FIGURE 4 is a side view in perspective in partially exploded form of the showing of FIGURE 1;

FIGURE 5 is a plan view of the coin sensing and evaluating portion of the invention;

FIGURE 6 is a plan view in elevation of the coin gate member as utilized herein;

FIGURE 7 is a side view in elevation of the gate member of FIGURE 6; and

FIGURE 8 is a simplified schematic circuit diagram for use with the invention.

Now turning to the drawings in detail, there is shown a presently preferred embodiment of the present invention. The embodiment shown is capable of use on coin actuated machines of all types and more particularly on vending machines. The register apparatus **10** of the invention is fed coins from a standard slug rejector indicated by box **12** (FIG. 4). The rejector, which may be any of the currently known, generally procurable types, is designed to receive an inserted coin and to channel the coin into a chute dependent on the value of the coin. In passing through the rejector, the coin is validated and spurious coins are rejected through a rejection slot (not shown). Such rejector mechanisms are well-known and form no part of the present invention. At the output of this slug rejector, valid coins pass downwardly through individual parallel chutes in the order of 5¢, 10¢, and 25¢. A standard 50¢ adaptor unit may be fitted to the rejector, the 50¢ pieces being received in a separate slot parallel to the remaining slots. With this adaptor an inclined slot in the mounting wall may be needed to feed valid 50¢ pieces to the collection box.

This slug rejector mechanism **12** is conventionally mounted within the apparatus cabinet (indicated only fragmentarily) adjacent a single coin receiving slot (not shown), so that the coins may be validated and separated

into the slots or chutes, as mentioned previously. This slug rejector may be mounted at the upper extremity of a vertically elongated channel mounting frame 22. This frame 22 has a web 24 of intermediate width compared with its length, and extending from the edges of the web are respective front and rear flanges 26 and 28 rectangularly disposed with respect to web 24 and generally encompassing the register apparatus 10.

The register apparatus is positioned below the slug rejector adjacent the output end thereof and includes generally a coin sensing mechanism 30, a credit storage apparatus 34, and a gate member 32 functionally interposed between the coin sensing mechanism and the credit storage apparatus. The gate member is the element which is acted upon by the coin sensing mechanism to control the action of the credit storage apparatus, as will be explained more fully.

The coin sensing mechanism comprises an opaque metal coin evaluating receptor 36 mounted to web 24 of frame 22 abutting the rear flange 28 (FIGURES 1 and 2) in the area directly below the output of slug rejector 12. Within this receptor 36, there are provided a series of parallel vertically extending slots or passages 38, 40, 42, 44 and 46. These passages are spaced apart by intermediate passage walls 48 in such a manner that the passages are individually aligned as functioning continuations of the output slots or chutes of the slug rejectors. These passages in receptor 36 are of sufficient width and length to accept particular coins. Thus, passage or slot 38 is of a width slightly greater than the thickness of a nickel, and of sufficient length to accept this coin with a small amount of end clearance. Passage 40 is similarly sized for dimes; passage 42 for quarters; passage 44 is a blank slot; and passage 46 is sized for half-dollar pieces. With this relative sizing, the coin may be supported in a substantially vertical position with a small amount of clearance between the coin and opposed edge walls and rear flange 28.

A circular opening 54 extends through the passage-walls 48 of receptor 36, in generally horizontal alignment to complete a single light penetrable aperture through the passage walls and through a like opening in the web 24 of frame 22. Positioned outwardly adjacent the end wall 56 of receptor 36 at the 5¢ end is a miniature incandescent lamp 58. This lamp is secured within a lamp socket 59 which in turn is affixed to frame 22 adjacent rear flange 28 such that the light from the lamp is transmitted through receptor opening 54 and may be received outwardly of the end wall at the 50¢ end of receptor 36. Opening 54 is spaced a vertical distance above the bottom surface 62 of receptor 36, so that any coin of any above-listed denomination whose bottom edge is supported adjacent or slightly below bottom surface 62, will interrupt the passage of light through the opening 54.

Mounted to the rearward surface of web 24 adjacent opening 54 is a light responsive photo electric cell 64 which may be of any conventional type. The cell's light responsive surface is fitted closely adjacent opening 54 and this surface is suitably shielded to prevent the reception of stray light, stray light being considered light other than that generated by lamp 58. Preferably, photo electric cell 64 is one which reacts to the reception or sensing of light on its responsive surface to generate a resistance of known quantity to an output circuit. The cell, which may be of the generally known cadmium sulfide type, responds to the interruption of received light by changing its resistance. The change in resistance is of a known or measurable quantity and the change remains in effect as long as the light received by the cell remains interrupted.

