ABSTRACT: A coin acceptor is capable of accepting either magnetic or nonmagnetic, legitimate coins of a single denomination. Separate coin paths are provided for testing magnetic and nonmagnetic coins for validity utilizing magnetic graduation and eddy-current separation principles. A coin rail defining the path for nonmagnetic coins is below a coin rail that defines the path for the magnetic coins, and a deposited coin is permitted to gravitate to the lower rail if it is of nonmagnetic composition. However, a guide ramp is provided that shifts into alignment with the upper rail when a magnetic coin is deposited to thereby divert the magnetic coin along the upper path. The guide ramp is shiftable between a normal position clearing the deposited coin and an operative position in alignment with the upper rail, response to the presence of a magnetic material in the deposited coin being provided through the use of a permanent magnet attached to the shiftable guide ramp which senses the deposited coin and shifts the ramp as it is attracted toward the approaching coin.
DUAL PATH COIN SORTING AND VALIDATING DEVICE

A proposed change in the composition of Canadian dimes and quarters from nonmagnetic coinage material to pure nickel has produced the need for a coin acceptor for vending machines that is capable of handling present Canadian and United States nickels plus the proposed nickel Canadian coinage which is magnetic. In the case of quarters, for example, the present Canadian quarter and older United States quarters are of nonmagnetic, silver alloy composition. The clad composition of newer U.S. quarters is similarly nonmagnetic and of approximately the same electrical conductivity as the silver alloy coinage. Thus, since both U.S. and Canadian quarters are of approximately the same size, the eddy-current separator may presently be utilized in accepters at border sites for slug rejection and coin validation. However, it is apparent that the proposed pure nickel Canadian coinage is unsuitable for eddy-current separation since the intensity of the magnetic field utilized in eddy-current separators holds a magnetic coin and prevents acceptance. Therefore, if a common acceptor is to be utilized for legitimate coinage of both magnetic and nonmagnetic composition, it is requisite that the magnetic coinage be precluded from subjection to magnetic fields of high holding power and yet some means of rejecting ferrous and other nonmagnetic slugs must be provided or present levels of slug protection will be sacrificed.

It is, therefore, an important object of this invention to provide a high security coin acceptor of maximum flexibility for validating both magnetic and nonmagnetic coinage and rejecting counterfeit coinage of either the magnetic or nonmagnetic type that may be deposited by an unscrupulous customer.

As a corollary to the foregoing object, it is an important aim of the instant invention to provide a coin acceptor which will accept pure nickel coinage and valid nonmagnetic coins in order that a common acceptor may be utilized in applications such as discussed above where both legitimate and counterfeit coins of both compositions are to be encountered.

Another important object of the invention is to provide a coin-handling device which will direct magnetic and nonmagnetic coinage along separate paths of travel in order to effect sorting of the coinage by composition classification.

A further and important object of this invention is to provide a coin-handling device as aforesaid capable of testing magnetic coins and nonmagnetic coins for validity in their respective paths, and which will not accept a magnetic coin traversing the path for nonmagnetic coins or a nonmagnetic coin that is traversing the path for magnetic coins, in order to preclude the possible acceptance of counterfeit coinage in the event that a coin should become misdirected into the improper path.

In the drawings:

FIG. 1 is a front elevational view of one embodiment of the acceptor;

FIG. 2 is a rear elevational view of the front mounting plate assembly of the acceptor of FIG. 1 showing the various components thereon in detail;

FIG. 3 is a fragmentary, front elevational view of the acceptor of FIG. 1 showing the cradle upon release thereof by a gravitating coin;

FIG. 4 is a front elevational view of the acceptor of FIG. 1 showing the front mounting plate and other components removed to reveal the rear plate of the unit;

FIG. 5 is a cross-sectional view taken along line 5-5 of FIG. 1;

FIG. 6 is a cross-sectional view taken along line 6-6 of FIG. 1;

FIG. 7 is a view identical to FIG. 6 except that the magnetically responsive coin guide is shown in a position supporting a magnetic coin thereon;

