United States Patent

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[54] **APPARATUS FOR COIN COUNTING AND DISPENSING**
5 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **133/8**
[51] **Int. Cl.** **G07d 9/00**
[50] **Field of Search** 133/8; 133/1, 2, 4, 5; 194/9, 1

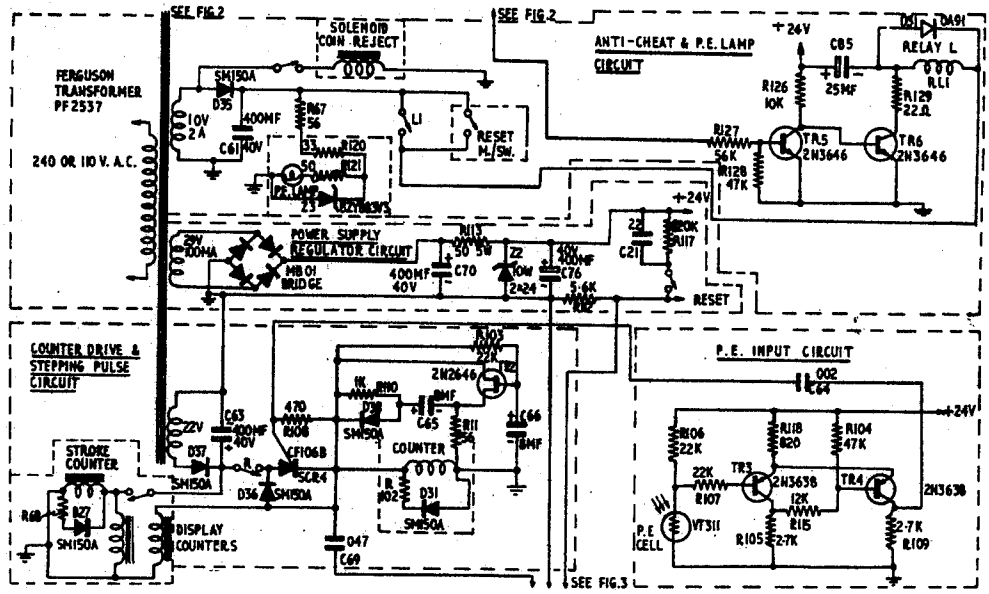
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ABSTRACT: Apparatus for coin or token counting and dispensing in which coins are delivered after being counted by causing them to pass between a light source and a light sensitive device, the apparatus including an electronic control circuit such that each time the edge of a coin cuts the light beam a pulse is produced, the circuit containing timing means to control the length of the pulse so that a series of pulses of uniform length are produced even when the flow of coins or tokens is irregular, a safety device to prevent the repeated delivery of a predetermined number of coins which the apparatus is set up to deliver, a programmed S.C.R. counter for batching a predetermined number of coins or tokens and a timing device arranged to prevent the further delivery of coins or tokens after the passage of the predetermined length of time from the delivery of the first coin or token.



