March 18, 1952 B. A. ANDREWS 2,589,214

ELECTRICAL COIN SELECTOR

Filed Sept. 29, 1947 3 Sheets-Sheet 1

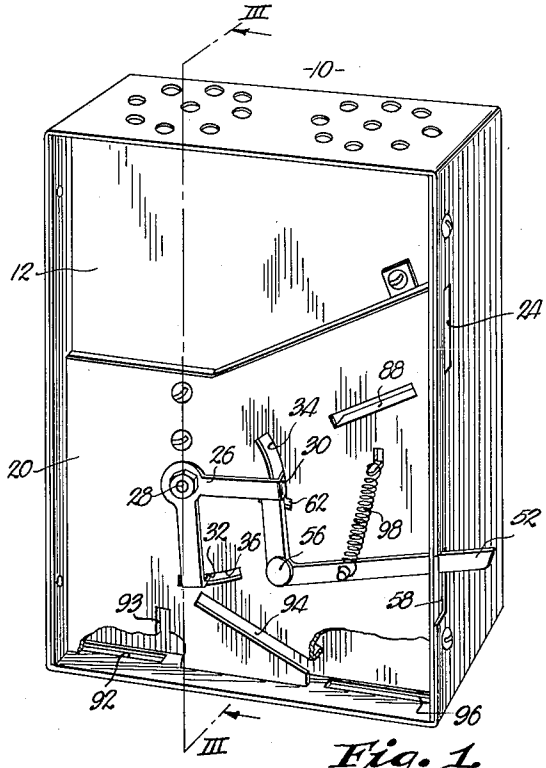

Fig. 1.

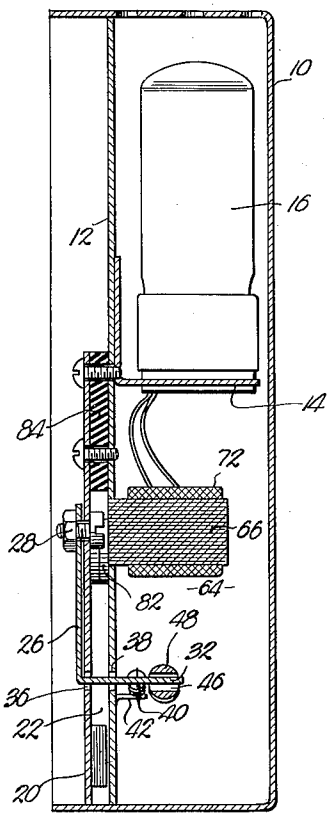

Fig. 3.

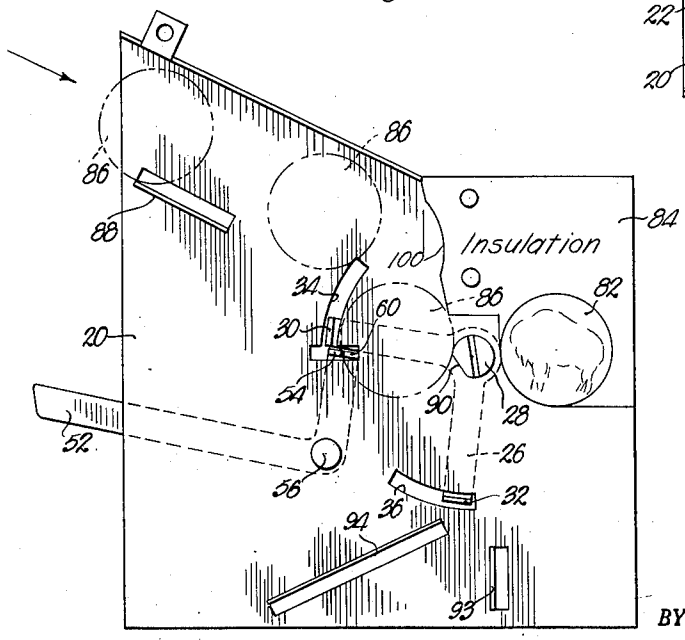

Fig. 2.

