Aug. 24, 1943. F. E. A. WALLIN 2,327,945

APPARATUS FOR SEPARATING GENUINE FROM SPURIOUS COINS

Filed April 15, 1940

Fig. 1

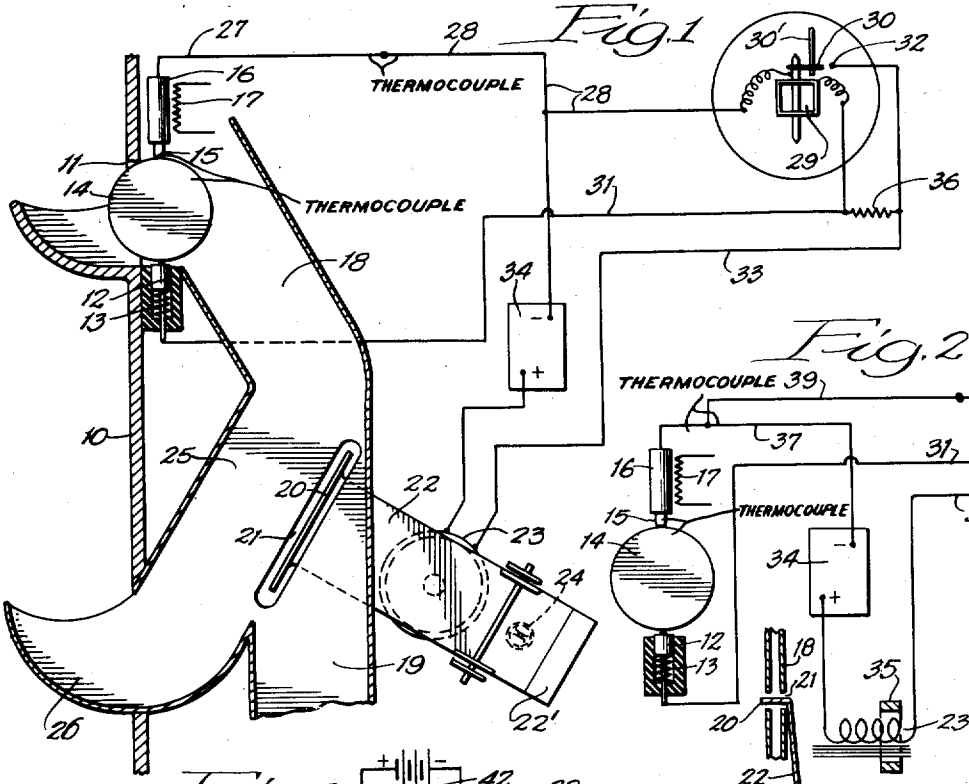


Fig. 2

Fig. 3

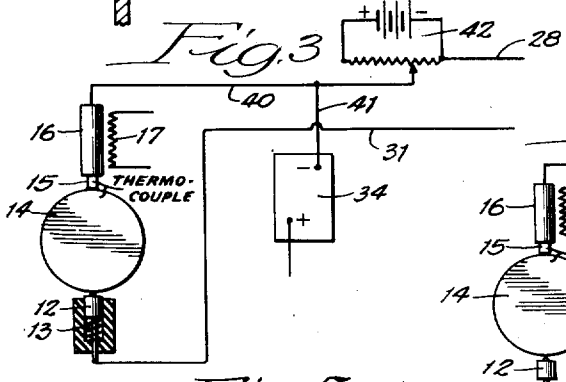


Fig. 4

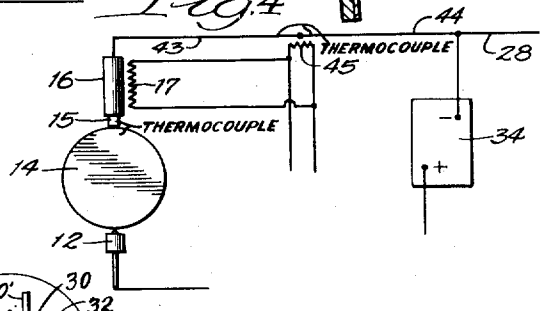
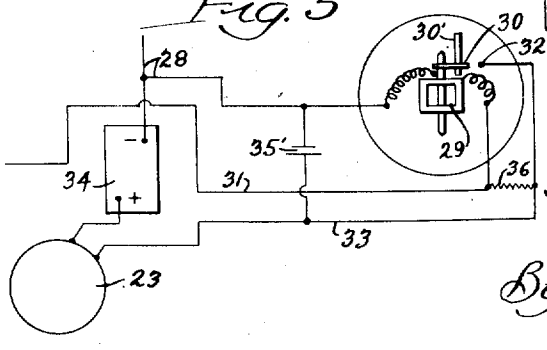


Fig. 5



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APPARATUS FOR SEPARATING GENUINE FROM SPURIOUS COINS

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14 Claims. (Cl. 194—100)

This invention relates to apparatus for separating genuine and spurious coins.

The improved apparatus is of the thermocouple type comprising a heated contact adapted to engage a coin. The thermo-electric couple resulting from this engagement produces a voltage, the magnitude of which is determined particularly by the nature of the metal of which the coin is made. Various metals and alloys under these circumstances give various characteristic thermocouple voltages and these characteristic voltages are, in accordance with the present invention, employed to effect the separation of genuine coins from slugs and spurious coins.

The invention is particularly adapted for employment with devices intended to receive United States nickels. It is an observed fact that the United States nickel, in contact with most other metals, constitutes a thermocouple which gives a higher thermo-electric current than does any other common metal, including the metals and alloys of which slugs and tokens are usually made, and also silver coins. Even coins of pure nickel, such as the Canadian nickel coin, give a lesser voltage, and likewise do alloys of the class generally referred to as German silver, which are sometimes employed as slugs. Certain metals, such as iron, give a thermo-electric voltage which is reversed in polarity with respect to the voltage produced by a United States nickel coin in the same location.

One of the objects of the invention is to provide an improved apparatus for separating genuine and spurious coins.