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SHEET 1 OF 5

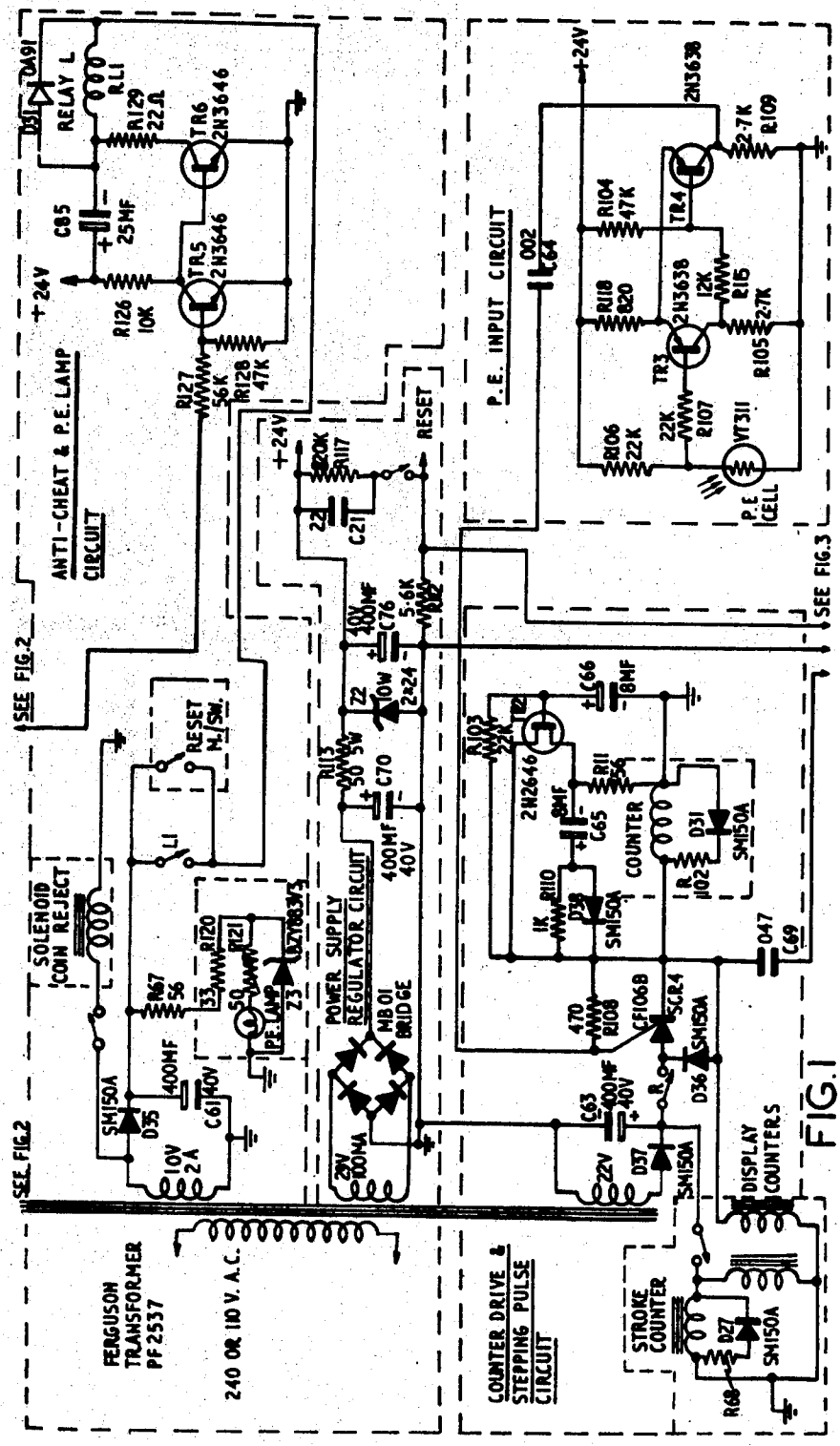


FIG. 1

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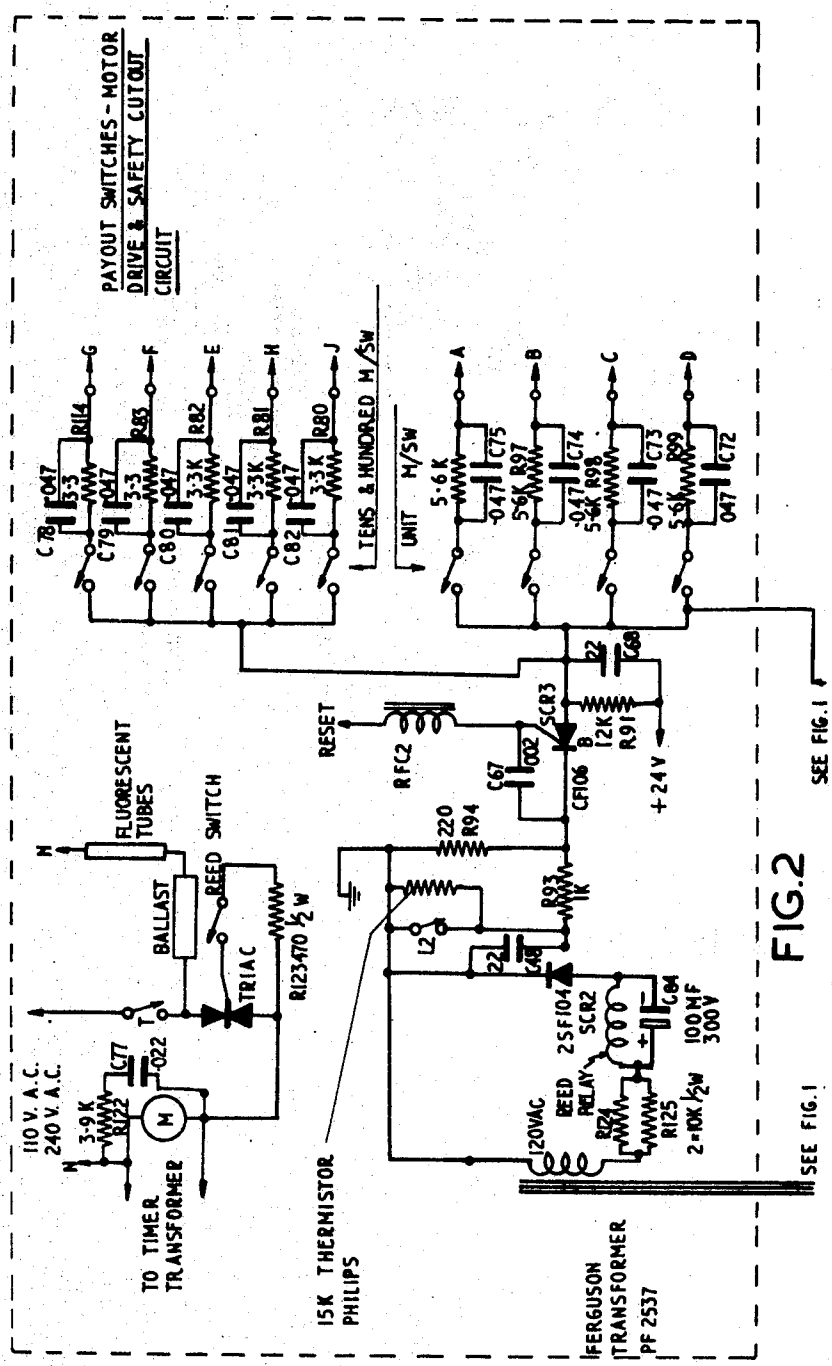


