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(54) **Coin processing apparatus**

Münzverarbeitungsvorrichtung

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Description

BACKGROUND OF THE INVENTION

1. Technical Field of the Invention

[0001] The present invention relates to an abrasion resistant member and a coin discriminating sensor for preventing occurrence of noise caused by static electricity, suitable for a coin processing apparatus employing a coin discriminating method of discriminating coins while sliding and conveying coins on a path by a transporting belt, and particularly coin processors.

2. Description of the Related Art

[0002] Japanese Patent Application No. 2,539,521 B2 discloses an example of a coin conveyance device of a coin processor, in which a mirror-finished iron metal member is described as a coin path member. The outline of the device will be described hereinbelow with reference to FIG. 1.

[0003] Coins M are conveyed from a hopper 201 along a path face 204a of a coin path 204 by a belt 207 and a rubber roller 208 looped over pulleys 205 and 206 on the coin path 204 and reach the side of a coin path 211. The coin path 211 has a coin rail 223 projected from the path face 211a, and a plurality of windows(coin assorting holes) 222(222a to 222f). Dimensions 221(221a to 221f) of each from the outer face of the rail 223 to the outer side of the windows 222 correspond to the outer diameters of coins. A conveyance belt 215 that runs between a driving pulley 213 and a driven pulley 214 is provided in a tensioned state over the windows 222. On the inside of the conveyance belt 215, presser rollers 251 each having a truncated cone shape are disposed. The coins M are conveyed while being slid in a state where the coins M are pressed against the conveyance belt 215 on the path face 211a of the coin path 211, so that the coins M drop from the corresponding windows 222 and housed in a housing portion(not shown) disposed below the windows 222. As described above, the coins M slide along the coin path faces 224a and 211a in a pressed state by the conveyance belts 207 and 215.

[0004] As a path member of each of the coin paths 204 and 211, a rolled steel plate bright member as a mirror-finished iron metal member is used. The surface of the member is subjected to a salting-in nitriding process to form a surface hardened layer and, after that, the surface hardened layer is polished, thereby obtaining a smoothed surface hardened layer. The path faces 204a and 211a are made of an iron metal member having a smooth surface hardened layer.

[0005] Although an abrasion resistant plate made of an iron material can be used for the path portion other than a discriminating section in the conventional device, in the case of using a magnetic type coin sensor, if an iron material is used, the magnetic flux is shielded. Consequently, the iron material cannot be used for the path member in the path section in which a coin sensor is positioned.

[0006] Conventionally, therefore, a plate of ceramics (insulator) is provided in a tensioned manner on the path face. Specifically, a magnetic sensor for discriminating coins is disposed in the coin conveying path section, ceramics having high abrasion resistance is attached to an object passing portion so as to be easily detached, and the portion is used as a part of the conveyance path. Consequently, coins slide on the coin path. In environments of low temperature and low moisture, coins made of metal slide on the ceramics at high speed, so that static electricity is charged in the coins and often discharged in some places. Due to the discharging of the static electricity, noise(circled portion) occurs in sensor sensed data as shown in FIG. 2, and a problem such as identification precision is not improved occurs.

[0007] As a countermeasure against static electricity, conventionally, a signal waveform is traced by software and a portion in which the sudden change occurs is not used for a discriminating process, thereby preventing an influence of static electricity noise is required. The occurrence of noise is not prevented even by performing a noise eliminating process by software. When noise which is not expected by the noise eliminating software occurs, a failure may occur. It is therefore necessary to prevent occurrence itself of noise.

[0008] United States patent publication no. 4,086,527 (Cadot) discloses an apparatus for the authentication of monetary articles, using a magnetic detector, wherein the detected signals are altered due to the coins passing nearby.

SUMMARY OF THE INVENTION

[0009] The present invention is devised in the light of such background, an object of the present invention is to provide an abrasion resistant member in a coin conveying path and a coin discriminating sensor capable of preventing occurrence of static electricity.

[0010] The present invention relates to an abrasion resistant member in a coin conveyance path for discriminating coins and the object of the present invention is achieved by a conductive material in a thin plate shape adhered so as to cover a path face faced by a magnetic sensor provided so as to face the under face of the coin conveyance path or to cover both path guides for path regulation provided on both right and left sides in the travel direction of coins, in the coin conveyance path having a coin discriminating sensor for discriminating the kind of each of coins conveyed one by one with a spacing therebetween along a sliding face.

[0011] Another invention relates to a coin discriminating sensor and the object of the present invention is realized by a coin discriminating sensor including a coin path portion, a reflection type sensor disposed so as to face the under face of the coin path portion, a first trans-

mission type sensor disposed so as to sandwich one lateral end of the path, and a second transmission type sensor disposed so as to sandwich the other lateral end of the path, and the coin path portion of the coin discriminating sensor is made of a conductive material.