Positioned directly below bottom surface 62 of the receptor 36 is the gate member 32 which in its normal condition blocks the escape of any coins from receptor 36. The gate member in its normal or at-rest condition will support a coin within its respective slot, so that the coin will interrupt or block the transmission of light from lamp 58 to cell 64.

The gate member 32, shown best in detail in FIGURES 6 and 7, comprises a flat upper gating surface 70, the rearward edge 72 of which is offset at one side to stepped stage 73 and at the other side is offset into a series of stepped stages 74, 76 and 78. The forward portion of the gating surface 70 terminates in an arcuate edge wall topping the forward end of its vertical side wall 80. The vertical side wall 80 is perforated to form a rear, longitudinally-extending elongated slot 82, and aligned therewith a forward elongated slot 84. Along the bottom edge of the forward half of gate member side wall 80, there is provided a horizontal rack portion 88 which is in the form of a series of regular gear teeth of any known design.

The gate member 32 is designed to be mounted primarily for slide motion with respect to web 24 of the channel frame 22 in a position directly below the receptor 36. To mount the gate member to the web, a rear bolt or rod 90 is secured to web 24, this bolt extending through the rearward slot 82 of member 32. An enlarged member, such as a head or nut 92, is secured on the free end of rear bolt 90 to slideably hold the gate member 32 spaced from web 24. A tension spring 94 is stretched between rear bolt 90 and a suitable opening 95 in the arcuate edge wall 96 at the front edge of gate member 32. This tension spring biases the gate member to a rearward normal position in which the rearward edge 72 of gating surface 70 extends slightly through a suitable opening 100 in the adjacent rear flange 28.

Spring 94 biases gate member 32 to a normal or retracted position in which the stepped stages 73, 74, 76, and 78 are blockingly situated beneath their respective slots in the receptor 36. With the gate member in this position, the stage 73 extends below the 50¢ slot of receptor 36 and blocks the bottom opening of the slot to the extent that no half-dollar received in the 50¢ slot 46 can pass from the receptor 36. Similarly, stages 74, 76 and 78 of gate member 32 are situated directly below the respective slots 42, 40, and 38 to block the passage of coins from the receptor. These stages are spaced from rearward edge 72 by distances such that on one forward step of known length of the gate member 32, stage 78 is moved a forward distance sufficient to unblock the passage of a nickel supported in slot 38. The nickel once unblocked will gravitationally pass from the receptor for collection. Stage 76 is spaced from rearward edge 72 a distance sufficient to unblock a dime in slot 40 on two forward steps of the gate member. Stage 74 is spaced forward of rearward edge 72 a distance such that on five steps of gate member 32, stage 74 will unblock a quarter held in slot 42. Stage 73 is spaced from rearward edge 72 a distance sufficient to clear a 50¢ piece for passage from slot 46 on ten steps forward of the gate member.

The rack portion 88 of the gate member is poised slightly above and out of mesh with a pinion wheel 108 of the rotatable assembly 110 of the credit storage apparatus 34. Pinion wheel 108 has mounted integrally and co-axially therewith a ratchet wheel 112 which is driven to rotate the wheels as a unit about the common rotational axis of the assembly 110. This axis is embodied by a rotatable shaft 114 which is mounted integrally as a part of the rotatable assembly 110 and is journalled for rotation through web 24 in a manner allowing joint movement of the wheels about the common axis. The shaft 114 has a coil spring 115 mounted thereabout to bias the rotatable assembly in a clockwise direction as viewed in FIGURES 1 and 4. Gear wheel or pinion wheel 108 is positioned on the rotatable shaft 114 between web 24 of the channel frame 22 and the ratchet wheel 112, and directly below the plane of rack portion 88.

Secured stationarily to the opposite side of web **24** co-axially disposed with respect to shaft **114**, is a printed circuit board **116** of any known construction having a plurality of arcuate contacts. A wiper spring assembly **118** is mounted on shaft **114** for rotation as an integral part of rotatable assembly **110**, and the wiper spring assembly completes the path to various external circuits through the printed circuit board contacts in a conventional manner.

The rotatable assembly **110** which forms the operative core of the credit storage apparatus may be generally described as an indirect drive escapement mechanism. In order to operate this rotatable assembly **110**, there is provided an engage magnet **120**, an add-credit solenoid **122**, and a subtract-credit solenoid **124**.

