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Specification

Title of the Invention

Coin Discrimination Apparatus

5 Background of the Invention

The present invention relates to a coin discrimination apparatus applied to a vending machine, a public telephone, or the like and, more particularly, to a coin discrimination apparatus for discriminating the
10 outer shapes of coins.

A coin discrimination apparatus of this type comprises an almost flat base plate obliquely extending such that the front surface thereof slightly falls toward the rear surface side, and a flapper having the
15 lower and upper ends, respectively, openable and swingable with respect to the front surface of the base plate. A coin slot member for receiving a coin and an inclined rail for supporting the circumferential surface of a coin are mounted on the base plate. The base
20 plate, the rail, and the flapper form a coin path for rolling the coin. A diameter discrimination window for discriminating the diameter of a coin is formed at a position where the coin path is formed. A discrimination rail serving as a thickness gauge for
25 discriminating the thickness of a coin is formed below the diameter discrimination window so as to communicate with a rolling rail. A coin drop window is formed in

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correspondence with a discrimination rail. A counterfeit coin having a smaller diameter than that of a corresponding authentic coin drops from the diameter discrimination window, and a counterfeit coin having a smaller thickness than that of a corresponding authentic coin is removed from the discrimination rail. These counterfeit coins drop from the coin drop window and are guided to a coin return path.

Although the above base plate is made of a metal plate in a conventional structure, a synthetic resin base plate formed integrally with peripheral members has recently been used to obtain a lightweight structure which facilitates the manufacture. More specifically, the coin rolling rail, the diameter discrimination window, the discrimination rail, and the like are integrally made of a synthetic resin. This integral molding greatly reduces the number of component parts and the number of assembly steps. In addition, assembly adjustment can be eliminated.

In the structure wherein the above base plate is integrally molded with the synthetic resin, the base plate itself must be replaced with another one if the size of the diameter discrimination window and the extension amount of the discrimination rail must be changed due to changes in denomination of coins to be discriminated, resulting in an economical disadvantage.

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When a base plate becomes bulky, a molding strain is generated to degrade discrimination accuracy.

Summary of the Invention

It is an object of the present invention to
5 provide a coin discrimination apparatus excellent in economy and discrimination accuracy even if the denomination of a coin to be discriminated changes.

In order to achieve the above object of the present invention, there is provided a coin
10 discrimination apparatus having an outer shape discrimination portion for discriminating an outer shape of a coin rolling along a coin path constituted by a rail for supporting a circumferential portion of the coin and a base plate for supporting a head or tail of
15 the coin, comprising an outer shape discrimination unit obtained by arranging the outer shape discrimination portion as a unit, an opening portion formed in the base plate in correspondence with the outer shape discrimination portion, the outer shape discrimination
20 unit being fitted in the opening portion, and fixing means for detachably fixing the outer shape discrimination unit in the opening portion.

Brief Description of the Drawings

Fig. 1 is an exploded perspective view showing
25 a coin discrimination apparatus according to the first embodiment of the present invention;

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Fig. 2 is a front view showing a state in which a flapper of the coin discrimination apparatus shown in Fig. 1 is removed;

Fig. 3 is a sectional view of the structure
5 along the line III - III in Fig. 2; and

Fig. 4 is a perspective view showing a coin discrimination plate member in a coin discrimination apparatus according to the second embodiment of the present invention.

10 Description of the Preferred Embodiments

An embodiment of the present invention will be described with reference to the accompanying drawings. Fig. 1 shows a coin discrimination apparatus according to the first embodiment. Fig. 2 shows a state in which
15 a flapper of the coin discrimination apparatus is removed, and Fig. 3 shows a section along the line III - III in Fig. 2. Referring to Fig. 1, a coin discrimination apparatus 1 comprises an almost flat rectangular synthetic resin base plate 2 and a coin
20 discrimination unit 24 detachably mounted on the base plate 2. The base plate 2 extends such that the front surface thereof is slightly inclined toward the rear surface by two side plates 3 formed integrally with the
25 base plate 2. A coin slot member 4 is attached to one corner of the upper end of the base plate 2. The coin slot member 4 has a coin slot gauge 5 for preventing reception of counterfeit coins having larger diameter

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and thickness than those of corresponding authentic coins.