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ELECTRICAL COIN SELECTOR

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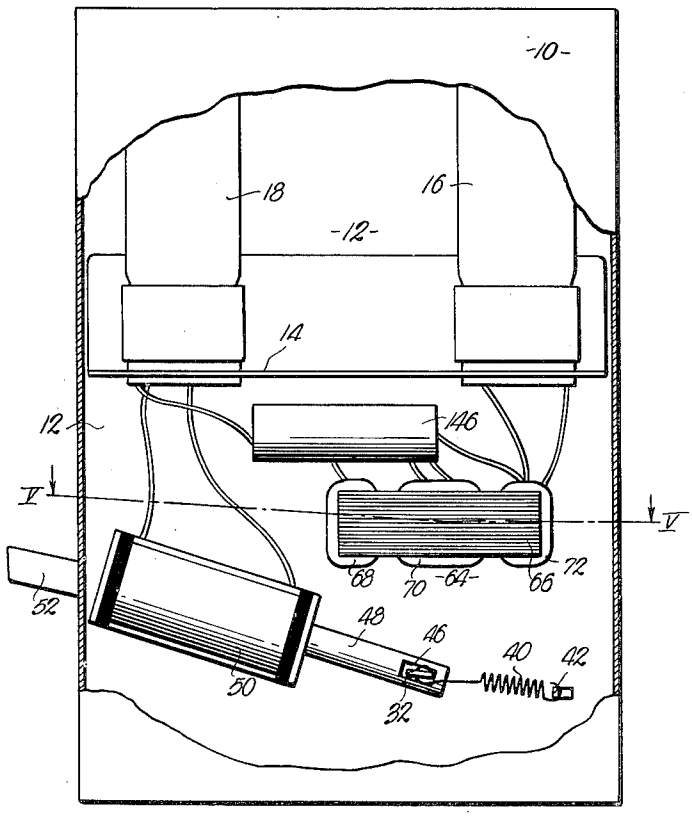

Fig. 4.

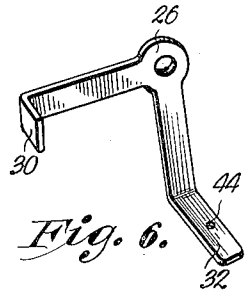

Fig. 6.

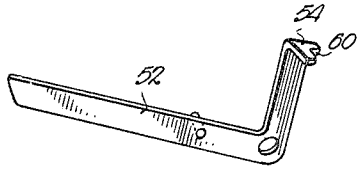

Fig. 7.

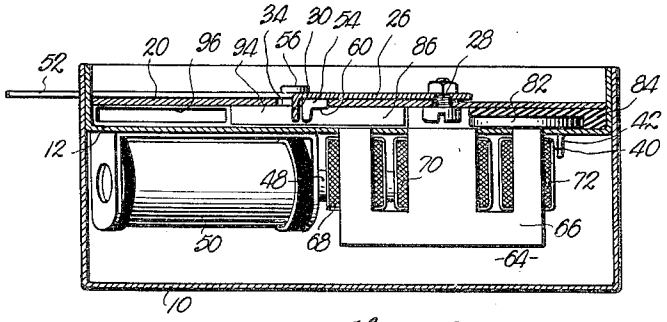

Fig. 5.