[0012] Further, the two inventions are more effectively achieved by using conductive ceramics as the conductive material and by using conductive alumina or conductive zirconia as the conductive ceramics.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] In the accompanying drawings:

FIG. 1 is a diagram for explaining a conventional coin path member;
FIG. 2 is a sensor output waveform on which noise is multiplexed in the case where the conventional path member is used;
FIG. 3 is a partial sectional perspective structural view showing an example of coin detection sensor used in the present invention;
FIG. 4 is a sectional structural view of the coin detection sensor used in the present invention;
FIG. 5 is a block diagram showing a processing system of excitation and detection signal of coin detection sensor;
FIG. 6 is a characteristic diagram showing an example of detection signal of coin detection sensor;
FIG. 7 is a structural diagram showing an example of the configuration of a first coin path according to the present invention; and
FIG. 8 is a structural diagram showing an example of the configuration of a second coin path according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] Further, in the present invention, to prevent charging with static electricity a conveyed coin and to provide a path member having excellent abrasion resistance without deteriorating magnetic detection sensitivity, conductive ceramics(conductive alumina or conductive zirconia) is adhered to the coin sliding face of a magnetic sensor. The conductive ceramics is conductive and does not cause an eddy current so much. Since the resistivity of conductive ceramics is about 1000 times as high as a general metal, occurrence of an eddy current is about $1/10^3$ (0.01%). Consequently, the conductive ceramics does not exert an influence on the quality of a magnetic signal, nor cause a problem of abrasion at the time of conveyance of coins, but has durability. In case of making the surface on which coins slide of a coin path of a magnetic sensor of a conductive material to eliminate noise caused by discharging of static electricity or discharging the static electricity charged on the ground(earth portion), it is feared that the signal attenuates and cannot be used for discrimination because the kind of a metal piece is discriminated by detecting an eddy current loss which occurs in coins. According to the present invention, however, there are no such problems.

[0015] A preferred embodiment of the present invention is described below with the accompanying drawings.

[0016] FIG. 3 is a partial sectional perspective view of a structure of a coin detection sensor 10 of the present invention, and FIG. 4 is its sectional view. The coin detection sensor 10 is shaped in a pi-form having a clearance for detaching and attaching a conveying belt (not shown) in its upper part, and a central rectangular bottom space forms a passage 11 of coin, and a shield plate 12 for shielding external magnetism laminated on the outer circumference. The coin detection sensor 10 has a U-letter shape having, in its upper portion, a gap for attaching the conveyance belt (not shown). The bottom portion of a rectangular space in the center portion serves as a path 11. On the outer surface, a shield plate 12 for shielding external magnetism is formed.

[0017] In the coin detection sensor 10, side sensors 20 and 30 of transmission detection type, each having a rectangular parallelepiped shape, are disposed each so as to sandwich an end portion of the path 11, and a cylindrical-shaped center sensor 40 of a reflection detection type is disposed below the path 11. The side sensors 20 and 30 are symmetric with respect to the center of the detection sensor 10. As for the side sensor 20, a primary coil 21 and a secondary coil 23 are wound around upper and lower portions, respectively, of a side core 22 having a U-letter shape which opens on the right side, and a primary coil 31 and a secondary coil 33 are wound around upper and lower portions, respectively, of a side core 32 having a U-letter shape which opens on the left side. The center sensor 40 has a cylindrical pot core 41. A primary coil 42 is wound around the pot core 41, and a secondary coil 43 is wound on the inner groove of the pot core 41 and buried. Further, a coin(not shown) for a temperature sensor is provided.

[0018] Although an abrasion resistant plate made of zirconia which is a non-conductive material is conventionally used as the material of the path 11, in the present invention, conductive ceramics(conductive alumina or conductive zirconia) is used.

[0019] In the present invention, an exciting and signal-detecting process is performed with a circuit configuration shown in FIG. 5 on the coin detection sensor 10. Specifically, an ocillation signal from an oscillator 1 is frequency-divided by a frequency divider 2 into a low frequency(4 kHz), an intermediate frequency(16 kHz) and a high frequency(250 kHz) which are modulated(added) by an adder 4 via band pass filters(BPFs) 3L, 3M and 3H for the low, intermediate and high frequencies, respectively. The resultant is applied to the primary coils 21, 32 and 42 of a coin detection sensor 10 via a current amplifier 5. That is, a composite excited signal of the low, intermediate and high frequencies is supplied to the primary coils 21 and 31 of the side sensors 20 and 30 and to the

primary coil 42 of the center sensor 40 via the current amplifier 5.

[0020] Outputs of the secondary coils 23, 33 and 43 are detected as output through amplifiers 44, 44L and 44R, respectively, and are passed to band pass filters, full wave rectifiers and low pass filters, thereby obtaining a reflected 4KHz signal R4S, a reflected 16KHz signal R16S, a reflected 250KHz signal R250S, a transmitted L4KHz signal TL4S, a transmitted L16KHz signal TL16S, a transmitted L250KHz signal TL250S, a transmitted R4KHz signal TR4S, a transmitted R16KHz signal TR16S, and a transmitted R250KHz signal TR250S. Specifically, an output of the secondary coil 43 of the center sensor 40 is frequency-divided by band-pass filters(BPFs) 451 to 453 via an amplifier 44 into low, intermediate and high frequencies which pass through full wave rectifiers 461 to 463 and low pass filters(LPFs) 471 to 473. A reflected 4KHz signal R4S, a reflected 16KHz signal R16S, and a reflected 250KHz signal R250S are thereby obtained. The center sensor 40 takes the form of an eddy current loss type magnetic sensor by the primary coil 42 and the secondary coil 43.