FIG.2

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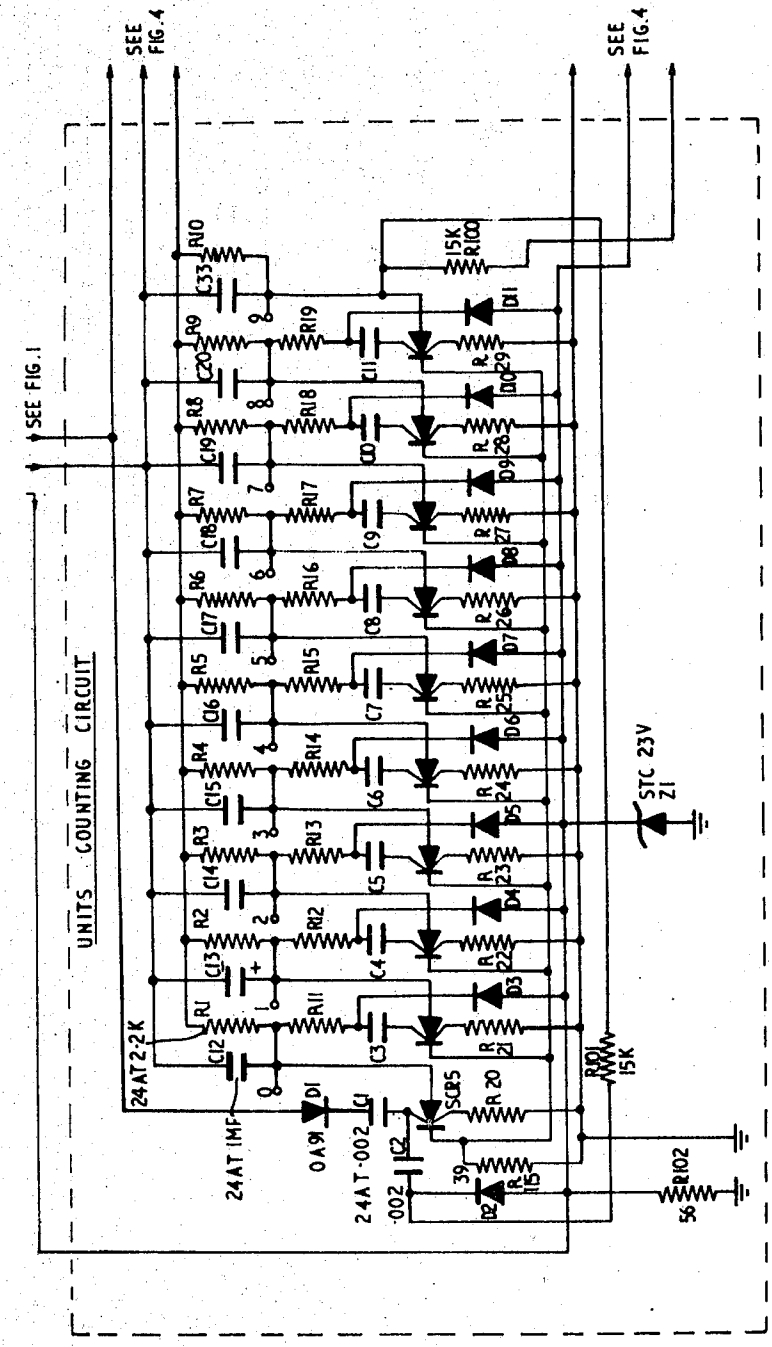