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ELECTRICAL COIN SELECTOR

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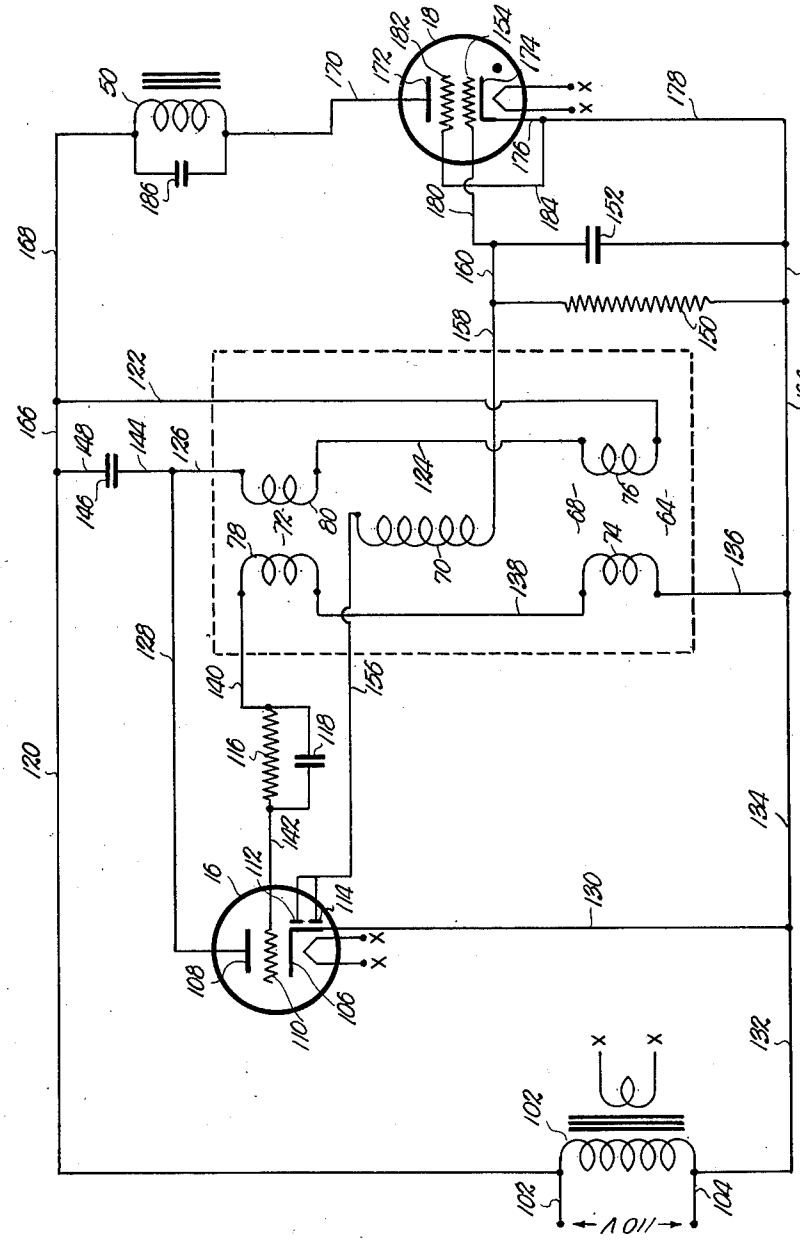

Fig. 8.

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Patented Mar. 18, 1952 2,589,214

UNITED STATES PATENT OFFICE

2,589,214

ELECTRICAL COIN SELECTOR

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Application September 29, 1947, Serial No. 776,672

4 Claims. (Cl. 194—100)

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This invention relates to apparatus for segregating materials electromagnetically through the medium of magnetic circuits having air gaps associated therewith for receiving the materials to be segregated.

The primary aim of this invention is to provide a coin selector having a coin chute provided with a releasable support for holding a coin within an air gap disposed in a magnetic circuit and operable to release the coin automatically upon a predetermined variance in said circuit.

The most important object of this invention is the provision of an electrical coin selector having a measuring device provided with a primary and a secondary electromagnetic field, the latter being operable to release coins of predetermined character when inserted into the primary field.

Another important object of this invention is to provide a coin selector of the aforementioned character wherein the said primary field comprises a pair of normally balanced windings producing balanced electromagnetic fields which are unbalanced by disposition of a standard coin in an air gap adjacent one of the windings, and operable to release a coin to be selected by insertion of the same in a second air gap adjacent the other windings, thereby balancing the pair of fields produced by primary windings.

A further object of this invention is the provision of a coin selector having a relay-controlled support operable upon de-energization of the above mentioned secondary field through insertion of a coin having characteristics similar to the standard within the primary field.

Other objects include the manner in which the coin to be selected is directed through paths of travel utilizing force of gravity as the motivating means, the way in which the coin is momentarily held in the magnetic field; and the manner in which "jamming" is prevented and all parts of the selector are confined in a relatively small space.

In the drawings:

Fig. 1 is a perspective view of an electric coin selector made in accordance with my present invention.

Fig. 2 is a side elevational view of a partition of the case showing one side thereof opposite to that shown in Fig. 1.

Fig. 3 is a cross sectional view taken on line III—III of Fig. 1.

Fig. 4 is a side elevational view thereof, parts being broken away for clearness.

Fig. 5 is a cross sectional view taken on line V—V of Fig. 4, looking in the direction of the arrows.

Fig. 6 is a detailed perspective view of one part of the coin support.

Fig. 7 is a detailed perspective view of another part thereof; and

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Fig. 8 is a schematic wiring diagram showing the electrical structure forming a part of the coin selector.

As is well known in this art, the wide use of coin operated machines for vending products of various nature brings forth the need of means for positively preventing the use of counterfeit coins and slugs generally to operate such machines. The most effective slug rejector embodies the use of the magnetic and conductive properties of the coins themselves, it being known that official coins are minted with a fairly high degree of accuracy with respect to their metallic content. This invention contemplates such method of selection through use of a compact unit that is highly efficient and not likely to get out of order through use.