[0021] An output of the secondary coil 23 of the side sensor 20 passes through an amplifier 44L and is frequency-divided by band pass filters(BPFs) 45L1 to 45L3 into low, intermediate and high frequencies, respectively, which are further passed to the full wave rectifiers 46L1 to 46L3 and low pass filters 47L1 to 47L3. The transmitted L4KHz signal TL4S, transmitted L16KHz signal TL16S, and transmitted L250KHz signal TL250S are thereby obtained. An output of the secondary coil 33 of the side sensor 30 passes through an amplifier 44R and is frequency-divided by band pass filters(BPFs) 45R1 to 45R3 into low, intermediate and high frequencies, respectively, which are further passed to the full wave rectifiers 46R1 to 46R3 and low pass filers(LPFs) 47R1 to 47R3. The transmitted R4KHz signal TR4S, transmitted R16KHz signal TR16S, and transmitted R250KHz signal TR250S are thereby obtained. Further, an output of the secondary coil of the temperature sensor passes through an amplifier 481, a BPF 482, a full wave rectifier 483, and an LPF 484 and is outputted as a temperature monitor signal THS.

[0022] The reflected 4KHz signal R4S, reflected 16KHz signal R16S, reflected 250KHz signal R250S, transmitted L4KHz signal TL4S, transmitted L16KHz signal TL16S, transmitted L250KHz signal TL250S, transmitted R4KHz signal TR4S, transmitted R16KHz signal TR16S, transmitted R250KHz signal TR250S, and temperature monitor signal THS are respectively inputted to discriminating means(not shown) for discriminating a coin, and a discriminating process and judgement are executed.

[0023] The discriminating means compares each feature quantity with a coin acceptance window predetermined in each coin, and discriminates a counterfeit. At high frequency, a signal difference depending on material is small, but the attenuation factor is determined by the material of the surface layer, and at low frequency, there is an effect also on the material of the intermediate layer, and therefore by comparing the attenuation factor at each frequency with the predetermined criterion, the coin can be discriminated. In this embodiment, the coin is conveyed shifted to the flank of a side sensor 20.

[0024] Embodiments of the present invention(abrasion resistant member in coin conveyance path and coin discriminating sensor) will be described hereinbelow with reference to the drawings.

[0025] FIG. 7 shows the structure of coin feeding, conveying, and discriminating portions of a coin processing apparatus including: a coin feeder 101 which takes the form of a turntable, a conveyance path 102 for conveying coins 100 one by one, a conveyance belt 103 for conveying coins while pressing the coins against the slide face, regulating guides 104a and 104b for guiding conveyance of coins, a diameter sensor 110 for detecting data of the diameter of a coin by a sensor for discriminating coins, material and thickness sensors 111 and 112 for detecting the material and thickness of each coin, and a path 105 of the discriminating portion.

[0026] A thin plate of conductive ceramics is adhered to the portion of the discriminating area 105 in the coin path portion, and a coin sliding face is provided so as to be smoothly connected to the front and rear paths 102. An abrasion resistant plate conventionally made of zirconia which is a non-conductive material is conventionally used as the material of the path member material for the discriminating sensor area 105 of the coin path portion. In the present invention, however, conductive ceramics(conductive alumina or conductive zirconia) is used. The conductive ceramics is also adhered to an identification portion path regulation guide 106a with which the rim of a coin comes into contact. The thickness of the conductive ceramics portion is 0.5 mm. The reason why the conductive ceramics is applied also to a path regulating guide 106 is to prevent a signal from becoming different from a normal signal due to leakage of an eddy current generated in the coin to the outside via path side walls.

[0027] A second embodiment shown in FIG. 8 is characterized by a coin detection sensor 10 having a configuration similar to that of FIG. 7 except that all of magnetic sensors are integrated and built in a casing shown in FIG. 3.

[0028] In the present invention, an exciting and signal-detecting process is performed with a circuit configuration shown in FIG. 5 on the coin discriminating sensor 120.

[0029] The discriminating means identifies, for example, as an object to be identified, a coin made of a plurality of metals, which is called a clad coin made of three kinds of metal layers. The discriminating means compares a characteristic amount with a determination frame preliminarily provided for each coin to discriminate whether the coin is true or false. At high frequencies, although a signal difference according to materials is small, an attenuation

factor is determined by the material of a surface layer. At low frequencies, an influence is exerted also on the material of an intermediate layer. Consequently, by comparing the attenuation factor at each frequency with a predetermined determination reference, a coin can be identified. In the example, a coin is conveyed along the side sensor 20 side.

[0030] Referring again to FIGs. 7 and 8, the shape of the path guide 104a is formed so that the coin is conveyed upward by the conveyance belt 103 along one side. In such a configuration, the discriminating means performs a signal process and detection as described in Japanese Patent Application Laid-open No. 9-245214 A.

[0031] In the present invention, the path 11 of the coin sensor 10 is made of conductive ceramics(conductive alumina or conductive zirconia), so that static electricity is not charged in a coin conveyed for discrimination. Consequently, a noise-free characteristic is achieved as shown by detection signals of the reflected 4KHz signal R4S(upper signal waveform), reflected 16KHz signal R16S(intermediate signal waveform), and reflected 250KHz signal R250S(lower signal waveform) as outputs of the center sensor 40 shown in FIG. 6. In the present invention, coins are not charged, and noise due to static electricity does not occur, so that coins can be accurately discriminated without taking countermeasures by software.

[0032] As described herein, in the abrasion resistant member and coin discriminating sensor according to the present invention, abrasion-resistant conductive ceramics is provided, so that occurrence of static electricity can be prevented, and software for eliminating noise caused by static electricity which is conventionally necessary becomes unnecessary. The electrical resistivity of the conductive ceramics and that ofa metal are different from each other by three digits, an amount of an eddy current is small, and an influence on a magnetic signal is hardly exerted.