Reference numeral 6 denotes a coin rail fixed to the base plate 2 such that the rolling surface of the coin rail 6 obliquely descends toward the left side in Fig. 1. A lightweight coin discrimination lever 8 and a magnetic coin discrimination magnet 11 are disposed between the coin rail 6 and the coin slot member 4, as shown in Fig. 2. Nibs 9 are formed at two sides of the upper end portion. The lightweight coin discrimination lever 8 is swingably supported by an axial support portion (not shown) integrally formed on the rear surface of the base plate 2. The lower end of the lightweight coin discrimination lever 8 is extended by a weight 10 from the front surface of the base plate 2 through a window 7 formed in the base plate. The lightweight coin discrimination lever 8 removes a lightweight counterfeit coin C1, dropping from the coin slot member 4, in a direction of thickness of the coin from the front surface of the base plate 2. This counterfeit coin is separated from the rolling surface of the coin rail and guided to a coin return path 22. The magnetic coin discrimination magnet 11 is mounted outside a cover (not shown) which entirely covers the front surface of the base plate 2 so as to oppose the lightweight coin discrimination lever 8 through the coin path. The magnetic coin discrimination magnet 11

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attracts a magnetic coin C2 in the same direction as
that of the lightweight coin discrimination lever 8,
i.e., in the direction of thickness of the coin from the
coin rail 6 and guides the coin to the coin return path
5 22.

Referring to Fig. 1, reference numeral 12
denotes an almost square opening portion obliquely
formed at almost the central portion of the base plate
2. A projecting piece 13 extending upward along the
10 rolling direction of the coin is formed on the surface
of the lower end portion of the opening portion 12. A
pair of ribs 14 extend at the two side portions of the
opening portion 12 while retracting from the front
surface of the base plate 2 by the thickness of the
15 projecting piece 13. A projecting body 15 (Fig. 3)
extending toward the rear surface of the base plate 2 is
formed at the upper end portion of the opening portion
12. Reference numeral 16 denotes an escape pin
extending through a hole formed in the base plate 2 so
20 as to be extendible toward the front surface side upon
actuation of a rotary solenoid (not shown) arranged on
the rear surface of the base plate 2. Reference numeral
17 denotes a coin accumulation sensor for detecting coin
accumulation; and 18, a storage lever extending through
25 a hole formed in the base plate 2 so as to be extendible
from the rear surface to the front surface of the base
plate 2 alternately in a manner interlocked with the

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escape pin 16. Reference numeral 19 denotes a coin storage sensor for detecting storage of a coin; and 20, a branching plate for branching the coin discriminated by the coin discrimination unit 24 into a coin storage path 21 and the coin return path 22.

The coin discrimination unit 24 comprises a coin discrimination plate member 25 consisting of a synthetic resin unit having almost the same outer dimensions as those of the opening portion 12 of the base plate 2, and a flapper 35 as a synthetic resin unit having almost the same outer dimensions as those of the coin discrimination plate member 25. A discrimination window 26 is formed at the central portion of the coin discrimination plate member 25 such that the lower end portion thereof is obliquely inclined toward the rolling direction of the coin. A discrimination rail portion 27 is formed in the coin discrimination plate member 25 immediately below the discrimination window 26. A gap between the coin rolling surface of the discrimination rail portion 27 and the upper end portion of the discrimination window 26 is slightly smaller than the diameter of an authentic coin. For this reason, a counterfeit coin having a smaller diameter than that of the corresponding authentic coin falls within the discrimination window 26 during passing through the discrimination rail portion 27 and is guided to the coin return path 22 through a coin drop window 39.

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A projecting piece 28 slightly extending from the surface of the coin discrimination plate member 25 is formed on the entire lower end of the coin discrimination plate member 25. Engaging pieces 29 each
5 having the same thickness as that of the projecting piece 13 are formed at the two sides of the coin discrimination plate member 25. Elastically deformable ratchets 30 engaged with the projecting body 15 (Fig. 3) extend toward the base plate 2. Reference numeral 31
10 denotes a shaft supported by bearing portions 32 extending at two end portions of the upper portion of the coin discrimination plate member 25. A coil spring 33 is loosely fitted on the shaft 31.

A pair of bearing grooves 36 are formed at the
15 two side portions of the upper end of a flapper 35. Upper and lower spring hook recesses 37 are formed at the central portion of the flapper 35. Reference numerals 38 denote three nibs extending at the upper portion and the two ends of the lower portion of the
20 rear surface of the flapper 36 so as to locate at the vertices of an isosceles triangle. As shown in Fig. 3, a coin drop window 39 open to the coin discrimination plate member 25 is formed at the lower end portion of the flapper 35. A coin support portion 40 constituting
25 the coin accumulation path and communicating with the discrimination rail portion 27 extends on the rear surface of the lower end portion. A spindle-shaped coin

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return actuating portion 41 is formed at the distal end of an arm 35a extending upward from the upper end portion of the flapper 35.