A case broadly designated by the numeral 10 has a normally vertical wall 12 upon which is mounted a horizontal shelf 14 for supporting a pair of tubes 16 and 18, hereinafter more fully described. A partition 20 within the case 10 is spaced from one face of the wall 12 to present a chamber 22, and a coin receiving slot 24 formed in one wall of the case 10 is in communication with the chamber 22 near the top thereof. For reasons hereinafter more fully explained, the partition 20 is preferably formed from steel or other metallic material of high permeability.

The partition 20 has swingably mounted on the outermost face thereof an L-shaped crank 26 through the medium of a bolt or the like 28. This crank 26 has, as clearly shown in Fig. 6, a pair of lateral ears 30 and 32 that turn inwardly into a pair of arcuate slots 34 and 36 respectively formed in the partition 20. The free end of the ear 30 terminates within the chamber 22 while the ear 32 of crank 26 passes through chamber 22 and through a slot 38 formed in the wall 12. This slot 38 is in opposed relation to the slot 36 and is of the same size and arcuate contour as the slot 36. A spring 40 having one end thereof secured to a projection 42 stamped inwardly from the wall 12 and the opposite end fastened within a hole 44 of ear 32, tends to maintain crank 26 biased in the position shown in Figs. 1 and 2. One end of the slot 36 remote from the slot 34 receives the ear 32 to limit the extent of movement of crank 26 by the spring 40.

The free end of the ear 32 extending outwardly from hole 44 passes freely through a slot 46 formed in a reciprocable core 48 of a relay 50 mounted within case 10 below the shelf 14 and upon the innermost face of wall 12.

An L-shaped lever 52 formed as clearly shown in Fig. 7 with a projection 54 extending laterally from one leg thereof, is pivotally mounted on the partition 20 as at 56 to one side and below the pivotal connection 28 of the crank 26. The other leg of the lever 52 extends outwardly from

case 10 through a slot 58 formed in the wall of case 10 having slot 24 therein.

The projection 54 has a notch 60 formed therein and passes inwardly into the chamber 22 through an arcuate slot 62 formed in the partition 20. This slot 62 is disposed in transverse relation to the slot 34 and registers with slot 34 at its lowermost end.

A measuring element broadly designated by the numeral 64, includes an iron E core 66 of conventional character and three windings 68, 70 and 72. Winding 68 constitutes a pair of coils 74 and 76 and the winding 72 is formed to present coils 78 and 80 while winding 70 comprises a single coil, all as illustrated in Fig. 8 of the drawings.

As clearly shown in Figs. 3 and 5, the E core 66 has its three legs extending through suitable openings formed in the wall 12 in communication with the chamber 22. A standard coin 82, partially embedded within insulation 84 disposed between wall 12 and partition 20 has one face thereof exposed to one of the outermost legs of the E core 66.

When a coin 86 to be selected is inserted into the slot 24, it will fall by gravity upon a ledge 88. This ledge 88 is stamped from the partition 20 to extend inwardly into the chamber 22 and is disposed at an angle to direct the falling coin 86 to a measuring position opposite to the standard coin 82.

The bolt 28 has its head formed as shown in Fig. 2 to present a flat 90, the distance between this head of bolt 28 and the notch 60 of lever 52 being less than the diameter of the coin 86, when bolt 28 and lever 52 are disposed in the normal position shown in Figs. 1 and 2. In other words, the bolt 28 is fixed to the crank 26 and is rotatable therewith and it is only when the flat 90 is in a substantially vertical position that coin 86 will drop from the measuring position in absence of manual actuation of the lever 52.

In the event that coin 86 measures electromagnetically with the standard 82 in a manner hereinafter to be fully described, relay 50 will be energized to swing crank 26 against the action of the spring 40. This moves the flat 90 to a position releasing coin 86 from between notch 60 and bolt 28 and at the same time moves the ear 32 of crank 26 to a position in slot 36 opposite to that shown in Figs. 1 and 2. The coin 86 will then drop and be guided by the ear 32 through chamber 22 and into a slot 92 formed in case 10. An inturned vertical flap 93 on partition 22 aids in directing the falling coin 86 to the slot 92. After passing through the slot 92, the coin 86 will move into a suitable control (not shown) for the machine with which this selecting device may be associated.