Claims

1. A coin processing apparatus for discriminating coins sliding on a coin conveyance path, having a coin discriminating sensor for discriminating the kind of each coins conveyed one by one with a spacing therebetween along a sliding face, **characterized in that** an abrasion resistant member made of a conductive ceramics in a thin plate shape is adhered to the surface of the coin conveyance path, so as to cover a discriminating area of a magnetic sensor provided under the coin conveyance path.

2. A coin processing apparatus according to claim 1, wherein path guides for path regulation are provided on both right and left sides in the travel direction of coins, wherein the abrasion resistant member is adhered to and covers the path guides.

3. A coin discriminating sensor as defined in a coin processing apparatus according to claim 1 or 2, comprising a reflection type sensor disposed so as to face the under face of the coin conveyance path, a first transmission type sensor disposed so as to sandwich one lateral end of the coin conveyance path, and a second transmission type sensor disposed so as to sandwich the other lateral end of the coin conveyance path.

Patentansprüche

1. Münzprüfer zum Unterscheiden von Münzen, die auf einem Münztransportweg gleiten, mit einem Münzdiskriminierungsensor zum Erkennen der Münzen, die eine nach der anderen mit einem Abstand voneinander entlang einer Gleitfläche transportiert werden, nach ihrer Art, **dadurch gekennzeichnet, dass** ein gegen Abrasion widerstandsfähiges Element bestehend aus einer leitfähigen Keramik in Form einer dünnen Platte an der Fläche der Münztransportweg angebracht ist, das einen Erkennungsbereich eines magnetischen Sensors, der unter dem Münztransportweg liegt, abdeckt.

2. Münzprüfer nach Anspruch 1, wobei Wegführungen zur Einstellung des Wegs sowohl an der linke, als auch an der rechten Seite in Transportrichtung der Münzen vorgesehen sind, wobei das gegen Abrasion widerstandsfähige Element an den Wegführungen angebracht ist und diese abdeckt.

3. Münzdiskriminierungssensor in einem Münzprüfer nach Anspruch 1 oder Anspruch 2, mit einem Sensor vom Reflektionsstyp, der derart angeordnet ist, dass er zu der unteren Fläche des Münztransportwegs weist, einen ersten Sensor vom Transmissionstyp, der er ein laterales Ende des Münztransportwegs zwischen sich aufnimmt, und einem zweiten Sensor vom Transmissionstyp, der er ein anderes laterales Ende des Münztransportwegs zwischen sich aufnimmt.

Revendications

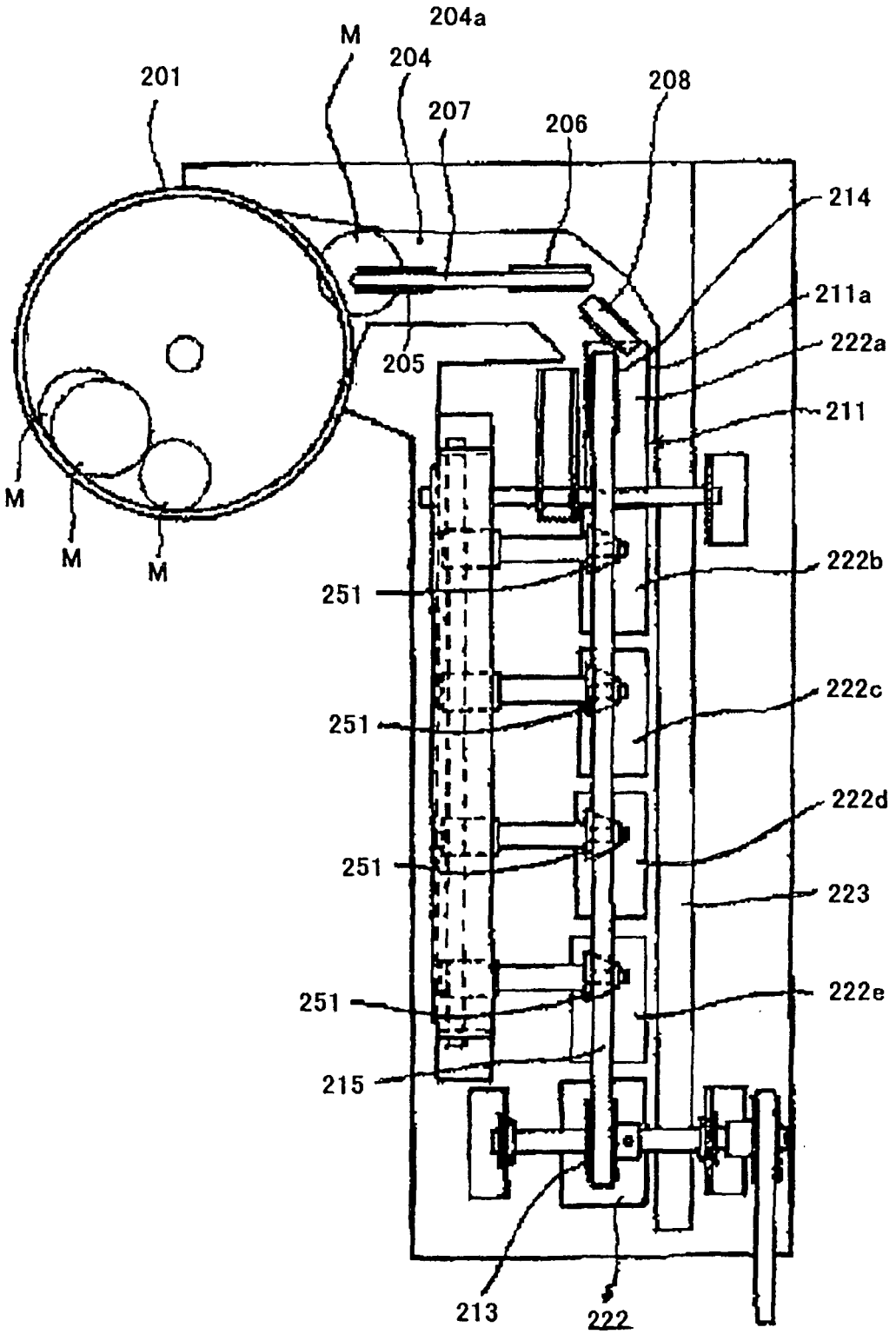
1. Appareil de traitement de pièces de monnaie pour différencier des pièces de monnaie glissant sur un trajet de transport de pièces de monnaies, ayant un capteur de différenciation de pièces de monnaie permettant de différencier le type de chaque pièce de monnaie acheminée une par une avec un espacement entre elles le long d'une face coulissante, **caractérisé en ce que** un élément résistant à l'abrasion fabriqué dans un matériau céramique conducteur en forme de plaque mince adhère à la surface du trajet de transport de pièces de monnaie, afin de