FIG. 8 is a diagrammatic, front elevational view of the acceptor illustrating the trajectories of coins of various materials gravitating from the rail of the magnetic coin validator;

FIG. 9 is a diagrammatic, front elevational view of the acceptor illustrating the trajectories of coins of various materials gravitating from the nonmagnetic coin validator (eddy-current separator);

FIG. 10 is a view similar to FIG. 2 but showing a second embodiment of the acceptor of the instant invention; and

FIG. 11 is a cross-sectional view taken along line 11-11 of FIG. 10 showing the shiftable coin guide in a position for supporting a magnetic coin.

Referring to FIGS. 2 and 3, a coin acceptor 20 has a rear plate 22 provided with a pair of forwardly extending side flanges 24. A front mounting plate assembly 26 is attached to the right-hand side flange 24 (as viewed in FIG. 1) by a hinge pin 28 and is biased toward the rear plate 22 by a spring 30.

An entrance funnel for deposited coinage is provided at the upper edges of rear plate 22 and plate assembly 26 and serves to guide individual coins into the acceptor. FIG. 4 illustrates an acceptor having a cross-sectional view taken along line 6-6 of FIG. 1; . . . FIG. 7 is a view identical to FIG. 6 except that the magnetically responsive coin guide is shown in a position supporting a magnetic coin thereon; . . . . FIG. 8 is a diagrammatic, front elevational view of the acceptor illustrating the trajectories of coins of various materials gravitating from the rail of the magnetic coin validator; and FIG. 9 is a diagrammatic, front elevational view of the acceptor illustrating the trajectories of coins of various materials gravitating from the nonmagnetic coin validator (eddy-current separator);

A optional and important object of this invention is to provide a coin-handling device as aforesaid capable of testing magnetic coins and nonmagnetic coins for validity in their respective paths, and which will not accept a magnetic coin traversing the path for nonmagnetic coins or a nonmagnetic coin that is traversing the path for magnetic coins, in order to preclude the possible acceptance of counterfeit coinage in the event that a coin should become misdirected into the improper path.

In the drawings:

FIG. 1 is a front elevational view of one embodiment of the acceptor;

FIG. 2 is a rear elevational view of the front mounting plate assembly of the acceptor of FIG. 1 showing the various components thereon in detail;

FIG. 3 is a fragmentary, front elevational view of the acceptor of FIG. 1 showing the cradle upon release thereof by a gravitating coin;

FIG. 4 is a front elevational view of the acceptor of FIG. 1 showing the front mounting plate and other components removed to reveal the rear plate of the unit;

FIG. 5 is a cross-sectional view taken along line 5-5 of FIG. 1;

FIG. 6 is a cross-sectional view taken along line 6-6 of FIG. 1;

FIG. 7 is a view identical to FIG. 6 except that the magnetically responsive coin guide is shown in a position supporting a magnetic coin thereon;

FIG. 8 is a diagrammatic, front elevational view of the acceptor illustrating the trajectories of coins of various materials gravitating from the rail of the magnetic coin validator;

FIG. 9 is a diagrammatic, front elevational view of the acceptor illustrating the trajectories of coins of various materials gravitating from the nonmagnetic coin validator (eddy-current separator);

FIG. 10 is a view similar to FIG. 2 but showing a second embodiment of the acceptor of the instant invention; and

FIG. 11 is a cross-sectional view taken along line 11-11 of FIG. 10 showing the shiftable coin guide in a position for supporting a magnetic coin.

Referring to FIGS. 2 and 3, a coin acceptor 20 has a rear plate 22 provided with a pair of forwardly extending side flanges 24. A front mounting plate assembly 26 is attached to the right-hand side flange 24 (as viewed in FIG. 1) by a hinge pin 28 and is biased toward the rear plate 22 by a spring 30.