An assembly method of the coin discrimination apparatus having the above structure will be described below. The projecting piece 28 of the coin discrimination member 25 is inserted from the front surface side of the base plate 2 into the opening portion 12. The projecting piece 28 is engaged with the rear surface side of the projecting piece 13, and the coin discrimination member 25 is laid down toward the base plate side about the projecting piece 13 as a pivot fulcrum. The pivotal movement of the coin discrimination member 25 causes the engaging pieces 29 to engage with the ribs 14 and the coin discrimination plate member 25 in the opening portion 12. At this time, the ratchets 30 are elastically deformed and engaged from the front surface side with the projecting body 15 formed on the rear surface side of the opening portion 12. The engagement of the ratchets 30 with the projecting body 15 and the projecting piece 28 with the projecting piece 13 regulates removal of the coin discrimination plate member 25 from the opening portion 12 toward the front surface side. The coin discrimination plate member 25 fitted in the opening portion 12 is fixed to the base plate 2. The front surface of the coin discrimination plate member 25

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fitted in the opening portion 12 is leveled with the front surface of the base plate 2 because the thickness of the engaging pieces 29 is equal to that of the projecting piece 13, and the discrimination rail portion 5 27 of the coin discrimination plate member 25 becomes continuous with the coin rolling surface of the coin rail 6 of the base plate 2.

The bearing grooves 36 of the flapper 35 are then fitted on the shaft 31 of the coin discrimination 10 plate member 25 fixed to the base plate 2. At this time, one end of the coin spring 33 is engaged with the recesses 37, so that a biasing force is applied to the flapper 35 toward the coin discrimination plate member 25 so as to pivot about the shaft 31. The flapper 35 15 pressed against the coin discrimination plate member 25 is brought into contact with the front surface of the coin discrimination plate member 25 through the three nibs 38 formed on the rear surface side, so that a gap with respect to the coin discrimination plate member 25 20 is kept to be slightly larger than the thickness of the authentic coin. In this state, the flapper 35 constitutes the coin path together with the coin discrimination plate member 25 and the discrimination rail portion 27. The coin discrimination unit 24 25 consisting of the flapper 35 and the coin discrimination plate member 25 which are assembled as described above

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is arranged to discriminate the outer shape and thickness of each coin.

A coin discrimination operation in the coin discrimination apparatus assembled as described above will be described below. Of coins C to be received from the coin slot gauge 5 of the coin slot member 4, a counterfeit coin having larger diameter and thickness than those of a corresponding authentic coin cannot pass through the coin slot gauge 5 and is discriminated. Of all the coins having passed through the coin slot gauge 5, the lightweight counterfeit coin C1 and the magnetic coin C2 are removed from the front surface of the base plate 2 in the direction of thickness of coins by means of the lightweight coin discrimination lever 8 and the magnet 11 and are guided to the coin return path 22. The coins which are not removed by the lever 8 and the magnet 11 drop on the rolling surface of the coin rail 6 and rolls along the rolling surface. The coins further roll along the discrimination rail portion 27 of the coin discrimination plate member 25 continuous with the rolling surface.

As shown in Fig. 3, on the discrimination rail portion 27, the upper end of a counterfeit coin C3 having a smaller diameter than that of a corresponding authentic coin is removed from the discrimination window 26, so that this coin C3 falls within the discrimination window 26 and is guided from the drop window 39 to the

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coin return path 22. On the other hand, a counterfeit coin C4 having a smaller thickness than that of a corresponding authentic coin is no longer supported by the discrimination rail portion 27 and a lower edge 35a
5 of the flapper 35. As in the counterfeit coin C3, the upper end of the coin C4 is removed from the discrimination window, so that the coin C4 falls within the discrimination window 26 and is guided from the coin drop window 39 to the coin return path 22.