couvrir une zone de différenciation d'un capteur magnétique prévu sous le trajet de transport de pièces de monnaie.

2. Appareil de traitement de pièces de monnaie selon la revendication 1, dans lequel des guides de trajet pour la régulation du trajet sont prévus sur les côtés droit et gauche dans le sens de déplacement des pièces de monnaie, dans lequel l'élément résistant à l'abrasion adhère et couvre les guides de trajet.

3. Capteur de différenciation de pièces de monnaie défini dans un appareil de traitement de pièces de monnaie selon la revendication 1 ou la revendication 2, comprenant un capteur de type à réflexion placé de façon à faire face à la face inférieure du trajet de transport de pièces de monnaie, un premier capteur de type à transmission étant placé de manière à prendre en sandwich une extrémité latérale du trajet de transport de pièces de monnaie, et un second capteur de type à transmission placé de manière à prendre en sandwich l'autre extrémité latérale du trajet de transport de pièces de monnaie.

FIG. 1


204a
M
204
201
208
207
206
214
211a
222a
205
211
M
M
M
222b
251
222c
251
222d
251
223
251
222e
215
213
222

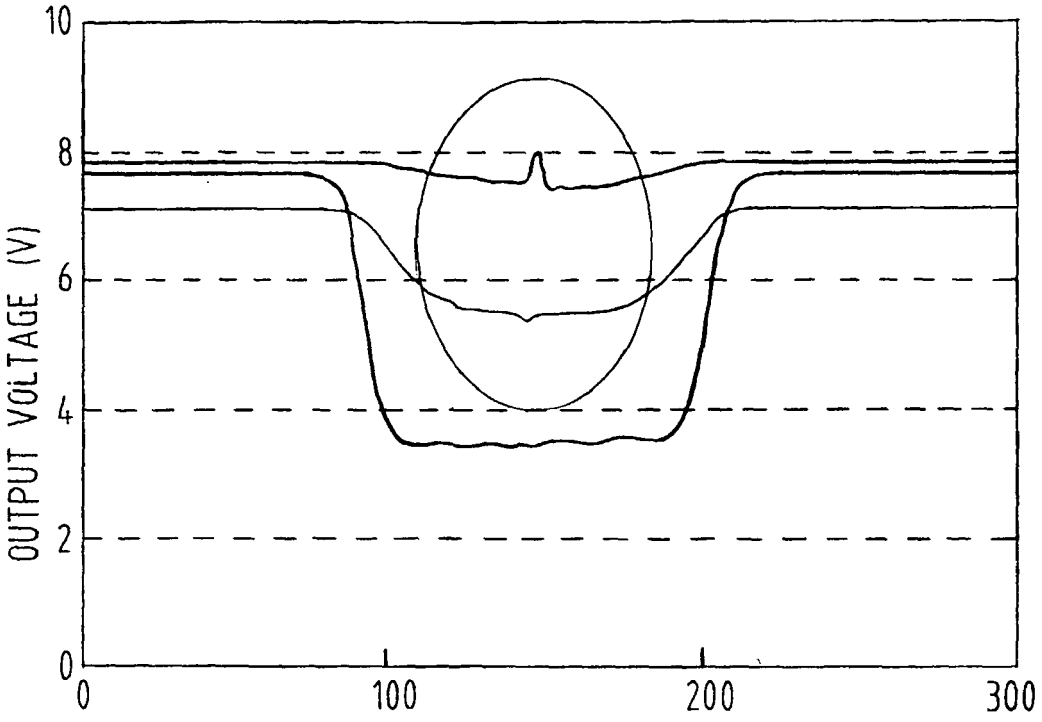


FIG. 2

FIG. 3

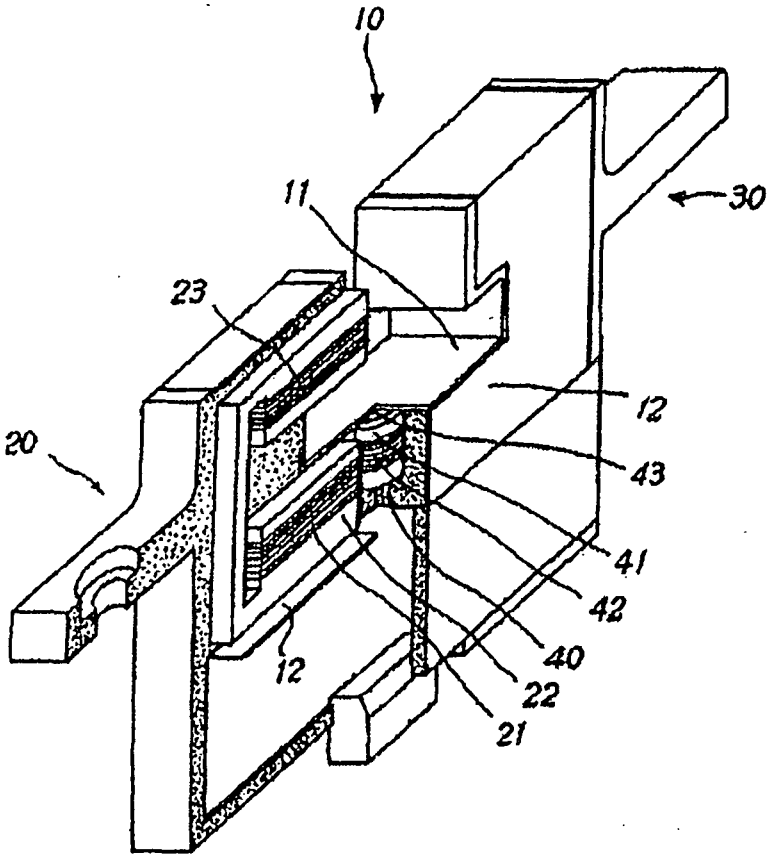
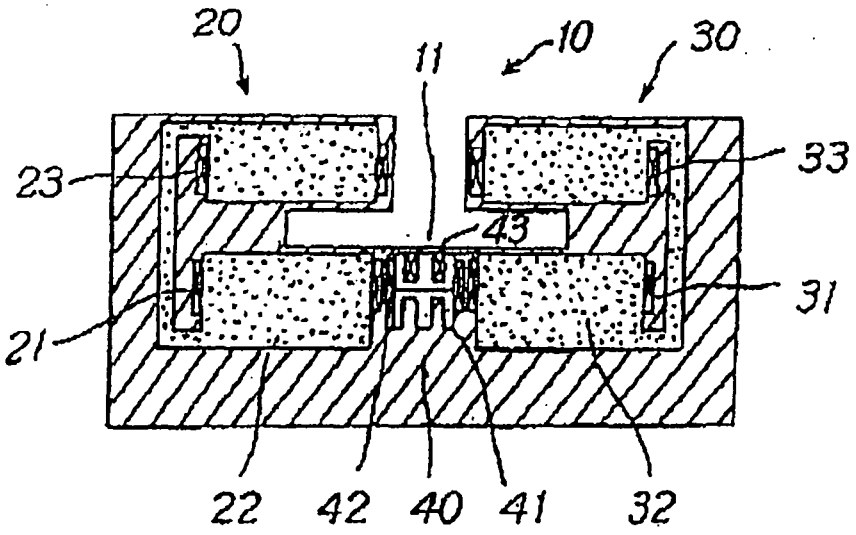