The engage magnet **120** is constructed conventionally with a magnetizable coil encircling a horizontally disposed coil core **128**. The coil and core are assembled as a unit to a magnetically permeable heel-piece or bracket **130**, which serves to stationarily affix the magnet to web **24** of the channel frame. An L-shaped armature **132** is controlled by the magnet with the armature shorter leg **134** adjacent coil core **128**. The longer leg **136** of the armature extends substantially parallel to the coil core and is connected near its free end to a forward mounting rod or bolt **91** within forward slot **84** of gate member **32**. The free end **137** of leg **136** fits through a suitable opening in the web **24** to limit the travel of gate member **32** and armature **132**. The armature is pivotal at the juncture of its legs **134** and **136** about a pivot pin **138** which may be secured to channel web **24**. A helical restoring spring **140** is wound about the pivot pin to bias the shorter leg **134** of the armature away from the coil core **128** and raise the free end of the armature longer leg **136** to the position shown in broken lines in FIGURE 1. This upward biasing maintains rack **88** of gate member **32** out of engagement with the pinion wheel **108** of the credit storage apparatus.

It can readily been seen that when engage magnet **120** is energized, the armature shorter leg **134** will be attracted to coil core **128** and the free end **137** of longer leg **136** will be pivoted downwardly to place rack **88** in mesh with pinion wheel **108** (as shown in solid lines in FIGURE 1). It can further be seen that once the gate member **32** is coupled to the rotatable assembly **110** through the rack and pinion engagement, the gate member will ride forwardly in a step-by-step manner consequent to counterclockwise step-by-step rotation of the rotatable assembly.

The add-credit solenoid **122** is used to provide this counterclockwise rotation of the rotatable assembly, and to store credit on the credit storage apparatus **34**. The add solenoid includes a coil **142** within a suitable mounting bracket **144** which anchors the add solenoid inside the front flange **26** of channel frame **22**. The coil has an opening for its reciprocable plunger **146**. On energization of the add solenoid coil **142**, the plunger in a generally known manner, is attracted and drawn into the plunger opening and thereby moves its associated mechanism accordingly.

The operating or driving lever **148** controlled by this add solenoid extends arcuately upwardly from a pivotal connection to the outer end of plunger **146** to a further pivotal mounting above the rotatable assembly **110**. The upper end **150** of driving lever **148** is also pivotal about a stationary pivot pin **152** which is mounted to extend through the web **24** of the channel frame **22**. This lever parallels the periphery of rotatable assembly **110**, and is slideably journalled within a spool-shaped guide **154** to maintain the lever motion in a single plane. Partway between the connection of the driving lever to plunger **146** and its engagement with the spool-shaped guide **154**, there is pivotally pinned to the driving lever an add pawl **156**. This pawl is somewhat complex in shape in that one end extends in a first plane parallel to web **24**, from

which the pawl is formed into two right angle bends to extend in a second plane parallel to the first plane. A pivot **157** extends through the pawl in both these planes to secure the pawl to driving lever **148**. From its extent in the second plane, the pawl terminates in an upwardly directed add-pawl finger **158**. This pawl finger **158** is positioned to engage a tooth of ratchet wheel **112** adjacent the bottom thereof. The pawl finger naturally is shaped to conform to the shape of the opening between adjacent ratchet teeth in conventional fashion.

Integral to the pawl **156** and extending rectangularly from pawl finger **158** in a horizontal plane away from the pawl body is a release tongue **160**. The add pawl **156** further has an indented projection **162** extending downwardly in what was called previously the first plane. This projection **162** acts as a terminal member for one end of a tension spring **164** which acts to bias the pawl into holding engagement with the ratchet wheel **112**.

The subtract solenoid **124** comprises a magnetic coil **170** which is mounted to web **24** by a suitable bracket. A plunger **172** projects downwardly from the coil and adjacent its free end **174**, the plunger is pinned to a vertical surface of subtract arm **176**. The subtract arm **176** extends in a generally horizontal manner from its pin connection and terminates in an upwardly directed pawl finger **178** which engages the periphery of ratchet wheel **112**. This pawl finger **178** is parallel to the add pawl finger **158** and is spaced approximately the distance of one ratchet tooth therefrom. Adjacent its lower edge, arm **176** has a ridge poised above the horizontal release tongue **160** of add pawl **156**, the purpose of which will be explained in greater detail.

Midway between pawl finger **178** and its connection to subtract plunger **172**, subtract arm **176** has a top surface **180** of comparatively short length from which there extends downwardly an indented projection **182**. This projection serves to anchor the rearward end of tension spring **164**. As mentioned previously, the forward end of tension spring **164** is secured on a similar projection **162** of add pawl **156**, and in this way, both the add and subtract pawls are coupled together for joint movement.