FIG.3

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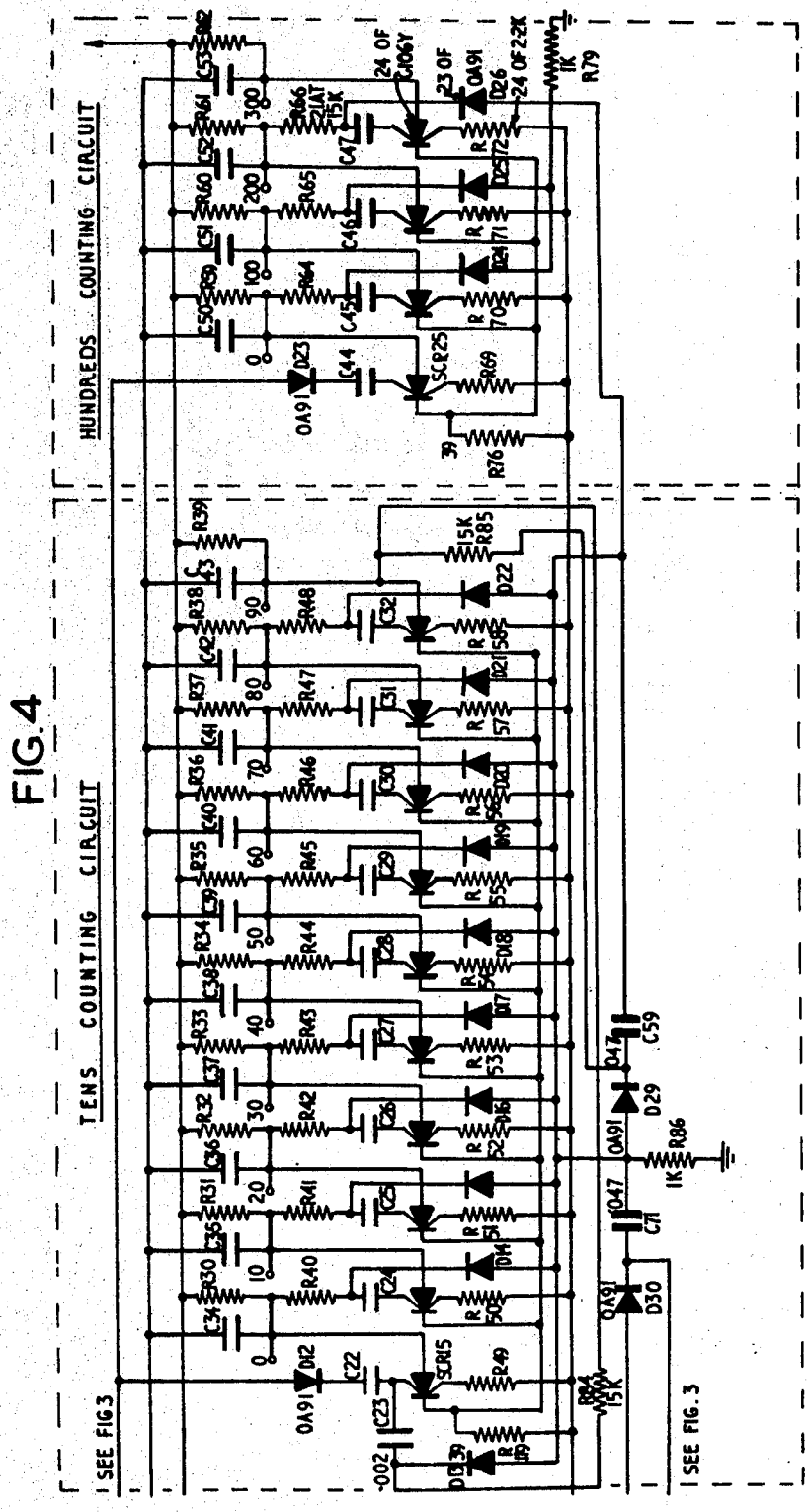
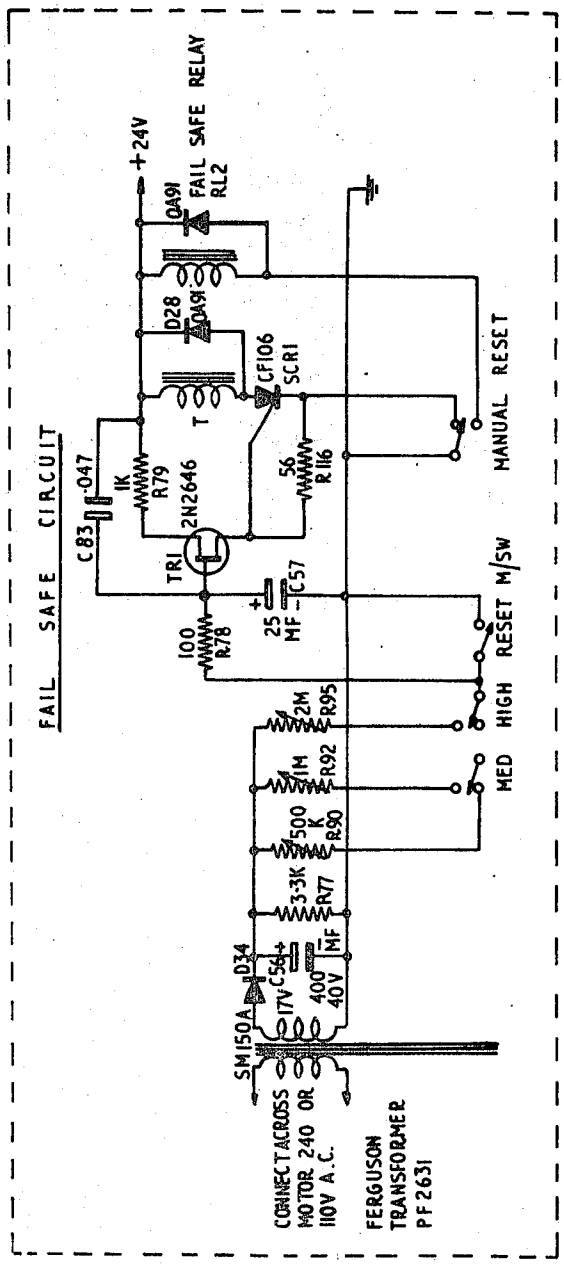