10
11
30
23
12
43
20
41
42
40
12
22
21

FIG. 4


20
11
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33
23
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22
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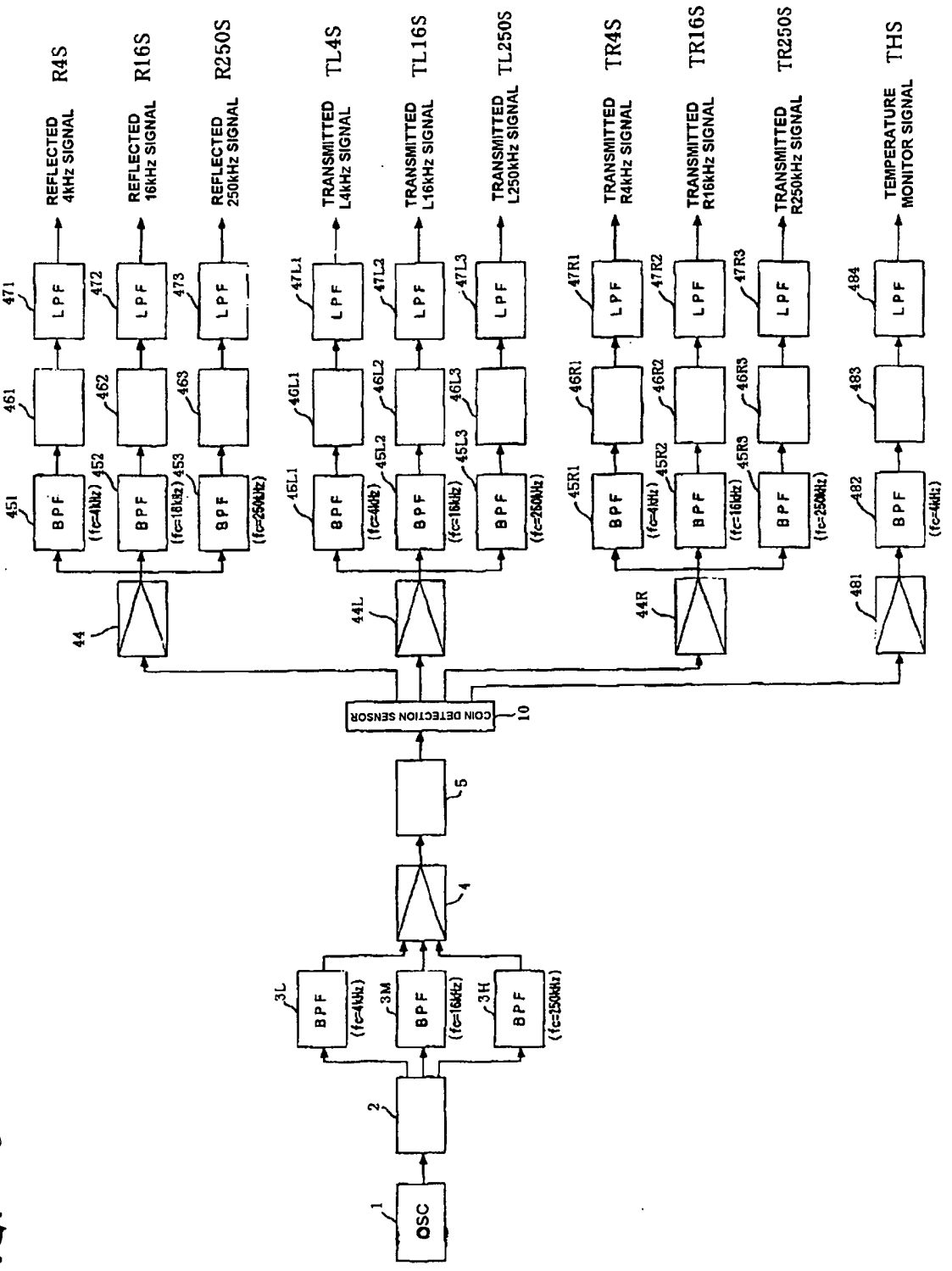
40
41
32

FIG. 5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2
BPF
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3L
BPF
(fc=16kHz)
3M
BPF
(fc=250kHz)
3H
4
5
COIN DETECTION SENSOR
10
44
44L
44R
481
451
452
453
461
462
463
471
472
473
16L1
45L2
45L3
46L1
46L2
46L3
47L1
47L2
47L3
45R1
45R2
45R3
46R1
46R2
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47R1
47R2
47R3
482
483
484
LPF
(fc=4kHz)
(fc=16kHz)
(fc=250kHz)
REFLECTED 4kHz SIGNAL
REFLECTED 16kHz SIGNAL
REFLECTED 250kHz SIGNAL
TRANSMITTED L4kHz SIGNAL
TRANSMITTED L16kHz SIGNAL
TRANSMITTED L250kHz SIGNAL
TRANSMITTED R4kHz SIGNAL
TRANSMITTED R16kHz SIGNAL
TRANSMITTED R250kHz SIGNAL
TEMPERATURE MONITOR SIGNAL
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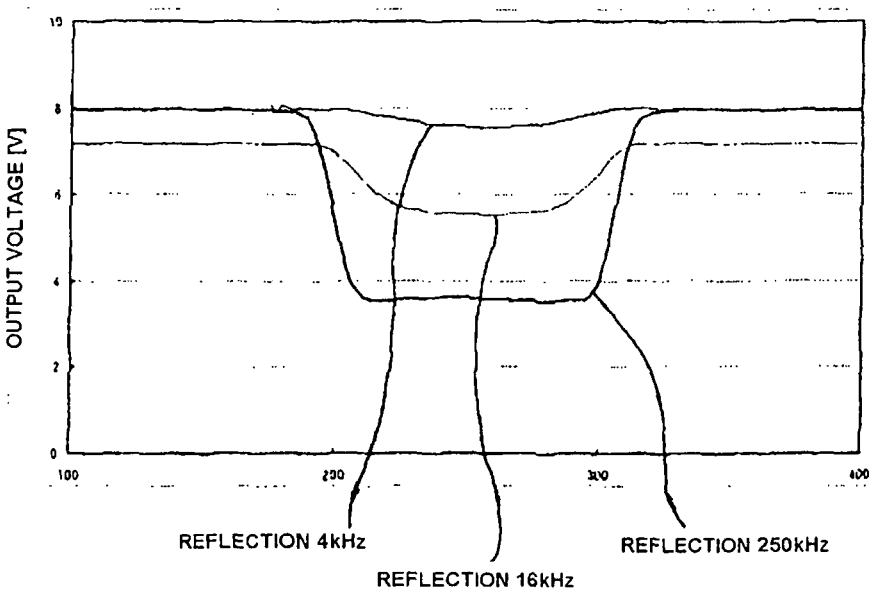
R16S
R250S
TL4S
TL16S
TL250S
TR4S
TR16S
TR250S
THS

FIG. 6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4
6
8
10
100
200
300
400
REFLECTION 4kHz
REFLECTION 16kHz
REFLECTION 250kHz