Another object of the invention is to provide such an apparatus which is incapable of response to spurious coins of selected thermocouple characteristics.

A further object of the invention is to provide such an apparatus, including a thermocouple circuit adapted to be completed by a coin to be tested, and to provide in such circuit means for supplying a voltage of desired value in opposition to the voltage produced by the coin.

Another object of the invention is to provide, in an apparatus of this type and which includes a sensitive relay, means for normally biasing the armature of the sensitive relay away from closed position.

Other objects, advantages and capabilities of the present invention will appear from the following description of preferred embodiments thereof taken in conjunction with the accompanying drawing, in which:

Figure 1 is a diagrammatic representation of a coin-actuated mechanism together with a typical circuit embodying my invention;

Figure 2 is a wiring diagram showing a modified form of my invention;

Figure 3 is a wiring diagram showing a still further modified form of my invention;

Figure 4 is a wiring diagram showing still another modified form of my invention; and

Figure 5 is a fragmentary wiring diagram showing a further modification.

The present coin separator may be used as a coin tester and it may also be used as a control device in a coin-actuated mechanism such as a vending machine, telephone pay station, etc. The invention is described and illustrated in connection with means suitable for use in a vending machine or the like. In such a machine, the control mechanism is, of course, located inside a cabinet 10. The coin is inserted through a suitable slot 11. As it passes through this slot, it engages a contact 12 which is resiliently pressed against it by a spring 13. The contact 12 forces the inserted coin 14 into engagement with a heated contact 15. The part of the contact 15 which engages the coin may be one of a large number of metals. Thus it may be of copper, but I prefer to employ silver in view of its superior contact characteristics and its high thermal conductivity.

