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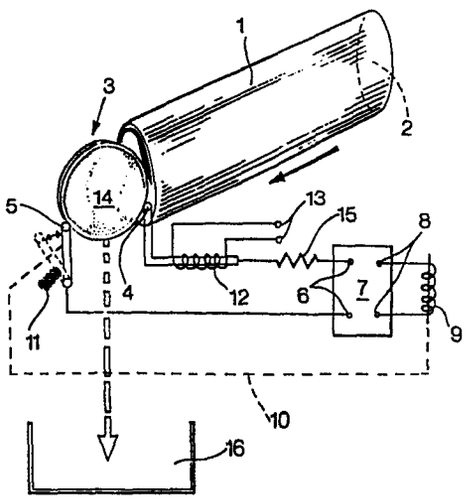
(54) Control means responsive to the presence of an article of a particular metal or alloy.

(57) A control device particularly for detecting the insertion of an incorrect coin or a counterfeit coin into a coin-actuated or coin-freed machine. The coin engages between a heated electrode (4) and an unheated conductor (5) and so the coin together with the electrode (4) and the conductor (5) forms "hot" and "cold" junctions. This generates an e.m.f. by a thermo-couple or the Seebeck effect. When the coin is made of the correct metal or quantity of metal the e.m.f. generated is sufficient to actuate a relay (9) to release the coin to actuate the machine or free it for actuation. Where the e.m.f. is insufficient the machine will remain inoperable. In that case the coin will be released after a predetermined time without operation of the machine.



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CONTROL MEANS RESPONSIVE TO THE PRESENCE OF AN ARTICLE OF A PARTICULAR METAL OR ALLOY

The invention relates to control means responsive to the presence of an article of a particular metal or alloy. The control means provided by the invention is particularly, but not exclusively, for permitting the operation of a coin-actuated or coin-freed machine only when an appropriate valid coin has been inserted into a coin-receiving slot of the machine and conversely to prevent the operation of the machine as a result of the insertion of an incorrect or counterfeit coin.

Coin-actuated or coin-freed machines such as gaming or amusement machines, ticket machines, dispensing machines, change-giving machines or coin-controlled telephones are often designed to receive coins of comparatively high denominations.

It is therefore becoming common for counterfeit coins made of materials other than the correct metal or alloy to be inserted into such machines or for coins of the realm of smaller denomination to be modified, for example to make them of the correct shape or size by the addition thereto of some other material such as a resin-based compound. An object of the invention is to provide control means which will detect such a counterfeit coin and so prevent the operation of the machine.

According to the invention, the control means is operable in response to the approach of an article made of a predetermined

metal or alloy into engagement with or into close proximity to an electrode made of a different metal or alloy, by the generation of an e.m.f. between the article and the electrode, the control means also including relay means operable by the e.m.f. to effect the actuation of a control member.

The article may be engaged between the electrode and a conductor spaced from the electrode, the control means also including means for heating the electrode whereby the part of the article engaging the electrode will become hotter than a part of the article remote from the electrode, said heated and unheated parts of the article thereby forming with the electrode and the conductor respectively "hot" and "cold" junctions, whereby an e.m.f. will be generated therebetween by a thermo-couple or Seebeck effect.

Preferably the electrode is heated by an induction winding positioned around the electrode. Alternatively the electrode may be heated by electrical resistance or by a gas flame or by other means.

Instead of the electrode being heated it may be cooled by an appropriate refrigerating coil, the part of the article which engages the electrode and the electrode itself thereby forming a "cold" junction and said remote part of the article and said conductor thereby forming a "hot" junction, an e.m.f. being produced, as before, by an electrocouple or Seebeck effect.

Where the control means is to be provided in a coin-actuated or coin-freed machine to permit the machine to be operated only when an appropriate valid coin has been inserted into a coin-receiving slot of the machine, the coin constitutes the aforesaid article and completes, when it has been inserted into the coin-receiving slot, an electrical circuit between the

electrode and the conductor, an e.m.f. of an effective magnitude being generated only where the coin is genuine, the e.m.f. therefore effecting operation of the relay means to permit actuation of the machine.

The relay means, when operated, may effect release of the coin from engagement with the electrode and permit the coin to fall into a receptacle for coins as well as freeing the machine for operation. The control means may also include means for releasing the coin from the electrode but without freeing the machine for operation when the required e.m.f. has not been generated, where a counterfeit coin has been inserted into the coin-receiving slot of the machine. The release means may be operable after the elapse of a predetermined time interval after insertion of the coin into the coin-receiving slot. The release means may be effective to release the coin into the aforesaid coin receptacle or to reject the coin from the machine. Alternatively the release means may be operative to deflect the coin into another coin receptacle, whereby only genuine coins are collected in the first-mentioned receptacle and coins deflected by the release mechanism are collected in the second-mentioned receptacle. The release means may also be effective to operate a warning device to indicate that a coin which is not of the correct denomination or which may be counterfeit has been inserted into the coin-receiving slot.