FIG. 4

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FIG. 5



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APPARATUS FOR COIN COUNTING AND DISPENSING

BACKGROUND OF THE INVENTION

The present invention relates to apparatus for coin or token counting and dispensing and more particularly to apparatus of the kind, hereinafter referred to as the kind set forth, in which coins are delivered and counted by causing them to pass between a light source and a light sensitive device, means being provided to count the interruptions in the passage of the light beam to the light sensitive device and to arrest the flow of coins or tokens after a predetermined number have passed.

Apparatus of the kind set forth finds its main use in connection with amusement machines such as poker machines, pinball tables and the like and in machines for counting coins or dispensing change.

In the case of amusement machines it is necessary to ensure that, on certain conditions being set up in the machine, a prize in the form of a predetermined number of coins or tokens is delivered with complete accuracy. It is further necessary to provide means which will defeat attempts to interfere with the machine and to ensure that should any malfunction occur the machine will shut itself off in such a manner as to prevent further use.

SUMMARY OF THE INVENTION

The present invention provides a number of features intended to assist in achieving the desiderata set out above and which may be used to advantage singly or in any combination in apparatus of the kind set forth.

The present invention consists in apparatus of the kind set forth including an electronic control circuit wherein the production of a pulse is initiated by the cutting of the light beam by the leading edge of a coin or token and having timing means to control the length of the pulse whereby a series of pulses of uniform length are provided on the passage of a succession of coins or tokens, means such that, after the predetermined number of coins or tokens have been dispensed, a repetition thereof is prevented, a programmed S.C.R. counter for batching a predetermined number of coins or tokens, and timing means arranged to prevent the passage of further coins or tokens after a predetermined time, whereby on failure of the counting means passage of coins or tokens over and above the predetermined number is limited.

For an understanding of the principles of the invention, reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the Drawings:

FIG. 1 is a schematic wiring diagram illustrating the power supply regulator, the anticheat and photoelectric lamp circuits, the counter-drive and stepping pulse circuit, and the photoelectric input circuit;

FIG. 2 is a schematic wiring diagram illustrating payout switches, a motor drive and a safety cutout circuit;

FIG. 3 is a schematic wiring diagram of the counting circuit for the units;

FIG. 4 is a schematic wiring diagram of the counting circuits for the tens and hundreds; and

FIG. 5 is a schematic wiring diagram of the fail safe circuit.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The apparatus described below is intended for use with the kind of coin handling apparatus known as a Hopper Feed System but may be used in conjunction with any other kind of coin dispensing or counting equipment.

The drawings show a solid state electronic circuit means to be used to control the accurate dispensing of a predetermined number of coins and record them on an electrical counter.

The circuit means also controls the starting up and switching off of the dispensing mechanism when the correct number of coins have been dispensed.

The circuit will be described when used in connection with a poker machine or other similar type of amusement machine. This type of machine is used in conjunction with a hopper coin dispensing device which is an arrangement of a rotating disc having around its outer periphery a number of spaced pins and so disposed in a reservoir of coins that on rotating it will pick up coins in the spaces between these pins and dispense them through the medium of a fixed runway or channel and lead them to a coin receptacle accessible from the outside of the machine.