When the crank 26 is actuated as above set forth, the ear 30 thereof will rise toward the top of slot 34 and prevent successive coins 86 inserted in slot 24 from falling upon the coin 86 disposed in the measuring position or passing into slot 92 while the crank 26 is so actuated. Such successive coins 86 will fall into the chamber 22 and upon an inclined ledge 94 stamped inwardly from the partition 20. This ledge 94 will direct such coins 86 into an opening 96 formed in the case 10 for movement back to the customer in the usual manner.

In the event the customer inserts a slug into slot 24 rather than a good coin 86, whereby the relay 50 will not be energized, such slug

may be returned by manually pushing lever 52 downwardly against the action of a spring 98. Spring 98 has one end thereof attached to partition 20 and its opposite end affixed to the lever 52 as clearly illustrated in Fig. 1. The released slug will then fall upon edge 94 and be held against movement into the slot 92 by the ear 32 which remains in the normal position shown in Figs. 1 and 2.

It is notable also that insertion of oversize coins is prevented by forming slot 24 of predetermined size and that undersized coins will fall freely between notch 60 and the head of bolt 28 for passage into the opening 96. Another important feature lies in the manner in which ear 30 of the crank 26 guides the coins 86 into the measuring position after the same roll from the ledge 86 and while crank 26 is in the normal coin-holding position. One edge 100 of the insulation 84 above the crank 26 serves to cooperate with the ear 30 in such coin-guiding function.

The electrical circuit used in connection with the tubes 16 and 18, measuring element 64 and relay 50 to energize the latter is illustrated in Fig. 8. The tube 16 is a single triode, duo-diode while tube 18 is a miniature thyratron, each receiving filament voltage from a transformer 102 by means of conventional circuits, not shown. Current is supplied to the transformer 102 and to the circuits about to be traced through a pair of lead lines 102 and 104.

The tube 16 performs two functions: The triode portion is used as a reversed feedback oscillator and includes a cathode 106, a plate 108 and a grid 110. The diode portion of the tube 16 serves as a rectifier and constitutes the cathode 106 and diodes 112 and 114.

The coils 74 and 78 of the measuring element 64 are identical in turns ratio and are series connected to form the grid coil assembly which is connected to the grid 110 of tube 16 through a grid resistor 116 and a condenser 118.

The coils 76 and 80 are also identical in turns ratio and are connected in series to form the plate coil assembly having connection with the plate 108 of the tube 16. Coil 70 is wound on the center leg of the measuring coil assembly 64 and is used to pick up balance voltage induced thereinto by the action of coils 74, 76, 78 and 80.

The circuit for energizing the tube 16 may be traced therefore, as follows:

From lead line 102 through wires 120 and 122, coil 76, wire 124, coil 80, wires 126 and 128, plate 108 and cathode 106 of tube 16, and wires 130 and 132 to lead line 104.

The grid 110 of tube 16 receives the voltage induced into coils 74 and 78 by mutual inductance thereof with coils 76 and 80 respectively through which a varying current is flowing. This voltage is of the proper amplitude and phase relationship so as to cause the plate current variations of tube 16. These plate current variations constitute the varying current flowing through coils 76 and 80. This is the cause of oscillation in the triode portion of tube 16. The circuit through grid 110 is traceable as follows:

From lead line 104 through wires 132, 134 and 136, coil 74, wire 138, coil 78, wire 140, condenser 118 and resistor 116, wire 142, grid 110 of tube 16, plate 108 of tube 16, wires 128 and 144, a condenser 146, and wires 146 and 120 to lead line 102.

Ordinarily, the plate supply for vacuum tube operation is a positive D. C. potential. In an oscillator such as that employed in this device, the

intensity of oscillations produced will vary with the positive value of the D. C. plate potential. If the plate potential is made zero or negative, the oscillations will die down or stop and the plate current disappear. Therefore, the oscillator operates only one half the time, the positive potential period of each cycle of the A. C. power supply used for the plate.

The thyratron tube 18, in common with thyratron tubes generally, will begin conduction of plate current suddenly, at the full value of current determined by the plate circuit component values and applied positive plate power potential, when the negative grid potential disappears or becomes a value near zero or a positive value. Re-establishment of the negative grid potential, however, does not stop the plate current. It continues until the plate potential is removed or reduced to near zero or made a negative value. Operation of the thyratron tube 18 with an A. C. plate supply, therefore, provides for terminating its plate current conductions or tube operation with the reintroduction of the negative grid potential on grid 180. The use of A. C. as the plate power supply, therefore, eliminates the necessity of employing special means for terminating operation of thyratron tube 18.

