Dec. 2, 1969 M. MELONI 3,481,443

COIN CHECKING DEVICE

Filed Jan. 18, 1968 3 Sheets-Sheet 1

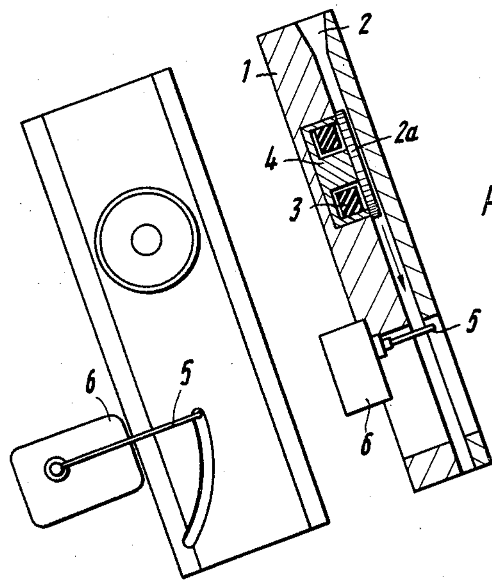

Fig. 1

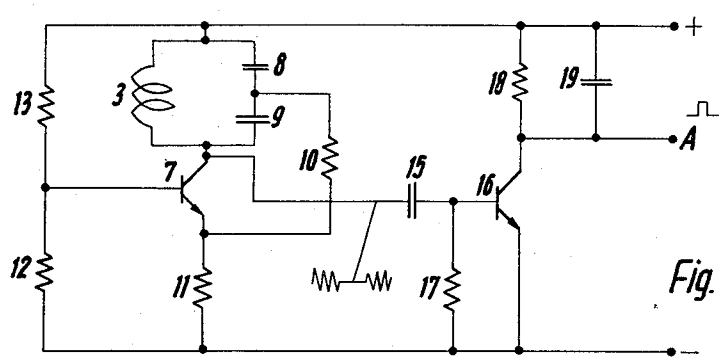

Fig. 2

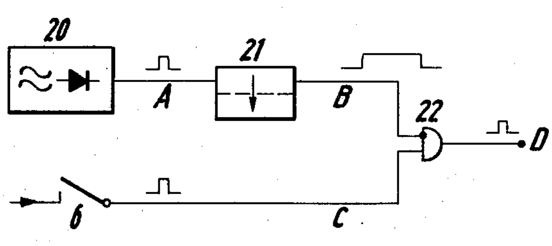

Fig. 3

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COIN CHECKING DEVICE

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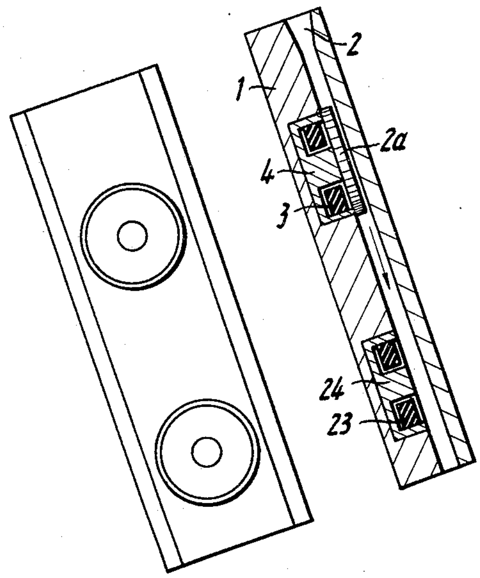

