

Aug. 15, 1961

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2,995,976

INSPECTION AND PROJECTION DEVICE

Filed Jan. 30, 1957

4 Sheets-Sheet 1

FIG. 1

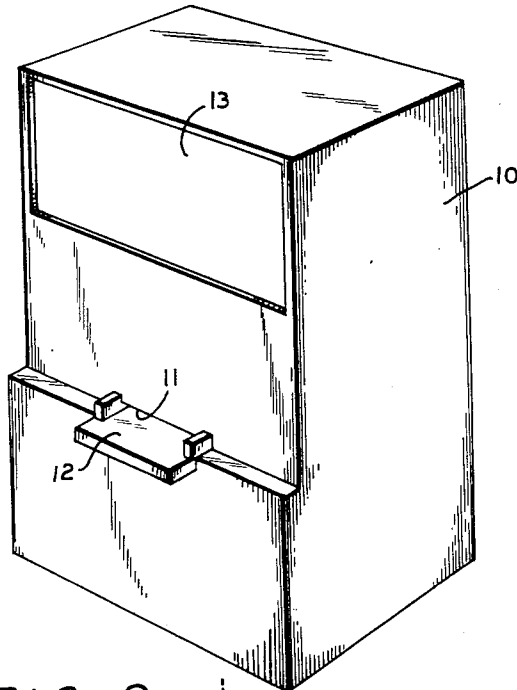
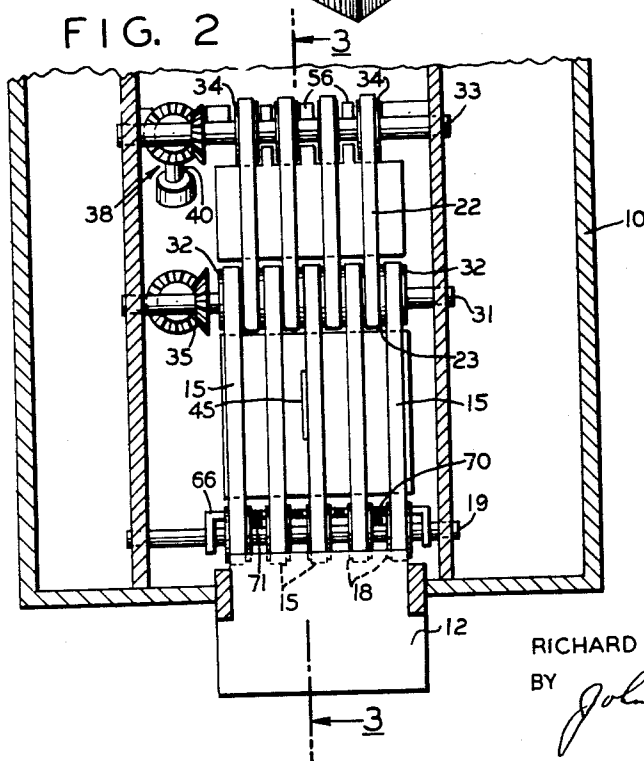


FIG. 2



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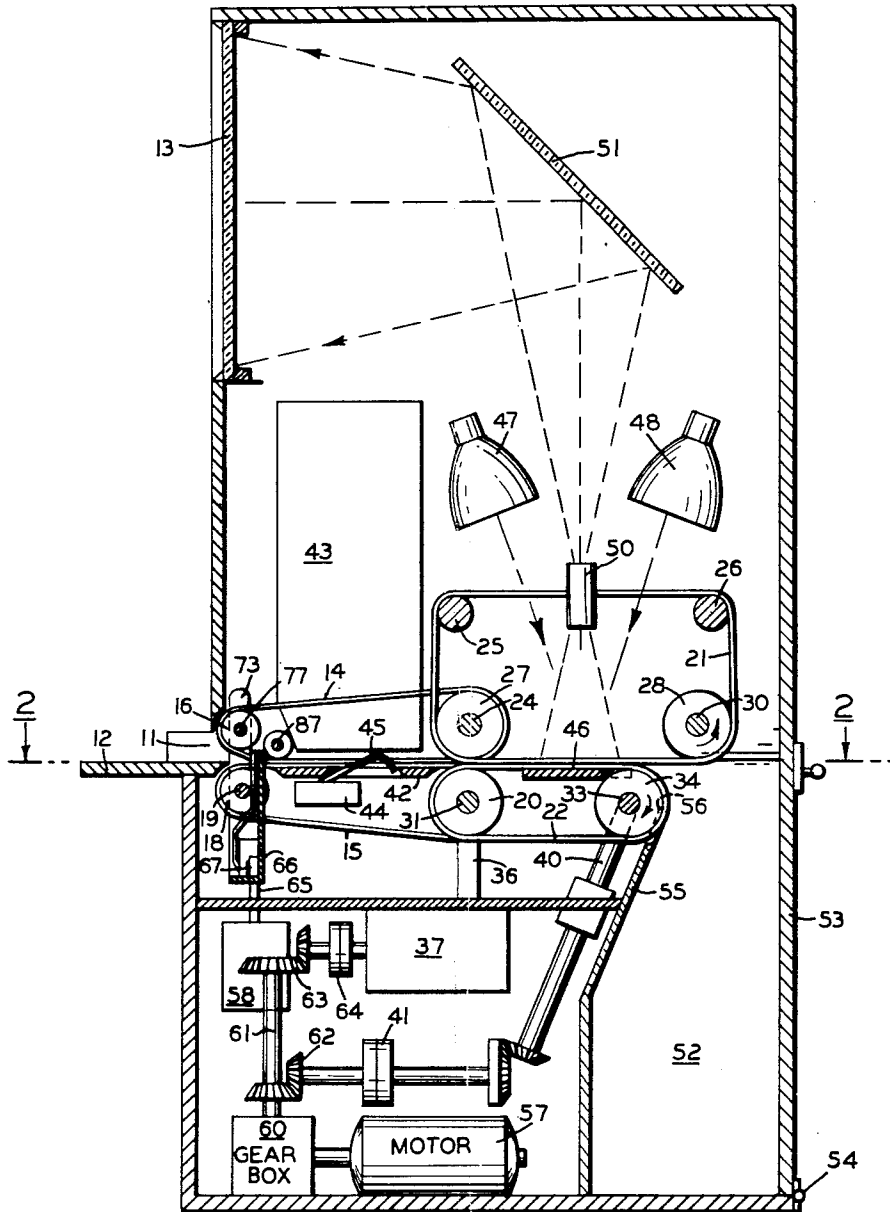
2,995,976