It is notable that the resistor 116 and condenser 118 together comprise a standard grid leak connection for providing bias voltage for the tube 16. The condenser 146 which is connected in parallel with the coils 76 and 80, is used as a frequency determining element.

The coil 70 has connection with the diodes 112 and 114 of the tube 16 and also to a resistor 150 and a condenser 152 to form a rectifier circuit having a time constant determined by the filtering requirements for retaining the essential negative bias potential that is applied to grid 154 of the tube 18 This value must also be sufficient to retain the negative potential to avoid operation of tube 18 over the non-operating period of the oscillator when the oscillator plate voltage is negative, as a consequence of operation with an A. C. plate supply. As the resistance or resistor 150 in the grid circuit somewhat affects the operation value of the grid of the tube 18, and also its value determines what potential will be developed by a given intensity of oscillation produced by tube 16, the combination of resistor 116 and condenser 118 as determining the intensity of oscillation produced by tube 16 will determine the value which may be used for resistor 150.

This circuit through coil 70 is traced as follows:

From lead line 102, through wires 120 and 148, condenser 146, wires 144 and 128, plate 108 of tube 16, cathode 106 of tube 16, diodes 112 and 114 of tube 16, wire 156, coil 70, wires 158 and 160, resistor 150 and condenser 152, and wires 162, 164, 134 and 132 to lead line 104.

The tube 18 is supplied with an A. C. potential through the following circuit:

From lead line 102 through wires 120, 166 and 168, relay 50, wire 170, plate 172 of tube 18, cathode 174 of tube 18, and wires 176, 178, 162, 164, 134 and 132 to lead line 104.

It is to be noted that the grid 154 of tube 18 has connection with the above described rectifier circuit through a wire 180 and that a second grid 182 of tube 18 joins with the circuit just above traced by a wire 184.

The two series primary windings 68 and 72 are so disposed that their electromagnetic fields created with a current through the windings,

have equal but opposite flux linkage with the secondary winding 70. With absence of the standard 82 or anything to disturb the electromagnetic field, no mutual inductance exists between the primary and secondary windings. There will be no net magnetic flux in the center leg of the iron core 66. This may be thought of as an electromagnetic balance bridge in which the two ends of the core 66 of element 64 bridge a magnetic circuit between points with the same electromagnetic potential, or there appears at each end of the center leg of core 66 an equal amount of magnetic flux of like polarity.

If, however, the magnetic forces produced by the windings 68 and 72 are made unequal, as by inserting the standard 82 in an air gap between one of the outermost legs of core 66 and the steel plate 20, there will exist between the ends of the center leg core 66 a difference in magnetic or magnetomotive force with a resulting flux through the core of coil 70.

Thus, if an alternating current is applied to the primary windings 68 and 72 in the manner above outlined with an existing primary coil field unbalance, there will be induced in the secondary coil 70 (on the center of leg of core 66) a voltage caused by flux from the electromagnetic field of the primary windings. Obviously, when the magnetic forces of the primary coil field are again brought into balance, no voltage will be present in the coil 70.

The insertion of the standard coin 82 produces an unbalance because of the change in the effective air gap from the permeability of the material of the coin or because of the circulatory currents induced in the coin by the flux passing through the coin, and likewise the placing of a coin 86 of like characteristic to the standard 82 in the other air gap adjacent the opposite leg of core 66 will bring the primary fields of the coils 68 and 72 back into balance.

The proper balance of the magnetic flux linkage of coil 70 with the two primary windings 68 and 72 is accomplished most readily by having the windings 68 and 72 each wound with the same number of turns and a symmetrical core structure. Coil 70 should have a sufficiently great number of turns so that the voltage is high enough for satisfactory circuit operation.

When the selector is in a normal inoperative position, voltage in the coil 70, applied to the cathode 106 of tube 16 through the resistor 150 and condensor 152 of the rectifier circuit, will produce a negative biased D. C. voltage at the grid 154 of tube 18. This D. C. voltage on grid 154 will prevent tube 18 from firing.

Thus, when a slug is inserted into the air gap adjacent the notch 60 of lever 52 and the flat 90 of bolt 28, that is incapable of bringing the primary field into balance, there will be no firing of tube 18 and relay 50 will not be energized.