Fig. 4

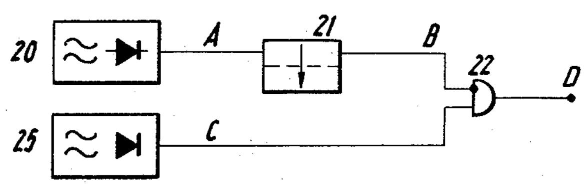

Fig. 5

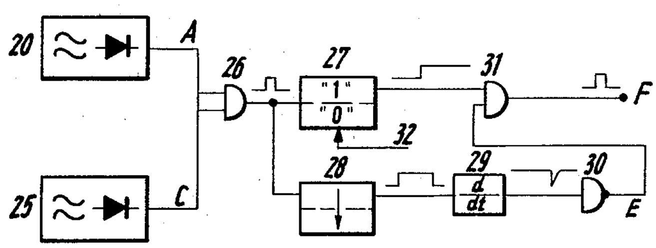

Fig. 6

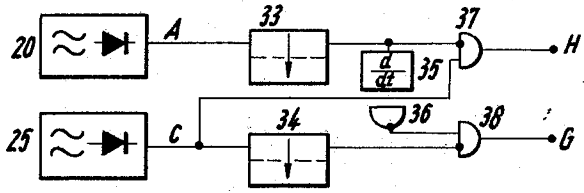

Fig. 7

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COIN CHECKING DEVICE

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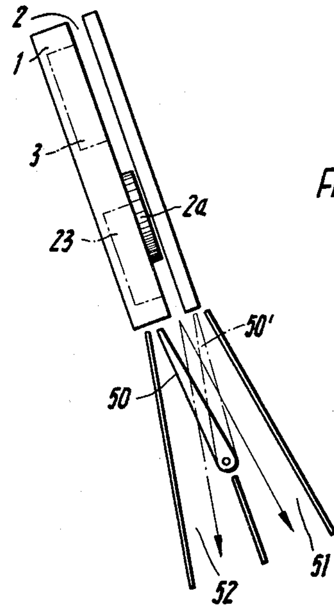

Fig. 8

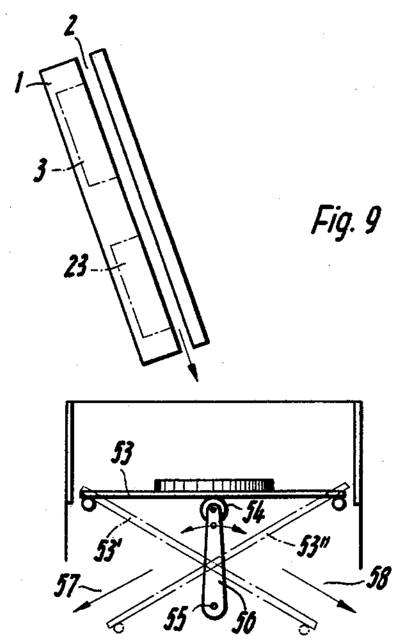

Fig. 9

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United States Patent Office

3,481,443
Patented Dec. 2, 1969

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3,481,443

COIN CHECKING DEVICE

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Filed Jan. 18, 1968, Ser. No. 698,926
Claims priority, application Switzerland, Jan. 20, 1967, 974/67
Int. Cl. G07f 3/02
U.S. Cl. 194—100 3 Claims

ABSTRACT OF THE DISCLOSURE

A coin checking device for vending machines and telephone kiosks has a coin path for metal bodies which are to be checked extending through the field of at least one self-induction coil which is part of the oscillatory circuit of an oscillator so constructed that its oscillations discontinue completely or do not discontinue, depending upon the electrical and magnetic properties of a metal body travelling along the coin path, the acceptance or rejection of the metal body depending upon whether the oscillations discontinue.

The invention relates to a coin tester, in particular for automatic vending machines and coin-operated telephones.

The object of the invention is to differentiate acceptable coins from unacceptable coins or metal objects in coin form and, where appropriate, to differentiate acceptable coin denominations from each other by virtue of the electrical and magnetic properties (for example, eddy current and magnetic hysteresis losses) of their alloy or cladding.

According to the invention, this is achieved in that the coin chute for the metal object of coin form to be tested extends through the field of at least one inductance coil which is part of a tuned circuit of an oscillator, so constructed that the action of a metal object passing through said coin chute causes oscillations of said oscillator to temporarily cease or not cease, depending on the electrical and magnetic properties of said metal object, acceptance or non acceptance respectively thereof depending on whether said oscillations cease.

Cessation of the oscillation may, for example, correspond to an acceptable coin and noncessation may correspond to a nonacceptable metal object, or vice versa.

By appropriate selection of the oscillator frequency, the penetration depth of the magnetic field into the metal may preferably be selected at a value smaller than the coin thickness. For the testing of cladded coins, the oscillator frequency can be selected at a value at which the penetration depth is no greater than the thickness of cladding, so that only the alloy of the cladding material but not the parent metal affects the test.

The oscillator oscillations are appropriately supplied to a rectifier whose output provides a pulse in the event of temporary cessation of the oscillations, said pulse being a criterion for the acceptability or non acceptability of the coin or of the metal object, respectively.

Appropriately, the pulse of one or more oscillator rectifier circuits connected to coils of the same coin chute are evaluated in a logic circuit in order to provide control pulses suitable for the operation, for example, of the automatic vending machine, or of the coin-operated telephone.