The top surface **180** of the subtract arm has a rectangular opening **184** which accommodates an upwardly directed single-step detent **190**. The edges of this opening act as travel stops to limit the movement of detent **190** in an obvious manner. Detent **190** in its main body portion is pivotally pinned at rod **194** to subtract arm **176** for joint movement relative to web **24** of frame **22**. From the main body portion of detent **190**, a downwardly directed indented projection **196** extends. The indentation of this projection serves to retain the forward end of a tension spring **198**, the rearward end of which is anchored to similarly configured indentation on a projection finger **200**. Projection finger **200** is integral to the subtract arm **176** and projects downwardly from the subtract arm adjacent to its pivotal connection to subtract plunger **172**.

In order to operate the indirect drive credit storage apparatus, there must be provided a source of timed pulses; such pulses may emanate from a motor driven cam mechanism, as indicated diagrammatically by the reference character **224** in FIGURE 8. When the mechanism is switched to the condition in which coin credits are to be stored, the add solenoid is energized momentarily by one of these timed pulses. Energization of the solenoid attracts plunger **146**. In so doing, the add driving lever **148** is moved toward front flange **26** across guide **154**. Movement of the driving lever in this direction pulls the add pawl **156** in the same direction. The pawl disengages from the ratchet tooth with which it had been in contact and slides across one space to engage the adjacent tooth. During this movement of add pawl **156**, subtract arm **176** remains in engagement with the ratchet wheel maintaining it stationary. At the conclusion of the pulse, plunger **146** restores due to the bias imposed on pawl **156** by return spring **164**. At this time, the ratchet wheel is stepped

one step in the counter-clockwise direction due to the action of spring **164**. Rotation of the ratchet wheel and its rotatable assembly **110** continues as long as pulses continue to be fed to the add solenoid **122**. Naturally, each step of the ratchet wheel carries with it pinion wheel **108** and wiper spring assembly **118**. When the stepping has concluded, the wiper spring assembly will complete a circuit to stationary contacts on printed circuit board **116** representing the number of steps the rotatable assembly will have taken from its normal position (as will be explained more fully).

To rotate the rotatable assembly back to its normal position, timed pulses are switched to the subtract solenoid coil **170**. When one of these pulses is received by the subtract coil, the plunger **172** will be drawn upwardly pivoting the subtract arm **176**. First this pivotal motion of arm **176** cams detent **190** to a position adjacent the ratchet wheel teeth and spaced one-half tooth spacing removed from the ratchet wheel position. The pivotal movement of arm **176** draws pawl finger **178** out of engagement with the ratchet wheel. Pawl finger **178** is further pivoted to a position engaging release tongue **160** to depress the add pawl **156** and withdraw pawl finger **158** from engagement with the ratchet wheel. At this time, the ratchet wheel rotates one-half step under the bias of spring **115** on shaft **114** until detent **190** engages the ratchet wheel and stops further rotation of the ratchet wheel. The subtract solenoid is thereupon de-energized and subtract arm **176** restores. Detent **190** begins to leave its engagement with the ratchet wheel. Under the influence of restoring spring **115**, the ratchet wheel and rotatable assembly are rotated in a clockwise direction. When the ratchet has rotated another half step, add pawl **156** engages the ratchet wheel and stops its rotation. Thereafter, arm **176** is biased out of contact with tongue **160** and engages ratchet wheel **112**. One full step has been taken by the ratchet wheel in the subtract direction. Such stepping continues until a rotatable assembly homing stop (not shown) engages a stationary stop arm (not shown) and pulse transmission to the subtract coil is terminated.

FIGURE 8 shows a simplified schematic diagram of a circuit which will aid in explaining the general functioning of the invention. In this circuit there is provided a source of current across leads **L1** and **L2**. An on-off switch **210** is placed in series in lead **L1** to open the circuit when desired.

Lamp **58** is connected in series with a voltage limiting resistor **212** across the line **L1–L2**, and as mentioned, this lamp physically is positioned to transmit light through the opening **54** in coin receptor **36**. Also connected across the line **L1** and **L2** is a series combination comprising the photo electric cell **64** and the coil of a coin detect relay **214**. This relay is maintained in its operated or energized condition when light transmission to the photo cell is unimpeded. This relay has a single contact set **216** which remains in an open circuit condition as long as relay **214** remains energized. When relay **214** is released, a condition which occurs on interruption of light received by cell, contacts **216** close. Closure of contacts **216** closes a parallel circuit both to the coil **126** of engage magnet **120** and to timer motor **220**. Engage magnet **120** on being energized, places rack **88** in mesh with pinion wheel **108**. Timer motor **220** on being energized, emits pulses at timed intervals through its output contacts **222**, the contacts being controlled by conventional timer motor cams indicated as box **224**. The impulses at contacts **222** pulse the add solenoid **122**, causing the wiper spring assembly **118** to step its contacts (only one of which is shown in FIGURE 8) across the printed circuit board **116** one step for each received pulse. The stepping is concluded when the total amount of money inserted has been sensed and collected, and the credit has been stored.