On the other hand, when a coin 86 of predetermined character approximating that of standard 82 is moved into the testing position, the primary field will approach a balanced condition and the negative bias on the grid 154 will be reduced to a point near zero. This reduction will cause tube 18 to fire and a current flow will pass through the relay 50, attracting its armature 48 and applying mechanical motion to the crank 26 to cause acceptance of the good coin 86.

Oftentimes a counterfeit coin inserted into slot 24 would be capable of causing the primary circuit to balance momentarily prior to such coin reaching its resting place in the testing position.

To prevent acceptance of such coins, the resistor 150 and the condenser 152 are provided with values capable of introducing a time constant of sufficient duration to prevent operation of tube 18. In other words, the reduction of the negative bias on grid 154 is slowed down until the coin reaches the testing position where it is incapable of balancing the primary electromagnetic field.

The firing of tube 18 is made possible through the connection of cathode 174 on one side of the 110 volt potential and the plate 172 on the opposite side thereof. Thus, with the shield grid 182 connected directly to the cathode 174, a change in the firing point of tube 18 will be effected.

The relay 50 is provided with a condenser 186 to receive the pulsating direct current potential when tube 18 is firing, thereby directing a steady current to relay 50 and preventing oscillation of its armature 48.

Obviously, the system of electromagnetic balance just described may be used for segregating materials generally and is not necessarily limited to coin selection. The extent of accuracy and sensitivity is governed by the amplitude of oscillations caused by triode portion of tube 16, which in turn increases the field strength of the coil assembly 64.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In an electrical coin selector having a case, a relay in said case and means for energizing said relay upon placing a coin of predetermined character in a measuring position within said case; a coin chute formed in the case for guiding said coin to the measuring position; a rotatable member in said chute and normally disposed for restricting the passage of said coin beyond the measuring position; and structure interconnecting said member and said relay for moving the member to a coin releasing position upon energization of the relay, said chute having branches for receiving coins from the measuring position, said structure including a crank having means for directing a coin released by movement of said member to one of said branches.

2. In an electrical coin selector having a case, a relay in said case and means for energizing said relay upon placing a coin of predetermined character in a measuring position within said case; a coin chute formed in the case for guiding said coin to the measuring position; a rotatable member in said chute and normally disposed for restricting the passage of said coin beyond the measuring position; structure interconnecting said member and said relay for moving the member to a coin releasing position upon energization of the relay; and manually operable means for releasing coins from said measuring position that are incapable of causing energization of said relay, said chute having branches for receiving coins from the measuring position, one of said branches being disposed for receiving coins released by said manually operable means, said structure including a crank having means for directing a coin released by movement of said member to the other of said branches.

3. In an electrical coin selector having a case, a relay in said case and means for energizing said relay upon placing a coin of predetermined character in a measuring position within said case; a coin chute formed in the case for guiding said coin to the measuring position; a rotatable member in said chute and normally disposed for restricting the passage of said coin beyond the measuring position; structure interconnecting said member and said relay for moving the member to a coin releasing position upon energization of the relay; and manually operable means for releasing coins from said measuring position that are incapable of causing energization of said relay, said chute having branches for receiving coins from the measuring position, one of said branches being disposed for receiving coins released by said manually operable means, said structure including a crank having means for directing a coin released by movement of said member to the other of said branches, said crank having means for directing additional coins inserted in said chute into said one branch while the member is being moved by the relay.

4. In a device of the character described, a measuring element having means for creating an electromagnetic field including a pair of normally balanced primary coils, and flux detection means including a secondary coil disposed in mutual inductive relation to said field; a standard disposed in the field of one of said primary coils for unbalancing the electromagnetic field, whereby to produce flux and thereby electromotive forces in the secondary coil; releasable structure for holding a coin to be tested in said electromagnetic field; a relay operably connected to said structure for releasing the same; and electrical means coupled with the relay and operable upon predetermined reduction of said electromotive forces in the secondary coil for energizing said relay, said electromotive forces being controlled by the character of the coin to be tested in said electromagnetic field, said electrical means including a circuit for the relay and a control tube for energizing said circuit, said tube having means connecting the same to the secondary coil for maintaining the tube normally inoperable by said electromotive forces, said electrical circuit being provided with means for applying a direct current negative bias to said tube when electromotive forces exist in said secondary coil and including elements for delaying the reduction of said negative bias as said forces in the secondary coil are reduced.

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