Thus the element 15 may be of silver and is carried by a copper member 16. The member 16 may be relatively large to serve as a reservoir for heat. The thermo-electric properties of silver and copper are substantially similar. However, silver has better contacting properties. The element 15, 16 is maintained hot, for example, at a temperature of around 250° F., by means of a heater coil 17, which is connected to any suitable source of energy. The contact 12 is, of course, unheated. It is to be understood that I do not intend to limit the invention to the temperature stated, since the contact 15, 16 may be maintained at a much higher temperature or at a lower temperature, if desired.

A coin inserted past the two contacts 12 and 15 passes into a chute 18 from which it would fall into a chute 19. However, a gate 20 normally extends through a slot 21 in the side wall of the chute structure 18, 19, into the path of a coin moving downwardly into the chute 19. The gate 20 is carried by the armature 22 of an electromagnet 23 and it is biased into the chute structure 18, 19, by a spring 24 which is secured to this armature and to any suitable stationary element within the cabinet. The armature 22 is

preferably counterbalanced about its pivot by means of a weight 22' so that the gate 20 cannot be displaced by exterior shocks.

It will be seen that when the electromagnet 23 is not energized, the gate 20 effectively prevents a coin or token from passing from the chute 18 into the chute 19. The gate 20 is arranged to constitute a part of a chute 25 which extends from the chute 18 to a return cup 26. The general mode of operation of the device is that when a genuine coin is inserted through the slot 11, the electromagnet 23 is energized and this coin passes downwardly into the chute 19 where it may actuate an electric switch (not shown) or some other well-known mechanism which it is desired to actuate or release by a genuine coin.

On the other hand, when a spurious coin is inserted through the slot 11, the electromagnet 23 is not energized and the gate 20 diverts the coin into the chute 25 and thence into the cup 26 where it may be retrieved by its owner.

The member 16 is connected through a short conductor 27 and conductor 28 to one side of the coil 29 of a sensitive relay and also to the movable arm 30 of this relay. The other side of the coil 29 is connected by a conductor 31 to the contact 12. The relay may suitably be the same as that described in my prior Patent No. 2,107,402. When the thermo-electric current is sufficiently great, the coil 29 is energized sufficiently so that it throws the arm 30 into engagement with a stationary contact 32. This stationary contact 32 is connected by a conductor 33 to the winding of the electromagnet 23. The other side of this electromagnet is connected through a source of electrical energy, for example, through a battery 34, to the conductor 28, and consequently to the arm 30.

It will thus be seen that when the arm 30 moves into engagement with the contact 32, the electromagnet 23 is energized and the gate 20 is withdrawn out of the chute. It will here be noted that it is preferred to delay the return movement of the gate 20 into the chute to a slight extent, in order to insure that it will not return and block a genuine nickel before that coin has been able to fall past the slot 21. This may readily be obtained by providing a shading ring 35 around the end of the winding on the electromagnet 23 remote from the armature 22. The delay of deenergization of the electromagnet 23 may be accomplished in other ways. Thus, I may connect a condenser 35' across lines 28 and 33, as shown in Fig. 5. When the contacts 30 and 32 are in engagement, the condenser is discharged. When the contacts 30 and 32 separate, the condenser 35' is charged by the battery 34 and the charging current passing through the electromagnet 23 maintains the armature 22 with its gate 20 out of the chute 19 for sufficient time to enable a genuine coin to fall through the chute 18 and into the chute 19.

I prefer to connect the conductors 31 and 33 through a high resistance 36, for example a resistance of around 6000 ohms.

In the embodiment of the invention shown in Figure 1, I prefer to make the wire 27 of nickel or some other metal which produces a high voltage with the heated member 15, 16, which is opposed to the voltage produced between the coin 14 and the members 15 and 16. Thus, for example, a Canadian five-cent piece is substantially pure nickel. It will readily be understood that if a Canadian nickel is introduced between the contacts 12 and 15, then the voltage produced between the coin and the member 15, 16 would be nullified by the equal and opposite voltage produced between the nickel wire 27 and the contact member 15, 16.