In addition to the crediting system, a coin register mechanism for a vending machine must include also means for initiating the vend cycle and for subtracting the stored credit. To effect the credit subtraction or count-down, there is provided the subtract solenoid **124** which steps assembly **118** in the clockwise or step-down direction. The operation of this solenoid is initiated in the following manner. When the proper amount of credit has been registered, for example 25¢ worth of credit stored on the credit register, wiper assembly **118** is resting on the 25¢ contact to complete a circuit from lead **L2** and wiper **118**, through the 25¢ contact of printed circuit board **116**, the 25¢ vending relay **230**, and the closed selector button **232** to lead **L1**. Selector button **232** being closed indicates the selection of a particular item costing 25¢, the buttons **232** and **234** being two of a series of interlocked buttons. When one of the buttons in the series is depressed, it locks all other buttons against selection and itself is retained in the depressed (circuit closed) position until released by conventional mechanisms (not shown) at the conclusion of the vending cycle.

Closure of the circuit through the 25¢ vending relay **230** energizes the relay; the relay closes its contacts **236** to complete a parallel circuit to both vend solenoid **238** and vend motor **240**. Energization of the vend motor initiates a vending cycle through its co-action with the vend solenoid **238** which is individual to both the selected article and selector button **232**. This initiation of vending or dispensing of the selected article may be effected in any conventional manner under the control of motor **240**.

At the end of the actual vending or dispensing cycle, motor **240** closes its cam contacts **242** to shunt out the vend solenoid **238**. The vend motor periodically opens and closes its other cam contacts **244** to pulse subtract solenoid **124** and step the wiper assembly toward its unoperated or home position in an obvious fashion. As the wiper assembly steps off the 25¢ contact on board **116**, relay **230** is de-energized and restores, opening its contacts **236**. The motor remains energized over closed cam contacts **242** and continues to step the rotatable assembly to the home position. When the rotatable assembly reaches the home position, suitable sensing members **246** (shown as a rectangular box) open to release the vend motor **240** which opens its contacts. The circuit is now in its normal position.

This form of vend and step-down of credit is well-known and has been shown only sketchily for a single 5¢ selection and a single 25¢ selection. FIGURE 8 further includes a 5¢ vend network including a 5¢ relay **250** with a contact pair **252**, a select solenoid **254** and the 5¢ selector button **234**. The operation to vend a 5¢ item is similar in mode of operation to that of a 25¢ item and need not be repeated herein.

The general mode of operation of the entire sensing and registering mechanism of the present invention may be described as follows:

The person wishing to purchase an article from the machine inserts a coin into a conventional slot in the machine front (not shown). The coin passes into the slug rejector **12**. In the rejector, the coin is validated in a conventional manner and is diverted into the chute representative of the coin value. From the rejector, the coin passes into the proper slot in receptor **36**. Assuming that the first coin inserted were a nickel, the coin would drop into slot or passage **38**.

At that time, gate member **32** is in its rearmost or normal position, as shown in solid lines in FIGURE 1. With the gate member fully retracted to its normal position, its stepped stages block passage of a coin from the coin receptor **36** and the coin will be retained therein. A nickel which reaches slot **38** will be held by the passage walls **48** on stage **78** of gate member **32** in a generally vertical position. The coin in this position blocks the transmission of light from lamp **58** through opening **54** to photo electric cell **64**. Interruption of the light received by the cell reduces the resistance of the cell and causes the coin detect relay **214** to be energized. Energization of the relay closes

its contacts **216** to energize both the engage magnet **120** and the timer motor **220**.

Energization of magnet **120** causes its armature **132** to be attracted to the coil core **128** thereby pivoting downwardly the remote end **137** of the armature. This pivotal motion of the armature pivots the gate member **32** and places the gate member rack portion **88** in mesh with the teeth of pinion wheel **108**.

The motor **220** is also energized to close cam contacts **222**. These contacts when closed complete the energizing path to add solenoid **122**. Energization of the solenoid draws add pawl **156** a distance equivalent to one tooth of ratchet wheel **112**. When cam contact **222** opens, add solenoid **122** restores and the ratchet wheel is stepped one step in the counter-clockwise direction. The ratchet wheel on this one-step rotation carries with it integral pinion wheel **108**, and, in addition, the gate member **32** which is meshed to the pinion wheel. This movement of gate member **32** draws the gate member a horizontal distance in the forward direction. This amount of gate member movement draws stage **78** a distance sufficient to unblock the passage for the nickel. The nickel drops gravitationally from coin receptor **36** past the advanced gate member **32** and through coin chute **260** to the coin collection area.