Examples of the coin tester according to the invention, are described hereinafter by reference to the drawings in which:

FIG. 1 is a plan view and longitudinal section of the mechanical part of an electronic coin tester with an oscillator coil,

FIG. 2 is the oscillator circuit and rectifier associated with said mechanical part,

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FIG. 3 is a block circuit diagram for evaluating the signals supplied by the arrangement illustrated in FIG. 1 and by the oscillator circuit with rectifier according to FIG. 2,

FIG. 4 is a plan view and longitudinal section of a modification of the arrangement according to FIG. 1 with two coils,

FIG. 5 is a block circuit diagram for an evaluation circuit for testing a coin denomination by means of the arrangement illustrated in FIG. 4,

FIGS. 6 and 7 being one block circuit diagram each of an evaluation circuit for testing two coin denominations by means of the arrangement according to FIG. 4,

FIGS. 8 and 9 being one diagrammatic view each of apparatus for conveying the coins and other metal objects in coin form after testing thereof.

According to FIG. 1, a block **1** is provided with a coin chute **2** in which a metal object **2***a* of coin form can slide downwardly at an angle. The said chute extends directly via an induction coil comprising a winding **3** and a core **4**. Owing to the inclined position, the coin slides directly over the coil. Below the coil and on its travel, the coin meets a light lever **5** of a switch **6**, which said coin operates during its passage.

FIG. 2 illustrates the circuit of an oscillator and rectifier. The numeral **7** refers to the transistor of the oscillator in whose collector circuit a parallel tuned circuit is connected, formed by the self-inductance of the winding **3** (FIG. 1) and two serially connected capacitors **8** and **9**. The tuned circuit terminal facing away from the transistor 7 is connected to the positive terminal of the feed source, which is not shown. The terminal common to both capacitors **8** and **9** is connected via a resistor **10** to the emitter of the transistor **7**, which in turn is connected via a resistor **11** to the negative terminal of the driving voltage source. The operating point of the transistor **7** is adjusted by the resistor **10**, a voltage divider comprising two resistors **12** and **13** whose tapping is connected to the base of the transistor **7**, and by the ratio of the capacitances **8** and **9**, so that the oscillations of the oscillator temporarily cease, or do not cease due to the effect of a metal object **2***a* of coin form passing through the coin chute **2** and depending on the electrical and mechanical properties of said metal object.

The numeral **16** refers to the transistor of the rectifier (with amplification), whose base is connected via a capacitor **15** to the collector of the transistor **7**. If the oscillator does not oscillate, the transistor **16** is blocked, the emitter of said transistor being connected directly to the negative terminal of the driving voltage source and its base being connected thereto via a resistor **17**. The output A, connected to the collector of the transistor **16** and relating to the circuit which is connected via a resistor **18** to the positive terminal of the driving voltage source, will have the potential thereof. If the oscillator oscillates, the transistor **16** will be conductive during the positive half-cycle and the voltage at the output A will become more negative than the positive terminal of the driving voltage source. A capacitor **19** is connected in parallel to the resistor **18**, its function being to smooth the voltage at point A. (In the description which follows, the logic level "1" is assigned to the voltage value at the output A when the oscillator does not oscillate while the logic level "0" is allocated thereto when the oscillator is in oscillation.)

When the oscillator is so adjusted that an acceptable coin (but no other metal object) causes the oscillator oscillations to cease, a pulse at the output A will indicate that such a coin has passed through the coin chute **2** along the coil **3**. This pulse can be employed for triggering appropriate control functions.

If the oscillator is so adjusted that all unacceptable metal objects in coin form (but not an acceptable coin) cause cessation of the oscillator oscillations, it will be possible to employ evaluation circuits of the kind illustrated in FIGS. 3–7, capable of evaluating the pulse generated by the circuit according to FIG. 2 and that supplied by the switch 6 (for example, a corresponding electronic device).

In FIG. 3, the numeral 20 refers to the circuit according to FIG. 2 with the output A, the numeral 21 refers to a univibrator which elongates a pulse occurring at output A to deliver said pulse at its output B; the numeral 6 refers to the switch already mentioned in the description of FIG. 1, said switch together with a current source not shown forming a pulse transmitter which delivers a pulse for each object passing through the coin chute 2, said pulse occurring at C after the pulse which occurs at output A, but prior to termination of the pulse which occurs at the output B. The pulse triggered by the switch 6 is conducted to the input of an AND gate 22, whose other input is a blocking input connected to B.

If the univibrator 21 is inactive on arrival of a pulse from 6, a situation corresponding to an acceptable coin, a signal (coin acceptance signal) will appear at the output D to indicate the passage of an acceptable coin, said signal also being able to control an automatic vending machine or coin-operated telephone in a manner not described.