10 An authentic coin C5 having passed through the coin discrimination unit 24 is supported by the storage lever 18 and the coin support portion 40 of the flapper 35 and is accumulated in the coin accumulation path. The accumulation sensor 17 detects whether at least one
15 authentic coin C5 is accumulated in the coin accumulation path. When coin storage is to be performed in this state, e.g., when a storage signal is received in the public telephone, the storage lever 18 is retracted from the coin path, and at the same time, the
20 escape pin 16 enters into the coin path. Only the lowermost accumulated coin is guided to the coin storage path 21. The second and subsequent accumulated coins are prevented by the escape pin 16 from rolling along the coin accumulation path. When storage of the coin
25 into the coin storage path 21 is confirmed, the storage lever 18 enters into the coin path, and at the same time the escape pin 16 is retracted from the coin path. The

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second and subsequent accumulated coins are supported on the coin accumulation path by the storage lever 18 and the coin support portion 40. In this manner, the authentic coins C5 are stored one by one in accordance
5 with the storage operation.

When the user performs a coin return operation at the end of operation of the equipment, the coin return actuating portion 41 of the flapper 35 is interlocked with the return operation and pressed
10 against the base plate 2 side by an interlocking rod (not shown). The flapper 35 is pivoted about the shaft 31, and the lower end of the flapper 35 is separated from the base plate 2 against the biasing force of the coil spring 33. The lower portion of the coin
15 accumulation path is opened to guide the authentic coin C5 accumulated therein to the coin return path 22, so that the authentic coin C5 is returned.

When the outer shape of a coin to be used is changed, i.e., when the diameter or thickness of a coin
20 to be used changes, the coin discrimination unit 24 is replaced with a new one. That is, a coin discrimination plate member 25 having a coin discrimination window 26 and a discrimination rail portion 27 which correspond to the diameter and thickness of a new coin and a flapper
25 35 having nibs 38 formed at the positions corresponding to the new coin are prepared. The ratchets 30 of the coin discrimination plate member 25 of the coin

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discrimination unit 24 currently mounted in the coin discrimination apparatus are elastically deformed to disengage the ratchets 30 from the projecting body 15 of the base plate 2, thereby removing the coin

5 discrimination unit 24 from the opening portion 12. The new coin discrimination unit having the coin discrimination plate member 25 and the flapper 35 is fitted in and fixed to the opening portion 12 in the same manner as described above.

10 In this manner, even if the outer shape of a coin to be used changes, the base plate 2 need not be replaced as a whole, and part of the base plate 2, i.e., only the coin discrimination unit 24 is replaced. A change in mold used to manufacture the coin
15 discrimination apparatus can be minimized, resulting in an excellent economical advantage. The change period can be greatly reduced, and the positional relationship between the equipment main body in which the coin discrimination apparatus is mounted and other
20 constituent parts need not be changed. Only the coin discrimination unit 24 is replaced with a new one, thereby facilitating the replacement.

The coin discrimination unit 24 for which a high discrimination accuracy is required can be
25 manufactured separately from the base plate 2. For this reason, when the small coin discrimination plate member 25 is molded with a synthetic resin, the molding strain

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can be prevented, as compared with the base plate 2 which is large in size, thereby increasing the coin discrimination accuracy. In addition, the base plate 2 and the flapper 35 which do not adversely affect the discrimination accuracy can also be made of a synthetic resin, thereby obtaining a lightweight structure.

Fig. 4 shows a coin discrimination plate member according to the second embodiment of the present invention. According to the characteristic feature of the second embodiment, the nibs 38 formed on the flapper 35 in the first embodiment are replaced with nibs 42 extending on the surface of a coin discrimination plate member 125. In molding the coin discrimination plate member 125 separately from a base plate 2, the nibs 42 for which a high gap accuracy is required with respect to a flapper 35 are formed integrally with the coin discrimination plate member 125 with a high accuracy.

In this manner, since the nibs 42 are formed on the coin discrimination plate member 125, the flapper 35 need not be changed even in a change in denomination of a coin to be discriminated. Only the coin discrimination plate member 125 must be changed with a new one in which the positions of the nibs 42 are changed in correspondence with the position of a discrimination window. The flapper 35 is thus used commonly, resulting in a good economical advantage.

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As has been described above, according to the present invention, in a coin discrimination apparatus having an outer shape discrimination portion for rolling a coin inserted from a coin slot by a rail for
5 supporting the coin in the radial direction of the coin and a base plate for supporting the coin in the planar direction of the coin to discriminate the outer shape of the rolling coin, the outer shape discrimination portion is detachably mounted as a unit on the base plate. Even
10 if a coin to be discriminated changes, only the outer shape discrimination portion is replaced with a new one matching the new coin with respect to the base plate. The base plate need not be replaced as a whole, resulting in a good economical advantage and
15 facilitating the replacement.