An entrance funnel for deposited coinage is provided at the upper edges of rear plate 22 and plate assembly 26 and serves to guide individual coins into the acceptor. FIG. 4 illustrates an acceptor having a cross-sectional view taken along line 6-6 of FIG. 1; . . . FIG. 7 is a view identical to FIG. 6 except that the magnetically responsive coin guide is shown in a position supporting a magnetic coin thereon; . . . . FIG. 8 is a diagrammatic, front elevational view of the acceptor illustrating the trajectories of coins of various materials gravitating from the rail of the magnetic coin validator; and FIG. 9 is a diagrammatic, front elevational view of the acceptor illustrating the trajectories of coins of various materials gravitating from the nonmagnetic coin validator (eddy-current separator);
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includes an upper passageway 84 (FIG. 5) communicating with a
coin exit opening 86 in rear plate 22 which, in turn, empties into a
lower passageway 88 where the accepted coin is
directed to the other coin-handling apparatus of the vending
machine (not shown). Another component of the rear plate 22 include a disc 90 of
magnetic material which is in opposed, closely spaced relation-
ships to the pole faces 48 of magnet 46. Additionally, a
scavenger lever 92 is shown mounted on a pivot pin 94 and is
provided with a cam 96 for engagement with a follower roller
98 (FIG. 1) carried by plate assembly 26. The scavenger lever 92 is spring-biased toward the normal position thereof illustr-
ated and is moved to the opposite position by the effect of the lower coin on the
plate assembly 26 about hinge pin 28 away from the rear plate
22 to remove the coin rail 44 or 54 from beneath a coin to be
rejected. A suitable scavenger wiper (not shown) would also be
employed and would extend from the lever 92 for operation
thereby in the usual manner. Rejected coins pass to the left of
separator 82 as viewed in FIGS. 4, 8 and 9.

With reference to FIGS. 10 and 11, the components of the second embodiment of the invention here shown that are sub-
stantially identical to components described above are
designated by the same reference numerals with the addition of the “a” notation. The views of FIGS. 10 and 11 are sim-
plified and serve to illustrate that, alternatively, a second cra-
dle 100 may be disposed beneath the first cradle 34a for re-
ceiving a coin having an incorrect orientation. A lower coin rail
102 which replaces the coin rail 54 of the first embodiment described above. An additional permanent magnet is utilized and
disposed such that a coin traveling along rein 102 must pass
directly across its pole faces 104. Alternatively, an upper extension on rail 102 could be employed in the lower side
of cradle 100 to direct coins onto the rail 102 for ultimate
gravitation from the lower end 106 of the lower cradle.
A comparison of the two embodiments is best made by
viewing FIGS. 6 to 10 and 11. In FIG. 6 it is clear that the coin
rails 44 and 54 are vertically offset and that the coin paths
defined thereby partially overlap. In the embodiment of FIGS.
10 and 11, however, the two rails 44a and 54a are disposed in a
common vertical plane and the coin paths defined thereby
do not overlap. For coins of a given diameter, it should be un-
derstood that a greater vertical spacing between the rails is
required in the second embodiment. Note the provision of a
shoulder 108 for deflecting a deposited coin into the lower
cradle 100 if the guide ramp 72a is withdrawn.

OPERATION

The operational principles for both embodiments of the in-
nvention are the same. When a deposited coin enters the tunnel
it is directed into the cradle 34 and strikes lugs 36 and 38 and the release dog 42 of latch 40. This rotates latch 40 slightly
counterclockwise as viewed in FIG. 1, permitting cradle 34 to
rotate in a clockwise direction under the weight of the coin
(FIG. 3). The incoming coin, if composed of a magnetic material, is thus brought into the field of the bar magnet 70
carried by member 64. Therefore, a magnetic coin contacts
member 64 to pivot about hinge pin 66 and shift from the posi-
tion thereof illustrated in FIG. 6 to the coin-supporting posi-
tion illustrated in FIG. 7. With the guide ramp 72 inserted into the
coin passage 76, the coin is prevented from gravitating further downwardly and is diverted toward the upper rail 44.
Conversely, if a coin of nonmagnetic material is deposited,
such coin will have no effect on the pivotal member 64 and
will gravitate downwardly through passage 76 until it comes to re-
side on the lower rail 54 (FIG. 6), whereupon the coin then
commences movement along the path of travel defined by the
lower rail 54.