Associated with this coin runway, or channel, is a light source and a photosensitive resistor or other similar electronic light sensitive device. These are so positioned that the light source is on one side of the trackway and the photoelectric cell on the other so that each coin passing down the runway from the dispensing hopper must cut this light beam.

The general arrangement and mechanical construction of machines of this type is well known and it is therefore unnecessary to described one in the present specification.

The cutting of the light beam creates a change of state in the photoelectric cell VT311 and this action is used by the electronic control circuit to count the coins. When the light is falling on the P.E. cell, it causes the cell to have a low resistance but, when this light is interrupted by the passing of a coin, the P.E. cell's resistance increases to a very high level. This P.E. cell is connected to the P.E. input circuit, shown in the bottom right-hand part of FIG. 1, which is part of the electronic control circuit. This circuit is a Schmidt-Trigger circuit and its function is to create one output pulse for each coin that interrupts the light source. Normally, when the light is falling on the P.E. cell, its low resistance causes sufficient voltage drop at the junction of resistors R.106 and R.107 to cause transistor TR.3 to conduct.

When transistor TR.3 is conducting it switches off transistor TR.4 but, when the light source is removed high internal resistance of the P.E. cell causes the voltage at the junction of resistors R.106 and R.107 to be such as to cause transistor TR.3 to switch itself off and allow transistor TR.4 to conduct applying a pulse via capacitor C.64 to the counter drive circuit and stepping pulse circuit, shown at the bottom left-hand portion of FIG. 1.

This counter drive and stepping pulse circuit consists of a 24v. DC power supply for the counters and a circuit to control automatically the variation in mark to space ratio caused by the coins when they run together while cutting the light beam to the P.E. cell and therefore ensure accuracy of a high speed out counter. This circuit also supplies the stepping pulses to the units counting circuit shown in FIG. 3.

The power supply in this circuit consists of a standard half-wave rectifier D.37 having a filter capacitor C.63. The relay contacts R are to prevent the out counter from counting once when the mains power is switched on or off.

When controlled rectifier S.C.R.4 receives a pulse from the P.E. circuit via capacitor C.64 it conducts, thereby operating the counter, and produces a pulse via capacitor C.69 to the unit counting circuit. This also applies positive voltage to the base of transistor TR.2 via resistor R.103 charging up capacitor C.66. When capacitor C.66 is sufficiently charged it will cause transistor TR.2 to conduct and this places the two charged capacitors C.66 and C.65 in series effectively doubling the plus 24v. supply voltage. This voltage applied to the cathode of rectifier S.C.R.4 effectively turns it off.

It can be seen that this circuit needs only to see the leading edge of a coin for its complete operation and therefore it is almost independent of the mark space ratio of the coins. This overcomes the problem of operating a high speed counter directly from the coins being dispensed from the hopper.

THE MOTOR DRIVE & SAFETY CUTOFF CIRCUIT SHOWN IN FIG. 2

The safety cut off circuit is to prevent the hopper repeating a pay should the unit be caused to step off the preset number

once a pay is completed. This could occur if someone forced a suitable instrument up the coin exit channel and interrupted the light beam after a pay had been completed. This circuit prevents this in the following way:

When the handle, or other play initiating device, is operated it actuates a series of reset switches. One of these switches produces a pulse which is coupled by transformer winding R.F.C.2 to the gate of rectifier S.C.R.3 and turns it on. Its conduction path is from plus 24v. DC via resistor R.91, rectifier S.C.R.3 and resistor R.94 to ground. Since resistor R.91 supplies only a small holding current nothing else can happen. Capacitor C.68 is to ensure that rectifier S.C.R.3 switches on by providing a short high current pulse. When a units pay switch is closed, rectifier S.C.R.3 conducts through the 5.6K. resistor connected, in series with the selected pay switch to the counting S.C.R.'s anode, the 2.2K. resistor R1, etc. (FIG. 3) to the plus 24v. This allows enough current to flow through rectifier S.C.R.3 to cause rectifier S.C.R.2 to switch on and drive the hopper motor M (FIG. 2).

When the correct number of coins is dispensed the S.C.R. of the selected count number is switched on. This places the anode end of the associated 2.2K. resistor at ground potential and causes rectifier S.C.R.3 to revert to its holding condition, but since, when rectifier S.C.R.3 is conducting, the capacitor connected across the 5.6K. resistor in this case is charged up so when the selected S.C.R. is switched on the capacitor discharges via the associated 5.6K. resistor causing the anode of rectifier S.C.R.3 to go negative, whereby rectifier S.C.R.3 is then switched off. If an extra pulse causes the selected S.C.R. to switch off and again put plus 24v. DC on the anode of rectifier S.C.R.3, it could not conduct as rectifier S.C.R.3 can only be caused to conduct by closing the reset switches and this requires that the handle be pulled.