The electrode and the conductor may be positioned to be engaged either by the periphery of the coin or by respective faces at a central region of the coin. Where the electrode and the conductor are positioned to be engaged by the periphery of the coin, there may be a second electrode and a second conductor together with the coin forming a second electrical circuit operable in a similar manner to said first-mentioned electrode and conductor to produce a second e.m.f. of effective magnitude only where the coin is genuine, operation of said relay means

only being effected where each e.m.f. is of a required effective magnitude, said second electrode and said second conductor being positioned to be engaged by respective faces at a central region of the coin.

The invention also includes a coin-actuated or coin-freed machine including a control means as set out in the three immediately preceding paragraphs.

Although the control means provided by this invention is particularly for use in coin-actuated or coin-freed machines, the control means may have other applications. For example, the control means may be used to actuate a warning device or to stop a drill or other machine tool where a drill or other tool has cut through a non-metallic covering or layer or a covering or layer of a first metal or alloy and has engaged a lower or inner layer or part of a predetermined metal or alloy, the drill or tool being the aforesaid article and said lower or inner layer or part being the aforesaid electrode.

By way of example, a control means in accordance with the invention for a coin-actuated or coin-freed machine to distinguish between a genuine coin of the correct denomination and an incorrect or counterfeit coin is now described with reference to the accompanying schematic and circuit diagram.

This shows a downwardly-directed coin-receiving tube or chute 1 extending from a coin-receiving slot 2 and a coin-locating position 3. A coin 2 is illustrated in the position 3 in which it rests upright on a pair of spaced supports 4, 5. The support

4 is fixed and in this example is formed by a piece of stiff bare copper wire. The support 5 is also electrically-conductive and is movable from the supporting position shown in full-lines to a release position indicated in broken lines.

The support 4 is the aforesaid electrode and the support 5 is the aforesaid conductor. The electrode and the conductor are connected electrically to the input terminals 6 of a D.C. amplifier 7. The output terminals 8 of the amplifier 7 are connected to the solenoid of a relay 9. This has an armature which is connected mechanically at 10 to the conductor 5 to withdraw the latter from its supporting position shown in full-lines or to allow it to return under a return spring indicated at 11. The electrode 4 is heated continuously, or intermittently by means of a thermostatic control, during the period the machine is operable by an inductive or resistive coil 12 from an electrical supply 13. The coil 12 may be a secondary winding of a transformer. Alternatively, the electrode 4 could be heated by a gas flame or in some other way.

When a coin 14 is inserted into the slot 2, it will roll down the tube or chute 1 and will be held in the position 3 in which it bridges the electrode 4 and the conductor 5. The portion of the coin which is in contact with the heated electrode 4 rapidly becomes heated and so forms a "hot" junction with the electrode 4. The portion of the coin which is in contact with the conductor 5 is unheated and forms a "cold" junction. The metal of the electrode 4, i.e., copper, and the temperature to which it is heated are such that when a coin of the correct alloy e.g., a copper-nickel used for "silver" coins, at a temperature between room and body temperature bridges the electrode 4 and the conductor 5, an e.m.f. of a predetermined voltage or range of voltages will be generated by a thermocouple or Seebeck effect. A typical temperature to which the electrode 4 is heated is 60°C. When a

counterfeit coin of a material other than the correct alloy or a genuine coin of a smaller denomination, to which a periphery of another material has been attached, bridges the heated electrode 4 and the conductor 5, no e.m.f. or an e.m.f. which is considerably smaller than the required e.m.f. produced by a genuine correct coin will be generated.

The e.m.f. generated is applied to the input 6 of a D.C. amplifier 7. The input current at 6 may be reduced by a variable resistor set for a particular value of coin or by a fixed resistor 15 of a value which will give an input current of a required value corresponding to the e.m.f. produced by a genuine coin of a particular value. The output 8 of the D.C. amplifier 7 is applied to the solenoid of a relay 9 which will, when energised, withdraw the conductor 5 from beneath the coin 14 in position 3, thereby allowing the coin to fall into a receptacle 16 within the machine. The relay 9 also closes a switch (not shown) for rendering the machine operational for a game to be played or for vending, or for whatever is the function of the machine.

Where an incorrect or counterfeit coin is used, a time-controlled device may be actuated to withdraw the conductor 5 after a predetermined time (e.g., 2 seconds) after insertion of the coin and thereby to release the coin but without energising the relay 9 to render the machine operational. The incorrect or counterfeit coin would then fall into the receptacle 16 and thus be confiscated from the user. Alternatively the time-controlled device which withdraws the conductor 5, may cause the counterfeit coin to be deflected into a special receptacle within the machine, where counterfeit coins are collected or to discharge the counterfeit coin to a reject slot. The time-controlled device may actuate a warning device (not shown) to give visual and/or audible warning that a suspect coin has been inserted into the machine. The warning device may be mounted in the machine or be at a remote position.