Once the nickel has dropped from coin receptor **36**, light transmission to photoelectric cell **64** is re-established. This light re-establishment to the cell causes relay **214** to restore and open its contacts **216**. The rack engage magnet is thereby de-energized and restores under the bias of its restoring spring **140**. Restoration of the magnet armature withdraws the gate member rack portion **88** from its meshed condition with pinion wheel **108**. Tension spring **94** retracts the gate member to its normal position.

If the item which the purchaser wishes to buy is a 5¢ item, he then depresses the 5¢ selector button **234** and the vending cycle is initiated. It is naturally understood that the wiper spring assembly **118** will have stepped to the first or 5¢ contact on the single step rotation of pinion wheel **108** closing the circuit to 5¢ relay **250**. Relay **250** closes contacts **252** to start vend motor **240** into a vend cycle, as described. On completion of the vend cycle, the credit wheel is stepped back to its original or home position.

If the item to be purchased in the previously mentioned instance is a 25¢ item, additional credit totalizing 20¢ must be added to the 5¢ already credited. At this time, the rotatable assembly **110** has been stepped one step indicating 5¢ credit storage and the gate member **32** has been retracted to its normal position following the collection of the nickel, as previously described.

Let us assume that two dimes are to be added to complete the 25¢ crediting. The first dime is inserted into the machine and passes through the slug rejector for validation. The dime then drops into dime slot **40** of receptor **36** and rests on stage **76** of gate member **32**. The dime resting on gate member **32** interrupts the transmission of light to photoelectric cell **64**, and once again coin detect relay **214** is energized. Energization of the relay closes its contacts **216** to operate rack engage magnet **120** and timing motor **220**. The rack engage magnet pivots its armature **132** to place the rack portion **88** in mesh with pinion wheel **108**. The timer motor **220** supplies a timed pulse at its contacts **222** to energize add solenoid **122**. At the end of this pulse, add solenoid **122** is deenergized and the rotatable assembly advances the gate member **32** a horizontal distance. This distance is not sufficient to release the dime and the light transmission to cell **64** remains interrupted. Therefore, the engage magnet **120** remains energized and the rack portion **88** remains in mesh with pinion wheel **108**. Timer motor **220** emits another timed pulse and the add solenoid is operated and released to step the rotatable assembly another step. This second step is sufficient to slide stage **76** a further distance, freeing the dime for gravitational passage from the coin receptor **36** to coin chute **260** for retention in a coin collection box (not shown) below. Once again, passage of the coin from coin receptor **36** reestablishes light transmission to cell **64** which, in the manner previously described, releases gate member **32** for retraction to its normal position.

At this time a total of 15¢ worth of credit is stored on the credit registering mechanism and another dime must be inserted to reach the 25¢ credit level. The action of the mechanism in response to this dime is similar to that previously described in that two further steps of the pinion wheel, its rotatable assembly and gate member **32** are effected before the dime is allowed to drop from coin receptor **36** to the coin collection box. Following collection of this last dime, the purchaser will depress the button **232** and the vending cycle will follow to emit the selected 25¢ item and to restore the credit storage apparatus to its home position.

From the foregoing it can be recognized that the coin receptor **36** and gate member **32** must retain a quarter for a period which includes five steps of the rotatable assembly and five forward steps of gate member **32**. Stage **74** of gate member **32** must be of sufficient length to retain the quarter within receptor **36** for five horizontal steps of the gate member. During the period in which the quarter is supported on gate member **32**, the light to the photoelectric cell **64** remains interrupted and the rack portion **88** of gate member **32** remains in mesh with the teeth of pinion wheel **108**. Thus, the gate member is stepped until the quarter is released.

Similarly, stage **73** of gate member **32** extends rearwardly a distance sufficient to maintain a 50¢ piece within slot **46** until ten steps of gate member **32** have occurred. In this way, credit storage units in 5¢ increments are stored by the cooperative activity of the coin sensing mechanism **30**, gate member **32**, and credit storage apparatus **34**.

It should be noted that many obvious safety features have not been shown to keep from unduly lengthening the disclosure. Such features would include an interlock between the subtract magnet and the engage solenoid to insure that attempts at addition and subtraction do not occur simultaneously. In addition, this interlock or some other form may be used to inactivate the circuit on a failure of lamp **58**, and thereafter reject all inserted coins. This last mentioned coin rejection also may be utilized to reject coins inserted in the machine too closely spaced in point of time. Such devices are well-known in the slug rejection art and need not be included in detail herein.