When, however, a United States nickel 14 is inserted in the position shown in Figure 1, it produces voltage with the contact member 15, 16 which is greater than the voltage produced between the wire 27 and this contact member. Consequently, a current flows through the wire 27, conductor 28, coil 29, conductor 31, and coin 14. It will readily be understood that coins or slugs of other metals giving thermo-electric voltages less than or opposed to that produced by pure nickel, will cause a current in the opposite direction and the arm 30 will tend to move away from the contact 32 rather than towards it. A stop 30' is preferably provided to prevent excessive reverse movements of the arm 30.

It will be noted that the wire 27 need not be of the same material as the coin which it is intended to reject. Thus, the wire 27 may be of German silver or of some other metal of less thermo-electric power with respect to the contact 15, 16. In such a case, a Canadian nickel would cause the arm 30 to move towards the contact 32 to a slight extent, insufficient to complete the circuit through the electromagnet 23. The opposed voltage introduced by the wire 27 of German silver, or other metal, does, however, materially cut down the current which would be produced by a Canadian nickel, but this opposed voltage would not render ineffective the voltage produced by a genuine United States nickel. This reversed or opposed voltage may be produced in many different ways, certain of which are shown below. It is to be noted that the junction between the wire 27 and the conductor 28 is cold.

It is to be noted that the battery 34 is arranged so that its polarity is opposed to that of the thermo-electric current. Thus, with a genuine coin, the member 15, 16 becomes positive, while the coin 14 become negative. Consequently, the negative pole of the battery 34 is connected to the conductor 28.

When the arm 30 engages the contact 32, there may be a slight tendency for the arm to remain in this position. When the flow of current through coil 29 from conductor 28 to 31 ceases, as a result of the movement of the coin 14 past the contacts 12 and 15, 16, a small current flows from the positive side of the battery 34 through electromagnet 23, resistance 36 and coil 29 in the opposite direction so that a definite force is applied to withdraw the arm 30 away from the contact 32. When a coin engages contacts 12 and 15, 16, the battery current through resistor 36 is shunted through the coin.

In the embodiment of the invention shown in Figure 2, the contact member 15, 16 is connected to the negative terminal of the battery 34 by a suitable wire, for example a copper wire 37. I connect the wire 28 to the conductor 37 by means of a wire 39 which produces with copper, for example, a relatively high voltage in opposition to the voltage produced between the coin 14 and the contact 15, 16. The wire 39 is connected to the wire 37 at a position where this wire 37 is relatively hot. Thus, the wire 39 may be an alloy of the same metallic composition as a United States nickel. It may even have a higher thermo-electric power with respect to copper than does a United States nickel, or it may have a power

somewhat less. Nevertheless, it does produce voltage which opposes the voltage produced between the coin 14 and the heated member 15, 16.

In Figure 3 I connect the member 16 to the negative side of the battery 34 by conductors 40 and 41. The conductor 40 is connected to the positive contact of a potentiometer 42. The negative side of the potentiometer is connected to the conductor 28 which is, of course, connected as in Figure 1. It will readily be understood that any degree of opposed voltage may be applied to the thermo-electric voltage by simply adjusting the potentiometer 42 and that by this adjustment it is possible to set the device so that it will take a United States nickel and reject a Canadian nickel and all slugs of metals ordinarily used, including German silver slugs. On the other hand, by simply reducing the back voltage applied by the potentiometer 42, the device can readily be set so that it will accept both a United States nickel and a Canadian nickel.

This back voltage may be obtained in other ways. Thus, as shown in Figure 4, I connect the member 15, 16 by a wire 43 of suitable composition, such as copper, to a wire 44, such as a German silver wire, nickel wire, or, in fact, any wire which constitutes a thermocouple with copper and which will give, if the junction between the wires 43 and 44 is heated, a voltage which is opposed to the voltage produced between the coin 14 and contact 15, 16. The wire 44 is connected to the negative terminal of the battery 34 and to the conductor 28. The junction between the wires 43 and 44 is heated by means of a heating coil 45. The back voltage produced by the thermocouple 43, 44 depends upon the temperature at which the junction is heated.