The motor drive circuit utilizes a Triac which is a gate operated device and it requires only 470 ohm resistor R.123 connected from its anode via a switch to its gate to enable it to be turned on or off as desired.

When rectifier S.C.R.2 is switched on, it acts as a half-wave rectifier and the current flows through the reed coil and the dropping resistors R.124 and R.125 causing the reed switch to close and switch on the Triac which operates the hopper motor. The capacitor C.84 is to prevent the reed switch from opening during the negative half cycle. It does this by charging up across the coil when rectifier S.C.R.2 is conducting and discharging through the reed coil on the negative half cycles. The thermistor connected from S.C.R.2's gate to its cathode is to ensure positive operation at high temperatures and prevent spurious pays at high operating temperatures due to the sensitivity of rectifier S.C.R.2 increasing to a point where rectifier S.C.R.2 will conduct with only the holding current of rectifier S.C.R.3. The thermistor's resistance decreases as the temperature increases and allows more current to pass through it to earth thus decreasing the available gate current to rectifier S.C.R.2 below the conduction level.

THE FAIL SAFE CIRCUIT SHOWN IN FIG. 5

This is a circuit designed to come into action should the main counting circuit fail to switch off the motor driving the coin dispensing hopper when the correct amount of coins have been paid out. Each time a pay out of coins is initiated by the payout arm switch, it also initiates this circuit, which starts timing and, if the pay is not completed in a predetermined time, the fail safe circuit causes the motor to be switched off. This circuit consists of a time delay relay of the magnetic latching type so that once operated the relay will not allow the motor to operate again until it is manually reset by a switch provided. The timer has 3 separate time delays brought into operation by the medium and high microswitches. The shortest time is set to protect all the low pays up to 18 coins, medium time is set to protect the small jackpot payouts up to 100 coins and the high time delay is set to protect the large jackpot payouts of 200 or more. It will be clear that, if only one time delay were used, it would have to be long enough to cover the larger pays so that any malfunction occurring on a small pay would allow the hopper to continue to dispense coins until they were in excess of the large pay before it cut out. With this system the time delay can be set so that a minimum number of coins are paid out over the correct amount should a malfunction occur on the main circuit. When the fail safe relay RL 2 operates it also breaks the power supply to a small solenoid located in the machine which prevents insertion of any more money until the fault has been corrected. The fail safe relay also switches off the display lights to indicate the machine requires attention.

REGULATED POWER SUPPLY CIRCUIT SHOWN IN FIG. 1

The regulated power supply circuit and the ring counter reset circuit supplies plus 24v. DC over a wide range of mains voltages. The main part of this circuit is the Zener Diode Z.2. The ring counter and safety cutoff reset pulse is obtained by closing the reset switch and causing capacitor C.21 to charge up giving a positive going pulse which is used to turn on the safety cut off rectifier S.C.R.3 (FIG. 2) and also to switch on the zero S.C.R.'s in the counting circuits referred to in hereinafter.

ANTICHEAT & PHOTOELECTRIC LAMP CIRCUIT SHOWN IN FIG. 1.

This circuit supplies the power for the photoelectric cell exciter lamp and the anticheat relay and it provides 10v. AC to the coin reject solenoid. When the machine is connected to the mains supply, relay L will not pull in until the handle is pulled and the relay switches closed. When this happens the relay L pulls in and becomes self holding while the voltage across it is maintained. Relay L is then caused to drop out at the end of each payout, effectively disabling the motor drive circuit after each payout is completed. This is a further protection against attempts to cheat the machine. The circuit operation is as follows:

When the handle is pulled, the S.C.R. reset switch causes rectifier S.C.R.3 to conduct. Also, the relay reset switch L1 closes and causes relay L to pull in and become self holding. When rectifier S.C.R.3 is reset, its anode voltage is only slightly positive, and this voltage is fed to the base of transistor TR.5 via resistor R.127. Resistor R.128 is to prevent transistor TR.5 conducting unless a large positive voltage is present at the junction of resistor R.127, transistor S.C.R.3 and resistor R.91. The base of transistor TR.6 is connected to the junction of transistor TR.5's collector and resistor R.126 and, since transistor TR.5 is not conducting, the voltage at this junction is positive so transistor TR.6 is conducting. When the payout is completed, rectifier S.C.R.3 is turned off causing a high positive voltage to be present at the junction of resistors R.127 and R.91 and rectifier S.C.R.3. This voltage is applied to the base of transistor TR.5, causing it to conduct and, in so doing, shorts the base of transistor TR.6 to negative, stopping transistor TR.6 from conducting and this breaks the current path of relay L and this relay drops out.