While there has been described what is at present thought to be a preferred embodiment of the invention, it is understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A coin register for use in a coin actuated device comprising:

(a) a coin chute receptive of coinage deposited in said device,

(b) means arresting the passage of coinage through said chute,

(c) means positioned remotely of said chute for testing the chute for the presence of arrested coinage in said chute,

(1) said last-mentioned means actuated by the test indicating the presence of a coin to emit a pulse train signal, and

(d) means responsive to said signal for registering the value of the coinage passed.

2. A coin register for use in a coin actuated device comprising:

(a) a coin chute receptive of a coin deposited in said device,

(b) means arresting the passage of the coin through said chute,

(c) means positioned remotely of said chute for continuously testing the chute for the presence of an arrested coin in said chute and for initiating a signal on such presence,

(d) means responsive to said signal for registering a unitary coin value, and

(e) means controlled by the continued presence of a coin in the chute after the value registration for registering further credits commensurate with the coin value.

3. A register as claimed in claim 2 further comprising:

(a) means for releasing said arresting means in response to the passage of a coin from said chute, and

(b) means for retaining the coin value registration following passage of a coin from said chute.

4. A coin register for a coin actuated device comprising:

(a) a coin chute receptive of coinage inserted in said device,

(b) means positioned remotely of said chute for testing for the presence of a coin in said chute,

(c) a gate blocking the passage of a coin through said chute,

(d) said testing means responsive to a coin on said gate for emitting a signal,

(e) means responsive to said signal for moving said gate stepwise in an unblocking direction, and

(f) further means responsive to said signal for registering a coin value of the lowest denomination.

5. A register a claimed in claim 4 in which there is:

means for restricting said gate to one step of movement to unblock said chute and allow passage of a coin of the lowest demonimation on registration of a coil value of the lowest denomination.

6. A coin register for use in an automatic vending machine comprising:

(a) a plurality of coin chutes each positioned to receive a coin of different denomination,

(b) gate means blocking the passage of a coin from any said chutes,

(c) means positioned externally of said chutes for sensing the presence of a coin in any one of said chutes to produce a signal,

(d) means controlled by said signal for emitting an output pulse,

(e) means responsive to said output pulse for moving said gate means in an unblocking direction a distance sufficient to permit passage only of a coin of the lowest denomination from a predetermined one of said chutes, and

(f) storage means responsive to said output pulse for registering a coin value of the lowest denomination.

7. A coin register for use in an automatic vending machine comprising:

(a) a plurality of coin chutes,

(b) each of said chutes positioned to receive a coin of different value,

(c) gate means blocking the passage of a coin from said chutes,

(d) means sensing the presence of a coin in any of said chutes to produce a signal,

(e) means operable during said signal for emitting a series of pulses dependent on the value of the coin sensed,

(f) means controlled by said series of pulses for moving said gate means to unblock the chute of the coin sensed to release the coin for passage therefrom,

(g) and value registering means responsive to said series of pulses for adding the pulses in said series to register the value of the coin released.

8. A coin register for use in a coin actuated machine comprising:

(a) a plurality of coin chutes each receptive of coinage of a different denomination inserted in said machine,

(b) gate means common to all said chutes for blocking the passage of a coin from said chutes,

(c) means externally of said chutes for sensing the presence of a coin blockingly retained in any of said chutes to produce a signal,

(d) means controlled by said signal for moving said gate means a finite distance sufficient to permit passage of a coin of the lowest denomination from its chute,

(e) means responsive to said signal for registering a single coin value of the lowest denomination,

(f) means for continuing the duration of said signal to cause continued movement of said gate means further finite distances dependent on the duration of said signal,

(g) and further means responsive to the continuation of said signal for registering further coin values dependent on the duration of said signal.

9. A coin registering apparatus comprising:

(a) a coin chute for receiving a coin deposited in said apparatus,

(b) a light source,

(c) apertures in said chute for transmitting light from said source through said chute,

(d) gate means for said chute retaining a received coin in position to intercept light transmission from said source,

(e) light sensing means positioned to sense light transmission from said source and to sense the interception of said light transmission,

(f) means controlled by the interception of light to said sensing means for registering the value of the deposited coin,

(g) and further means controlled by sensing means for moving said gate means to release the deposited coin.