This temperature may be controlled within wide range by varying the size and resistance of and the energy supplied to the heater 45. By adjusting the heat of the junction between the elements 43 and 44, a back voltage may be produced which enables me to arrange accurately for the rejection of coins or tokens which do not produce an adequate voltage with the contacts 15, 16.

The heaters 17 and 45 are preferably connected to the same source of heating current so that variations in line voltage result in similar variations of both the thermoelectric voltages, and since these voltages are in opposed relation, the effect of line voltage change is largely nullified.

Although the invention has been described in connection with specific details of preferred embodiments thereof, it must be understood that I do not intend to be limited to the specific details of these embodiments except in so far as set forth in the accompanying claims.

Having thus described my invention, I declare that what I claim as new and desire to secure by Letters Patent of the United States is:

1. A coin separator comprising a heated contact and an unheated contact adapted to be engaged simultaneously by a coin, a moving coil relay having its coil in series with said contacts and adapted to be energized by the thermoelectric current produced between the heated contact and the coin, a pair of contacts controlled by said relay, one of said relay contacts being connected to one side of said coil and physically carried by said coil, a work circuit connected to said relay contacts, means in said work circuit arranged to control the disposition of a coin after the coin has passed said heated and unheated contacts, a source of direct current in said work circuit, and a high resistance connected to the other relay contact and to the other side of said coils, the polarity of said source being arranged so that a slight current normally flows from the source through said coil in a direction to move the coil in the direction to separate the relay contacts.

2. In combination, a relay having a moving coil, a contact carried by said coil, a stationary contact adapted to be engaged by the moving contact, a control circuit including a source of current and said coil, one of said contacts being connected to one side of said coil, a work circuit including a source of direct current and said contacts, and a high resistance connected to the other contact and the other side of said coil, the polarity of said source being arranged normally to supply a current through said resistance and through said coil in a direction positively to move the movable contact away from the stationary contact.

3. In a coin selector, in combination, a pair of contacts adapted to be engaged by a coin in testing position, means for heating one of said contacts, a relay in circuit with said contacts for controlling the disposition of the coin and adapted to be closed when a thermo-electric voltage of predetermined degree is produced by said coin and said contacts, means for supplying an opposed current to said relay, and means controlled by a coin in testing position for preventing the supply of said opposed current to the relay.

4. In a coin selector, in combination, a pair of contacts adapted to be engaged by a coin in a testing position, means for heating one of said contacts, a relay in circuit with said contacts for controlling the disposition of the coin and adapted to be closed when a thermo-electric voltage of predetermined degree is produced by said coin and said contacts, a load circuit controlled by said relay and including a source of current, a circuit including said relay and said source of current tending to open said relay, and means controlled by a coin in testing position for preventing the supply to said relay of current tending to open said relay.

5. In a coin selector, in combination, a pair of contacts adapted to be engaged by a coin in testing position, means for heating one of said contacts, a relay in circuit with said contacts for controlling the disposition of the coin and adapted to be closed when a thermo-electric voltage of predetermined degree is produced by said coin and said contacts, a load circuit controlled by said relay and including a source of current, a circuit in shunt relation to said load circuit and including said relay and a resistance arranged to supply voltage to said relay opposed to said thermo-electric voltage, said contacts being arranged in shunt relation to said relay whereby a coin in testing position reduces the opposed voltage applied to said relay substantially to zero.

6. In a coin selector, in combination, a pair of contacts adapted to be engaged by a coin in a testing position, means for heating one of said contacts, a relay, a movable and a stationary contact controlled by said relay, a source of direct current, conductive means connecting said heated contact to one side of said relay, to the movable contact associated therewith, and to the negative side of said source, a conductor connecting the other of the first said contacts to the other side of said relay and to a resistance, a conductor connecting the stationary contact associated with said relay to the other side of said resistance and to the positive side of said source, and an electromagnetic load element for con-

trolling the disposition of the coin in circuit with said source and in circuit with the contacts associated with the relay and with said source.