From the foregoing, it may be appreciated that magnetic
coins and nonmagnetic coins are handled in separate paths of
travel once the same are introduced into the acceptor 20. The
upper rail 44 for magnetic coins trajectories the same from its
lower end 50 for further separation in accordance with a mag-
netic graduation effect caused by the presence of the mag-
netized section 52. Since section 52 is not highly magnetized
by virtue of being spaced from the pole faces 48 of magnet 46,
magnetic coins rolling along rail 44 will not be held on the rail
by magnetic attraction but, instead, trajectory from the lower end
50 thereof as illustrated diagrammatically in FIG. 8. Steel
coins (slugs) or illegitimate-coinage composed of other highly
magnetic, ferrous materials follow the trajectory designated
110 and “wrap” around the lower end 50 due to the high mag-
netic attraction. Less magnetic coinage, such as the proposed
pure nickel Canadian quarter, follows the trajectory designated
112 and are only partially wrapped about the end 50 by the effect
of the magnetic field 52. Thus, a coin of pure nickel composition is directed into the accept track
while steel slugs are rejected. If, for some reason, a malfunc-
tion should occur and the guide ramp 72 directs a nonmag-
netic coin onto rail 44, such coin is not affected by the mag-
netic field and strikes the deflector 78, whereupon the non-
magnetic coin is deflectected along a trajectory 114 and is re-
jected in the same manner as described above. Thus, whether legiti-
mate or counterfeit, nonmagnetic coins directed onto the
upper rail 44 will not be accepted.