10. A coin registering apparatus comprising:

(a) a plurality of coin chutes for receiving coins deposited in said apparatus,

(b) gate means common to said chutes for retaining a deposited coin in the chute within which the coin is received,

(c) a light source,

(d) apertures in said chutes for transmitting light from said source through said chutes,

(e) structure in said gate means positioning a retained coin within its chute to intercept light transmission from said source,

(f) light sensing means positioned to sense light transmission and to respond to the interception of said light transmission to produce an output signal,

(g) means controlled by said signal for registering the value of the deposited coin,

(h) and further means controlled by said signal moving said gate means a distance sufficient to release the deposited coin.

11. A coin value registering apparatus comprising:

(a) a plurality of coin chutes each receptive of a coin of different denomination deposited in said apparatus,

(b) gate means common to all said chutes for retaining a deposited coin in the receiving chute,

(c) a light source,

(d) apertures in said chutes for transmitting light from said source through said chutes,

(e) structure in said gate means positioning a retained coin to interrupt light transmission through said apertures,

(f) a light responsive element positioned to sense light transmission and to respond to the interruption of said light transmission to produce a signal,

(g) pulse generating means emissive of a series of pulses continuing for the duration of said signal,

(h) means responsive to the pulses of said series for registering the value of a coin of the lowest denomination received for each of the pulses of said series,
(i) and step means controlled by the registration of said pulses for slideably moving said gate means to release the deposited coin.

12. A coin controlled apparatus comprising:
(a) a light source,
(b) a coin chute receptive of a coin inserted in said machine,
(c) gate means in said chute,
(d) light sensing means receptive of light from said source,
(e) structure in said gate means maintaining a coin in said receiving chute to interrupt the reception of light by said sensing means,
(f) circuit means responsive to the interruption of light to said light sensing means for producing a signal continuing as long as a coin is maintained by said gate means,
(g) means controlled during the duration of said signal for additively registering the value of a coin of unit denomination at regular intervals during said continuing signal,
(h) and means responsive to said registration for stepping said gate means at regular intervals until said coin is released from said gate means.

13. A coin value registering device including:
(a) a plurality of coin chutes each receptive of a coin of different denomination deposited in said device,
(b) gate means common to all said chutes for retaining a deposited coin in the chute receptive of its denomination,
(c) a light source,
(d) a light sensing element positioned to sense light transmitted from said source,
(e) said gate means positioning a retained coin to interrupt light transmission to said element,
(f) circuit means connected to said element and responsive to the interruption of light transmission thereto for producing a signal for the duration of said light interruption,
(g) means controlled by said signal for stepping said gate means in a direction toward releasing the coin retained in said chute,
(h) further means controlled by said signal for registering the lowest coin denomination on each step of said gate means,
(i) and means for restoring said gate means consequent to release of the coin from said chute.

14. A coin controlled totalizing apparatus comprising:
(a) a light source,
(b) a plurality of coin chutes each receptive of coins of a unit denomination and multiples thereof,
(c) light sensing means positioned to sense light from said source,
(d) gate means commonly blocking passage of a coin from said chutes and for retaining the blocked coin

in position to interrupt light transmission to said sensing means,
(e) means responsive to the sensing of said light interruption for moving said gate means stepwise,
(f) blocking members on said gate each individual to one of said chutes,
(g) a first of said blocking members opening the unit denomination chute on the first step of said gate means,
(h) other blocking members successively opening the chutes on movement of said gate means in steps numbered in multiples of said unit denomination,
(i) and means for restoring said gate means on passage of the blocked coin from said chute.

15. A coin controlled apparatus comprising:
(a) a source of light,
(b) a coin evaluation receptor including a plurality of parallel, vertical coin chutes open at both top and bottom,
(c) said receptor positioned to receive a valid coin in a chute representative of the coin denomination,
(d) apertures extending through the chutes in said receptor to transmit light from said source through said chutes,
(e) gate means normally blocking the passage of any coin from said receptor,
(f) chute walls cooperative with said gate means to retain a received coin in the chute to interrupt light transmission across said chute on retention of the received coin,
(g) light sensing means positioned to sense light transmitted through said receptor chutes and to react to the interruption of said light transmission,
(h) credit storage means,
(i) means responsive to the reaction of said light interruption for initiating the storage of credit of a coin valued at a unit denomination,
(j) means acting to combine said initiating means operatively with said gate means and said credit storage means for joint motion,
(k) and motive means responsive to said initiation for moving said gate means a distance sufficient to allow passage therethrough of a coin of unit denomination and for storing credit of unit denomination, said last-mentioned means responsive to continued light interruption to register a multiple of said unit denomination and to move said gate means a distance sufficient to release the retained coin.

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