7. In a coin selector having means for receiving a coin, a relay, and means controlled by the relay for controlling the disposition of the inserted coin, in combination, a heated contact adapted to engage the inserted coin, a second contact adapted to engage the coin when it is engaged by the heated contact, means completing a circuit through said contacts and relay, and means in said circuit for supplying a voltage in opposition to the voltage produced between the heated contact and coin.

8. In a coin selector having means for receiving a coin, a relay, and means controlled by the relay for controlling the disposition of the inserted coin, in combination, a heated contact adapted to engage the inserted coin, a second contact adapted to engage the coin when it is engaged by the heated contact, means completing a circuit through said contacts and relay, and thermocouple means in said circuit for supplying a voltage in opposition to the voltage produced between the heated contact and coin.

9. In a coin selector having means for receiving a coin, a relay, and means controlled by the relay for controlling the disposition of the inserted coin, in combination, a heated contact adapted to engage the inserted coin, a second contact adapted to engage the coin when it is engaged by the heated contact, means completing a circuit through said contacts and relay, said circuit completing means comprising a conductor having thermo-electric properties generally similar to the coin to be selected and having one end heated by said heated contact and an unheated end, said conductor being arranged to provide a thermocouple producing a voltage in opposition to the voltage produced between the heated contact and coin.

10. In a coin selector having means for receiving a coin, a relay, and means controlled by the relay for controlling the disposition of the inserted coin, in combination, a heated contact adapted to engage the inserted coin, a second contact adapted to engage the coin when it is engaged by the heated contact, means completing a circuit through said contacts and relay, including a conductor having thermo-electric properties generally similar to the heated contact, and a conductor having thermo-electric properties generally similar to the coin to be selected, second said conductor being connected to first said conductor at a heated position and having an unheated end, said conductors being arranged to provide a thermocouple producing a voltage in opposition to the voltage produced between the heated contact and coin.

11. In a coin selector having means for receiving a coin, a relay, and means controlled by the relay for controlling the disposition of the inserted coin, in combination, a contact adapted to engage the inserted coin, an electrical heating element for heating said contact, a second contact adapted to engage the coin when it is engaged by the heated contact, conductors completing a circuit through said contacts and relay, including conductors having different thermo-electric properties, an electrical heating element for heating a junction between said conductors of different thermo-electric properties to produce a voltage in opposition to the thermo-electric voltage produced between the heated contact and coin.

12. In a coin selector having means for receiving a coin, a relay, and means controlled by the relay for controlling the disposition of the inserted coin, in combination, a contact adapted to engage the inserted coin, an electrical heating element for heating said contact, a second contact adapted to engage the coin when it is engaged by the heated contact, conductors completing a circuit through said contacts and relay including conductors having different thermo-electric properties, an electrical heating element for heating a junction between said conductors of different thermo-electric properties to produce a voltage in opposition to the thermo-electric voltage produced between the heated contact and coin, and means connecting said heating elements to a common source of current.

13. In a coin selector having means for receiving a coin, a relay, and means controlled by the relay for controlling the disposition of the inserted coin, in combination, a heated contact adapted to engage the inserted coin, a second contact adapted to engage the coin when it is engaged by the heated contact, means completing a circuit through said contacts and relay, a source of voltage, and means for supplying voltage from said source to said circuit in opposition to the voltage produced between the heated contact and coin.

14. In a coin selector having means for receiving a coin, a relay, and means controlled by the relay for controlling the disposition of the inserted coin, in combination, a heated contact adapted to engage the inserted coin, a second contact adapted to engage the coin when it is engaged by the heated contact, means completing a circuit through said contacts and relay, and a potentiometer in said circuit for supplying a voltage thereto in opposition to the voltage produced between the heated contact and coin.

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