When the relay L is released, the contacts L.2 short the gate of rectifier S.C.R.2 to ground thus preventing any pay taking place. The photocell exciter lamp 50 is a sub miniature 5v. type with a life exceeding 50,000 hours. The resistors R.67 and R.120 are to drop the voltage applied to the junction of the Zener Diode Z.3 and the sliding resistor R.121. This arrangement is to provide a regulated voltage to the lamp regardless of mains voltage variations and also, by adjusting resistor R.121, any difference in P.E. cells can be compensated for by varying the lamp intensity.

UNITS COUNTING CIRCUIT SHOWN IN FIG. 3

The units counting circuit is driven from pulses from the counter circuit and is to count from 1 to 9 pulses so that, coupled with the motor drive and safety cutout circuit, it turns the

hopper motor off when the preselected number of coins have been paid out.

TEN'S COUNTING CIRCUIT SHOWN IN FIG. 4

The ten's counting circuit is driven with pulses derived from the coupling network **D.30, C.71** and **R.86** when No. **9** S.C.R. in FIG. **3** is switched off and the No. **0** S.C.R. is switched on, i.e. on the 10th pulse, so that each 10th coin causes the ten's circuit to step once.

THE 100'S COUNTING CIRCUIT SHOWN IN FIG. 4

The **100**'s counting circuit is driven with pulses derived from the **10**'s to **100** coupling network **D.30, D.29, C.71, C.59** and **R.86** when the No. **90** S.C.R. in the tens counting circuit is switched off and the zero S.C.R. in the tens counting circuit is switched on, i.e. on the 100th coin, so that each 100th coin causes the **100** circuit to step once.

The units, tens and hundreds counting circuits are identical in their method of operation, there being three main advantages of using this circuit over the conventional S.C.R. ring counter circuit. They are:

1. The circuit is so designed that where any one S.C.R. is switched on all other S.C.R.'s in that ring are switched off, thus preventing the ring from a miscount due to more than one S.C.R. being on, as can happen with a conventional circuit.

2. Polarized commutating capacitors can be used as the polarity of the voltage across the capacitor is never reversed as it is in a conventional circuit.

3. High level of pulse is required to step the ring from one S.C.R. to the next so the circuit cannot be stepped by stray pulses.

We claim:

1. In resettable coin or token counting and dispensing apparatus of the type having payout switches operated in accordance with the predetermined number of coins or tokens to be counted and dispensed, an electronic control circuit comprising, in combination, a photoelectric detector including means providing an incident light beam interrupted by the leading edge of a coin or token to be counted and dispensed, to produce a pulse; first timing means connected to said detector and controlling the length of each pulse to produce a series of pulses of substantially uniform length responsive to passage of a succession of coins or tokens through said light beam; means operable, responsive to completion of each payout of coins or tokens predetermined by said payout switches, to block repetition of such payout until the apparatus is reset; a programmed S.C.R. counter operable by said payout switches, normally to count only said predetermined number of coins or tokens as a payout amount; and second timing means operable, responsive to a predetermined time interval elapsing following production of the initial pulse, to block dispensing of additional coins or tokens above a preselected maximum number; whereby, on malfunction of said counter, dispensing of coins or tokens over and above said predetermined number is limited to said maximum number.

2. In coin or token counting and dispensing apparatus, an electronic control circuit, as claimed in claim **1**, including a SCHMIDT-TRIGGER circuit connected to said detector and providing a short pulse responsive to interruption of said light beam by the leading edge of a coin or token; an S.C.R. connected to said SCHMIDT-TRIGGER circuit and turned on responsive to said short pulse; and a unijunction timing circuit connected to said S.C.R. and controlling the latter to interrupt conduction thereof after a preset time.

3. In coin or a token counting and dispensing apparatus, an electronic control circuit, as claimed in claim **1**, wherein said S.C.R. counter is a ring counter circuit constructed and arranged so that, when any one S.C.R. is switched on, all other S.C.R.'s in the same ring are switched off.

4. In coin or token counting and dispensing apparatus, an electronic control circuit, as claimed in claim **1**, wherein said means blocking repetition of such dispensing comprises a holding relay arranged to drop out after completion of dispensing of said predetermined number of coins or tokens to disable the apparatus from delivering further coins or tokens; and resetting means operable to reset said holding relay to restore the apparatus to a working condition.

5. In coin or token counting and dispensing apparatus, an electronic control circuit, as claimed in claim **1**, including a plurality of said second timing means each operable responsive to a respective different predetermined time interval elapsing following production of the initial pulse; and selectively operable means operable to connect a selected one of said second timing means in said electronic control circuit in accordance with the respective specified predetermined number of coins or tokens to be dispensed.