However, if the coin is not acceptable, the univibrator 21 will be activated on arrival of the pulse at C, thus blocking the passage of said pulse through the AND gate 22, to prevent the generation of a coin-acceptance signal.

FIG. 4 shows an arrangement similar to that of FIG. 1, but in which the pulse transmitter with the switch 6 (FIG. 1) is replaced by a second induction coil having a winding 23 and a core 24. This coil, corresponding to coil 3, is part of a second oscillator circuit with rectifier corresponding to the circuit according to FIG. 2, but being adjusted as described herein below as regards cessation of the oscillator oscillations.

FIG. 5 is a block ciriuit diagram of a logic evaluation circuit for testing a coin denomination with the system illustrated in FIG. 4. In this, the numeral 20 refers to the first oscillator circuit with rectifier connected to the winding 3, while the numeral 25 refers to the second oscillator circuit connected to the winding 23. The method of operation is the same as in FIG. 3. The oscillator of the second circuit 25 is so adjusted that every metal object passing by the coil 23, including an acceptable coin, causes cessation of the oscillations of said oscillator.

The arrangement according to FIG. 4 may also be employed for testing whether one of two different coin denominations is present. FIG. 6 shows an evaluation circuit suitable for such procedure. In this circuit, the numeral 20 once again refers to the oscillator circuit with rectifier connected to the coil 3, while the numeral 25 refers to the oscillator circuit with rectifier connected to the coil 23. The oscillators are so adjusted that one coin of one denomination causes the oscillation of one oscillator to cease, while a coin of the other denomination causes only the oscillations of the other oscillator to cease, and a nonacceptable metal object causes the oscillations of both oscillators to cease. The outputs A and C of both circuits 20 and 25 are connected to the inputs of an OR gate 26, whose output will therefore deliver a pulse, if a pulse occurs in one of the two circuits 20 and 25, that is to say, the oscillations of the affected oscillator will cease. The output of the said gate 26 is connected to the input of a univibrator 28, which elongates the pulse occurring at its input. A differentiating circuit 29, connected to the output of the univibrator 28, delivers a negative pulse at the end of the pulse delivered by the univibrator 28, said negative pulse being converted by the inverter 30 at the output E thereof into a positive pulse, which is transferred to the input of an AND gate 31. Elongation of the pulse by the univibrator 28 is sufficient to ensure that the pulse occurs at the output E, after the possible appearance of the pulse at the output of the circuit 25. The output of the OR gate 26 is also connected to the balanced input of a flip-flop 27, set to the "0" position prior to each test via a zero setting input 32, by circuit means not shown, the position of said flip-flop being altered by each pulse arriving at the balanced input. The other input of the AND gate 31 is connected to the output of the flip-flop 27.

A coin of one of the two acceptable denominations causes only one pulse to occur at the output of 26, while the flip-flop 27 will be in the "1" position when a pulse arrives at the output E of the inverter 30. The AND gate 31 is rendered conductive by the flip-flop 27 to allow passage of the pulse from the output E. The pulse appearing at the output F of the AND gate 31 is the coin acceptance signal.

If the metal object is not acceptable, two pulses will arrive at the input of the flip-flop 27 to set said flip-flop first to "1" and then to "0", whereupon the AND gate 31 is driven to cut off, so that the pulse delivered by the inverter 30 cannot produce a coin-acceptance signal at the output F.

The arrangement illustrated in FIG. 4 can be employed with the circuit illustrated in FIG. 6, if different alloys are employed for a certain coin denomination, for example, for Swiss 20 cent pieces, for which a magnetic alloy was employed for a time while a nonmagnetic alloy was employed at other times, while the external appearance remained the same. The arrangement may however also be employed for testing two coins of different denomination, where it is also possible for such coins to have different diameters, if arrangement of the coin chute 2, for example, its inclined position, ensures that each coin denomination always passes in the same position by the coils 3 and 23.

FIG. 7 illustrates a circuit which indicates whether one coin denomination of two coin denominations and which denomination thereof is present, and which circuit can also be employed in conjunction with the arrangement illustrated in FIG. 4. The numeral 20 refers to the oscillator circuit and rectifier connected to the coil 3, whlie the numeral 25 refers to the oscillator circuit and rectifier connected to the coil 23. The pulse delivered at the output A of the circuit 20, is elongated in a univibrator 33, while the pulse delivered at output C of the circuit 25 is elongated in a univibrator 34. The pulse delivered by 33, is differentiated in a differentiating circuit 35 and is inverted in an inverter 36. A pulse, delivered to an input of an AND gate 38 and occurs after a pulse which may appear at the output C of 25, will thus arrive at the output of 36. The other input of the AND gate 38 is a blocking input connected to the output of the univibrator 34, so that the gate 38 is driven to cut off if the univibrator 34 is activated. One input of the AND gate 37 is connected to the output of the univibrator 33, while the other input is connected to the output of the circuit 25. The oscillators of the circuits 20 and 25 are adjusted as explained by reference to FIG. 6.