FIG. 7

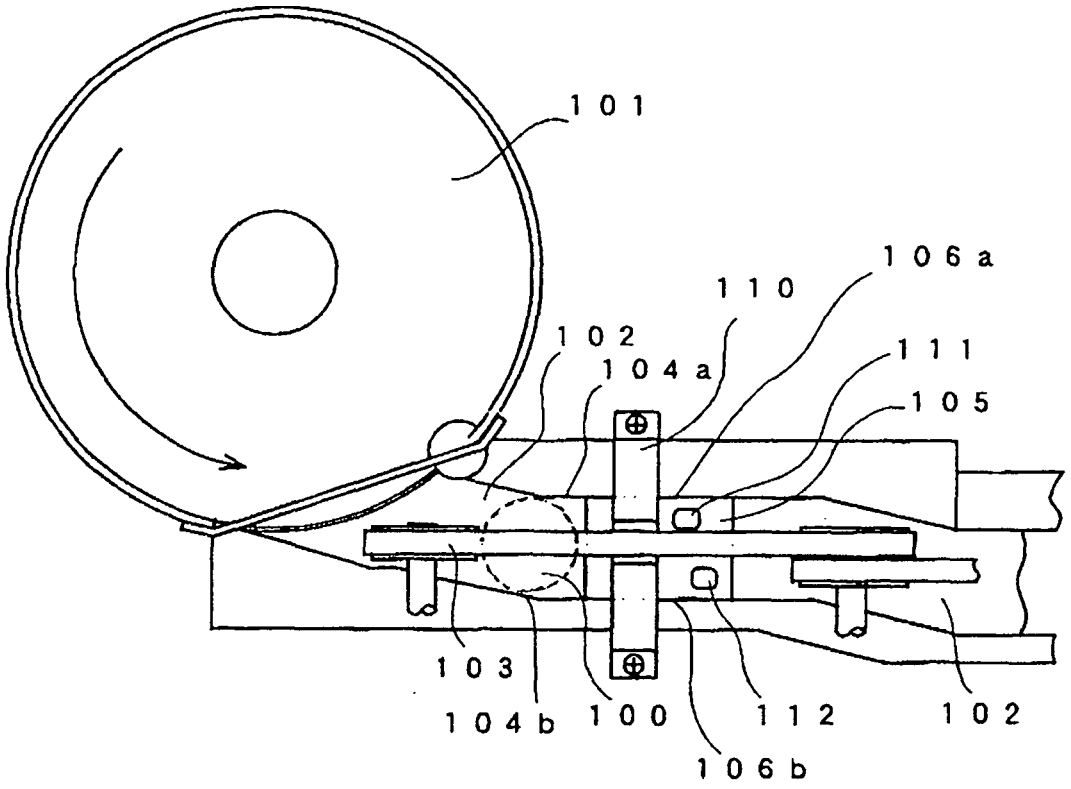
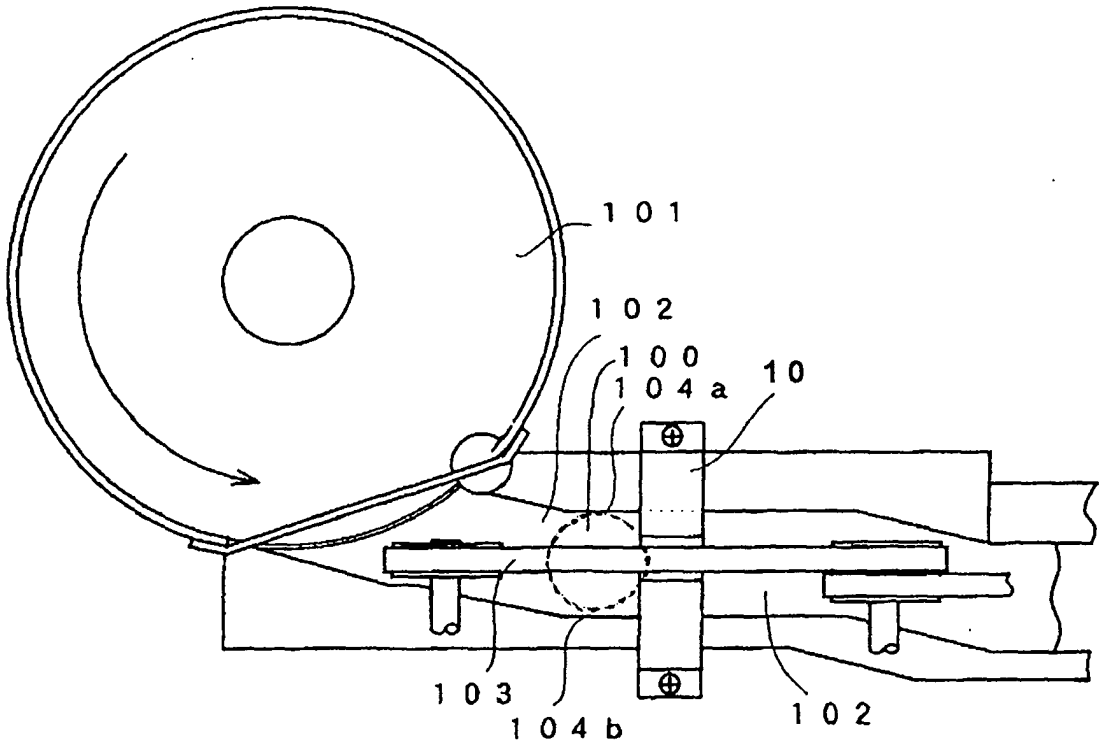


FIG. 8



REFERENCES CITED IN THE DESCRIPTION

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