Although the electrode 4 and the conductor 5 are touched by the periphery of the coin, the electrode 4 and the conductor 5 may alternatively be engaged by the faces of the coin at a central region of the coin or two sets of electrodes 4 and conductor 5 may be employed, one set to be engaged by the periphery of the coin and the other set to be engaged by the faces of the coin at a central region thereof. In the latter arrangement a required effective e.m.f. from each of the sets of electrode 4 and conductor 5 would be required to effect operation of the relay 9. The positioning of the electrode 4 and the conductor 5 to engage the faces of the coin at a central region thereof would check the metal or alloy at the central region of the coin and also that it is of the correct thickness. However the positioning of the electrode 4 and the conductor 5 so that they will be contacted by the edge of the coin is preferred because it is more likely that the periphery of a counterfeit coin will be of the wrong material, e.g., where a smaller lower denomination coin is converted to the shape and size of a larger higher denomination coin by attaching a resin-based compound to its edges or periphery.

The use of a thermocouple or Seebeck effect to generate an e.m.f. has been found to result in very sensitive adjustment between operation and non-operation with respect to any particular value of coin of a variable resistor or selection of an appropriate value of fixed reactor 15. There would, in a multiple coin machine, be a separate control means, as described herein, for each denomination of coin, the circuit in each control means having a different value of resistor 15 or a different setting of a variable resistor in order to give on inserting a genuine coin of that denomination a particular e.m.f. corresponding to that denomination of coin.

The relay may be a conventional solenoid type or relay or it may be any equivalent relay means, such as an electronic device.

The control means provided by this invention is more simple than conventional coin detecting and handling devices usually used in coin-actuated or coin-freed machines and is therefore cheaper to produce and also cheaper to maintain as very little servicing or adjustment would be required.

CLAIMS

1. A control means operable in response to the approach of an article made of a predetermined metal or alloy into engagement with or into close proximity to an electrode made of a different metal or alloy, by the generation of an e.m.f. between the article and the electrode, the control means also including relay means operable by the e.m.f. to effect the actuation of a control member.

2. A control means according to Claim 1 in which, in use, the article (14) engages between the electrode (4) and a conductor (5) spaced from the electrode (4), the control means also including means (12) for heating the electrode (4), whereby the part of the article (14) engaging the electrode (4) will become hotter than a part of the article remote from the electrode, said heated and unheated parts of the article (14) thereby forming with the electrode (4) and the conductor (5) respectively "hot" and "cold" junctions, whereby an e.m.f. will be generated therebetween by a thermo-couple or Seebeck effect.

3. A control means according to Claim 2 in which the means for heating the electrode (4) is an induction winding (12) positioned around the electrode.

4. A control means according to Claim 2 in which the electrode (4) is heated by electrical resistance.

5. A control means according to any of Claims 2 to 4 provided in a coin-actuated or coin-freed machine to permit the machine to be operated only when an appropriate valid coin (14) has been inserted into a coin-receiving slot (2) of the machine, the coin (14) constituting the aforesaid article

and completing, when it has been inserted into the coin-receiving slot (2), an electrical circuit between the electrode (4) and the conductor (5), an e.m.f. of an effective magnitude being generated only where the coin (14) is genuine, the e.m.f. therefore effecting operation of relay means (9) to permit actuation of the machine.

6. A control means according to Claim 5 in which the relay means (9), when operated, effects release of the coin (14) from engagement with the electrode (4) and permits the coin to fall into a receptacle (16) for coins as well as freeing the machine for operation.

7. A control means according to Claim 6 also including means for releasing the coin (14) from the electrode (4) but without freeing the machine for operation when the required e.m.f. has not been generated, where a counterfeit coin has been inserted into the coin-receiving slot of the machine.

8. A control means according to any of Claims 5 to 7 in which the electrode (4) and the conductor (5) are positioned to be engaged by the periphery of the coin (14).

9. A control means according to any of Claims 5 to 7 in which the electrode (4) and the conductor (5) are positioned to be engaged by respective faces at a central region of the coin (14).

10. A control means according to Claim 8 in which there is a second electrode and a second conductor together with the coin forming a second electrical circuit operable in a similar manner to said first-mentioned electrode (4) and conductor (5) to produce a second e.m.f. of effective magnitude only where the coin (14) is genuine, operation of said relay means (9) only being effected where each e.m.f. is of a required

effective magnitude, said second electrode and said second conductor being positioned to be engaged by respective faces at a central region of the coin (14).

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