Three different cases may occur:

(1) An acceptable coin of the first kind produces a pulse at output A but no pulse at output C. The pulse at output A activates the univibrator 33. At the end of the pulse delivered by the univibrator 33, a pulse will appear at the output of the inverter 36 and pass through the gate 38, since the univibrator 34 will be inactive, for which reason the gate 38 will not be driven to cut off. The pulse which indicates that an acceptable coin of the first kind is present will appear at the output G of the gate 38.

(2) An acceptable coin of the second kind produces a pulse at output C of the circuit 25 but no pulse at output A. The pulse at output C activates the univibrator 34, a procedure which has no further consequences. The said pulse passes through the gate 37, which is not driven to cut off by the univibrator 38. A pulse which indicates that an acceptable coin of the second kind is present appears at output H of the gate 37.

(3) A nonacceptable coin produces a pulse at output

A as well as at output C, both univibrators **33** and **34** are activated and drive the gates **37** and **38**, respectively, for the pulse arriving from **25** and **36** respectively, to cut off, so that no pulse appears at the two outputs H and G, thus indicating that the metal object in coin form is not acceptable.

The circuits according to FIGS. 6 and 7 may appropriately be extended for more than two coin denominations, the number of coils on the coin chute having to be correspondingly increased.

According to FIG. 8, a branch is disposed at the end of the coin chute **2**. In the solidly drawn position of the tongue **50** as shown, the nonacceptable coin, or some other metal object drops from the chute **2** into a duct **51** for nonacceptable coins and metal objects. The coin-acceptance signal at the output D in FIGS. 3 or 5, or F in FIG. 6, or H or G in FIG. 7, causes (by means not shown) the tongue to pivot into the position **50′** shown in dot-dash lines, so that an acceptable coin drops into the coin-acceptance chute **52**.

The apparatus according to FIG. 9 is provided with a tilting plate **53** for the same purpose, said tilting plate being capable of being tilted into a first and into a second inclined position by means of an arm **56**, pivotable about an axis **55** and provided at its free end with a roller **54**. In the first inclined position **53′**, obtained by a coin-acceptance signal, the acceptable coin slides in the direction of the arrow **57** into a coin-receiving duct, in the second inclined position **53″**, obtained in the absence of a coin-acceptance signal, the nonacceptable coin or the other metal object, respectively, slides in the direction of the arrow **58** into a duct provided therefor.

I claim:

1. A coin tester for automatic vending machines, coin-operated telephones, and the like, comprising a coin chute through which a metal object of coin form to be tested may pass, an oscillator having a tuned circuit, at least one inductance coil in the tuned circuit having a field through which said chute extends, said oscillator so constructed that the output alternating current produced thereby ceases if the metal object passing through said coin chute does not possess predetermined electrical and magnetic properties corresponding to the coin denomination to be accepted, a rectifier supplied by the alternating current produced by said oscillator and having an output delivering a first pulse in the event of temporary cessation of the alternating current from said oscillator, means for elongating the first pulse, a pulse transmitter connected to be operated by an object passing through said coin chute through the field of said inductance coil to deliver a second pulse, and a gate circuit having a first and a second input, said first input connected to the output of the means for elongating the first pulse and adapted to be biased thereby, said second input connected to the output of said pulse transmitter and adapted to be biased by said second pulse and said gate circuit having an output on which a coin-acceptance signal appears if only said second input is biased.

2. A coin tester as set forth in claim **1**, in which said pulse transmitter includes a second oscillator having a tuned circuit, a second inductance coil in the tuned circuit of the second oscillator having a field through which said chute extends, a rectifier circuit connected to the output of said second oscillator, said second oscillator so constructed that the output alternating current produced thereby is temporarily interrupted by the effect of all metal objects of approximately coin size passing through said coin chute, said rectifier circuit operative to rectify the alternating current from said second oscillator and to deliver a second pulse in the event of temporary cessation of the alternating current from said second oscillator.

3. A coin tester as set forth in claim **1**, in which said pulse transmitter comprises a switch means, a switch operating arm movably connected to said switch means and extending into said coin chute in the path of travel of objects passing through said chute and said switch arm connected to be moved by an object passing through said chute to actuate said switch means and produce said second pulse.

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