Since a nonmagnetic coin will not cause the guide ramp 72 to
be drawn inwardly into blocking relationship to the coin
passage 76, the nonmagnetic coin rolls down the lower ramp
54 directly across the pole faces 48 and into the strong mag-
netic field at the upper end 44 of the magnet 46. The upper rail
44 and the field of magnet 46 adjacent the lower end 56 of
rail 54 is further intensified by the disc 90 of magnetic material to provide an effecient eddy-current-type separator for the
nonmagnetic coins. Referring to FIG. 9, coins composed
of metallic materials of relatively low electrical conduc-
tivity are less affected by the braking action of the magnetic
field and follow a longer trajectory designated 106 thereof.
The外国人 continued to describe the operation and trajectory of the acceptor and deflector system, detailing how the magnetic forces acted upon different types of coins to ensure separation and correct orientation. The text concluded with a summary of the invention's advantages and potential applications in coin counting and sorting machines.
said receiving and sensing means being disposed adjacent to said structure for directing each deposited coin thereinto for travel along one of said paths if the coin is magnetic and along the other of said paths if the coin is nonmagnetic; 7
said structure having magnetic coin-validating means for accepting valid coins and rejecting invalid coins traveling along said one path, and nonmagnetic coin validating means for accepting valid coins and rejecting invalid coins traveling along said other path; 7
said magnetic coin-validating means including a first, inclined, coin-supporting rail defining said one path; 10
said nonmagnetic coin-validating means including a second, inclined, coin-supporting rail beneath said first rail and defining said other path; 15
said first rail having a lower end and a magnetized section presenting said end; 20
said second rail having a lower end and said nonmagnetic coin-validating means further including a magnet adjacent said end of the second rail and provided with poles disposed in closely spaced relationship to coins gravitating over said end of the second rail, whereby to provide eddy-current braking of nonmagnetic coins thereon; there being means beneath said rails defining a common track for coins accepted by said testing structure; 25
said magnetic and nonmagnetic coin-validating means being disposed to impart trajectories to valid coins gravitating from the ends of respective rails extending into said common accept track. 30
2. In a coin acceptor as claimed in claim 1, said receiving and sensing means including a shiftable coin guide movably between a first position where a deposited coin is directed along said one path, and a second position where the deposited coin is directed along said other path. 35
3. In a coin acceptor as claimed in claim 2, said receiving and sensing means further including means responsive to the deposit of a magnetic coin for shifting said guide from said second position to said first position thereof. 40
4. In a coin acceptor:
means for receiving deposited coins and sensing whether each of the latter is magnetic; and 45
coin testing structure presenting a pair of coin paths; 50
said receiving and sensing means being disposed adjacent to said structure for directing each deposited coin thereinto for travel along one of said paths if the coin is magnetic and along the other of said paths if the coin is nonmagnetic; 55
said structure having magnetic coin-validating means for accepting valid coins and rejecting invalid coins traveling along said one path, and nonmagnetic coin validating means for accepting valid coins and rejecting invalid coins traveling along said other path; 60
said magnetic coin-validating means including a first, inclined, coin-supporting rail defining said one path; 65
said nonmagnetic coin-validating means including a second, inclined, coin-supporting rail beneath said first rail and defining said other path; 70
said rails being vertically offset and sufficiently closely spaced to partially overlap said paths; 75
said first rail having a lower end and a magnetic section presenting said end; 80
said second rail having a lower end and said nonmagnetic coin-validating means further including a magnet adjacent both of said ends and provided with poles disposed in closely spaced relationship to coins gravitating over said end of the second rail, whereby to provide eddy-current braking of nonmagnetic coins thereon; 85
said magnet having a field magnetically coupled with said section to magnetize the latter. 90
5. In a coin acceptor:
means for receiving deposited coins and sensing whether each of the latter is magnetic; and 95
coin testing structure presenting a pair of coin paths; 100
said receiving and sensing means being disposed adjacent to said structure for directing each deposited coin thereinto for travel along one of said paths if the coin is magnetic and along the other of said paths if the coin is nonmagnetic; 105
said structure having magnetic coin-validating means for accepting valid coins and rejecting invalid coins traveling along said one path, and nonmagnetic coin-validating means for accepting valid coins and rejecting invalid coins traveling along said other path; 110
said magnetic coin-validating means including a first, inclined, coin-supporting rail defining said one path; 115
said nonmagnetic coin-validating means including a second, inclined, coin-supporting rail beneath said first rail and defining said other path; 120
said rails being disposed in a common vertical plane; 125
said first rail having a lower end and a magnetic section presenting said end, and said magnetic coin-validating means further including a magnet having a field magnetically coupled with said section to magnetize the latter; 130
said second rail having a lower end and said nonmagnetic coin-validating means further including a magnet adjacent said end of the second rail and provided with poles disposed in closely spaced relationship to coins gravitating over said end of the second rail, whereby to provide eddy-current braking of nonmagnetic coins thereon. 135
6. In a coin acceptor:
means for receiving deposited coins and sensing whether each of the latter is magnetic; and 140
coin testing structure presenting a pair of coin paths; 145
said receiving and sensing means being disposed adjacent to said structure for directing each deposited coin thereinto for travel along one of said paths if the coin is magnetic and along the other of said paths if the coin is nonmagnetic; 150
said structure having magnetic coin-validating means for accepting valid coins and rejecting invalid coins traveling along said one path, and nonmagnetic coin-validating means for accepting valid coins and rejecting invalid coins traveling along said other path; 155
said magnetic coin-validating means including a first, inclined, coin-supporting rail defining said one path and having a lower end and a magnetized section presenting said end, whereby different trajectories are imparted to highly magnetic invalid coins and less magnetic valid coins; 160
said nonmagnetic coin-validating means including a second, inclined, coin-supporting rail defining said other path and having a lower end, and a magnet adjacent said end of the second rail and provided with poles disposed in closely spaced relationship to coins gravitating over said end of the second rail, whereby to provide eddy-current braking of nonmagnetic coins thereon and to stop and hold magnetic coins thereon; 165
said testing structure having deflector means spaced from said end of the first rail for deflecting nonmagnetic coins gravitating therefrom along the same trajectory as said highly magnetic invalid coins whereby, in the event that deposited coins are directed along improper paths, neither coin validating means will effect an acceptance.