According to the present invention, the outer shape discrimination portion comprises: a coin discrimination plate member having a diameter discrimination window and a thickness gauge; and a
20 flapper member spaced apart from the coin discrimination plate member in the direction of thickness and having a coin drop window. An opening portion in which the coin discrimination plate member is fitted is formed in the base plate. At the same time, the coin discrimination
25 plate member, the flapper member, and the base plate are made of a synthetic resin, so that the coin discrimination apparatus is made of the synthetic resin

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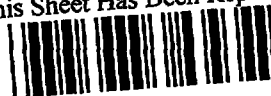


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as a whole, thus obtaining a lightweight apparatus. In addition, since the coin discrimination plate member can be molded separately from the base plate, the molding strain can be prevented to increase the discrimination
5 accuracy.

According to the present invention, since the coin discrimination plate member is separated from the base plate, the plate member can be made compact. For this reason, even if the coin discrimination plate
10 member is made of a synthetic resin, the molding strain can be minimized with a high accuracy. The distance between the coin discrimination plate member and the flapper member can be accurately maintained by the projection, thus increasing the discrimination accuracy.
15 The projections are formed on the coin discrimination plate member to keep the distance from the flapper member constant, the flapper member need not be changed even with a change in coin discrimination plate member upon a change in a coin to be discriminated because the
20 projections for keeping the distance from the flapper member constant are formed on the coin discrimination plate member. Therefore, the flapper member can be commonly used, resulting in an excellent economical advantage and reducing the number of parts management
25 steps.

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CLAIMS

What is claimed is:

1. A coin discrimination apparatus having an
2 outer shape discrimination portion for discriminating an
3 outer shape of a coin rolling along a coin path
4 constituted by a rail (27) for supporting a
5 circumferential portion of the coin and a base plate (2)
6 for supporting a head or tail of the coin, characterized
7 by comprising:
8 an outer shape discrimination unit (24)
9 obtained by arranging said outer shape discrimination
10 portion as a unit;
11 an opening portion (12) formed in said base
12 plate in correspondence with said outer shape
13 discrimination portion, said outer shape discrimination
14 unit being fitted in said opening portion; and
15 fixing means (13, 15, 28, 30) for detachably
16 fixing said outer shape discrimination unit in said
17 opening portion.

2. An apparatus according to claim 1, wherein
2 said outer shape discrimination unit comprises: a coin
3 discrimination plate unit (25) having a diameter
4 discrimination window (26) and a thickness gauge (27)
5 formed in said rail, said diameter discrimination window
6 and said thickness gauge being arranged in said coin
7 path; and a flapper unit (35) spaced apart from said

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8 coin discrimination plate unit by a predetermined
9 distance and having an upper end portion detachably and
10 pivotally mounted on said coin discrimination plate
11 unit, said flapper unit supporting a lower end portion
12 of an authentic coin passing through said diameter
13 discrimination window and said thickness gauge.

3. An apparatus according to claim 2, wherein
2 said coin discrimination plate unit is made of a
3 synthetic resin together with said diameter
4 discrimination window and said thickness gauge.

4. An apparatus according to claim 3, further
2 comprising a plurality of projections (42), formed
3 integrally with said coin discrimination plate unit, for
4 spacing said coin discrimination plate unit and said
5 flapper unit apart from each other by a predetermined
6 distance.

5. An apparatus according to claim 2, wherein
2 said flapper unit has, at a lower end portion thereof, a
3 coin return window (39) for returning a counterfeit coin
4 discriminated by said diameter discrimination window and
5 said thickness gauge, and is normally biased toward said
6 coin discrimination plate unit and cooperates with said
7 coin discrimination plate unit to constitute said coin
8 path, and said lower end portion of said flapper unit is

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9 opened against a biasing force in a coin return
10 operation, thereby returning an accumulated coin.

6. An apparatus according to claim 5, wherein
2 said base plate is formed of a synthetic resin together
3 with said opening portion, and said flapper member is
4 formed of a synthetic resin together with said coin
5 return window.

7. An apparatus according to claim 1, wherein
2 said fixing means comprises: a pair of engaging members
3 (13, 28), formed at a lower end portion of said opening
4 portion and a lower end portion of said outer shape
5 discrimination unit, for supporting said outer shape
6 discrimination unit and said base plate on the same
7 plane; and a pair of second engaging members (15, 30),
8 formed at an upper end portion of said opening portion
9 and an upper end portion of said outer shape
10 discrimination unit, for fixing said outer shape
11 discrimination unit engaged with said first engaging
12 members while said outer shape discrimination unit is
13 fitted in said opening portion.

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