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4 Sheets-Sheet 2

FIG. 3



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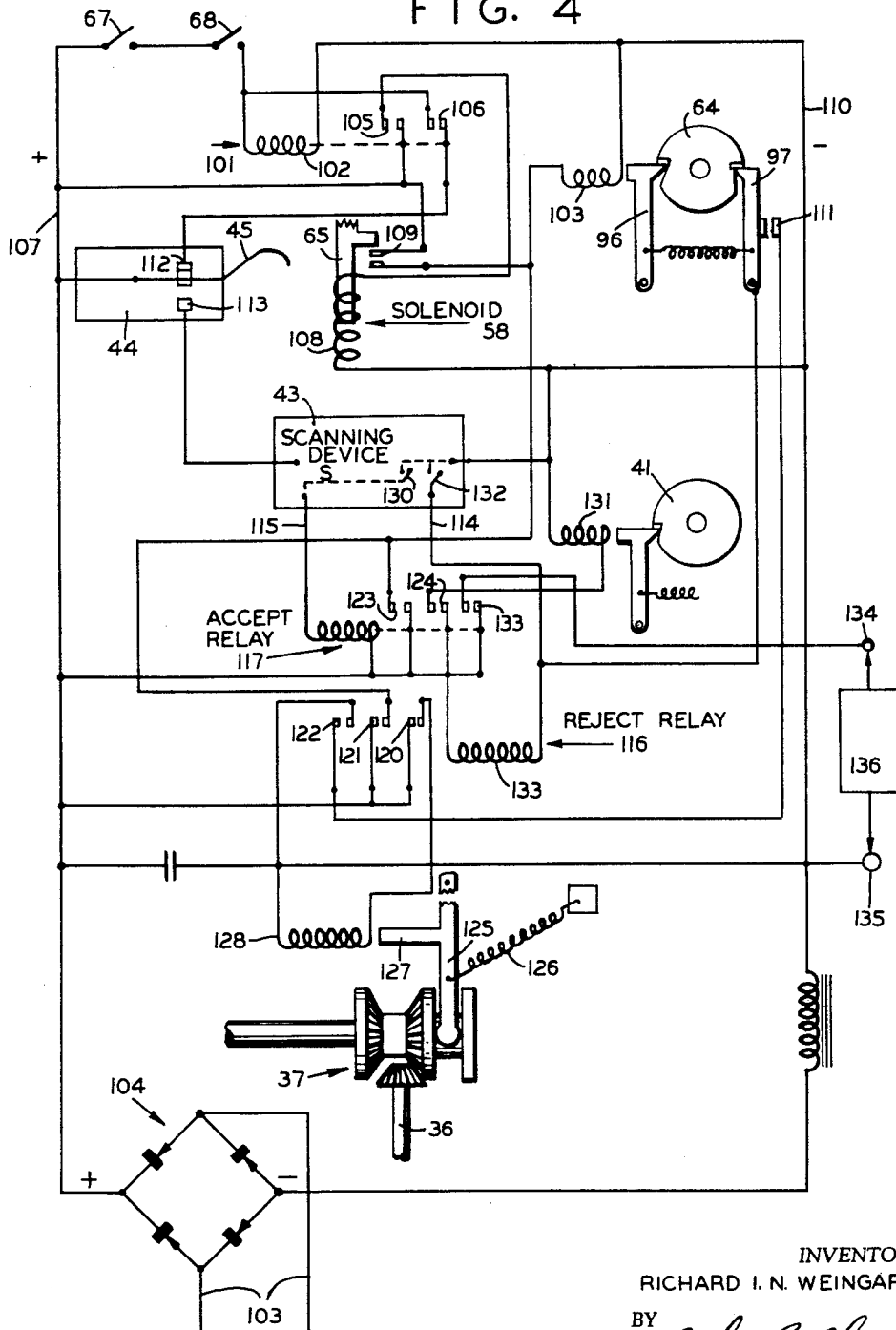
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4 Sheets-Sheet 3

FIG. 4



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2,995,976

INSPECTION AND PROJECTION DEVICE

Filed Jan. 30, 1957

4 Sheets-Sheet 4

FIG. 5

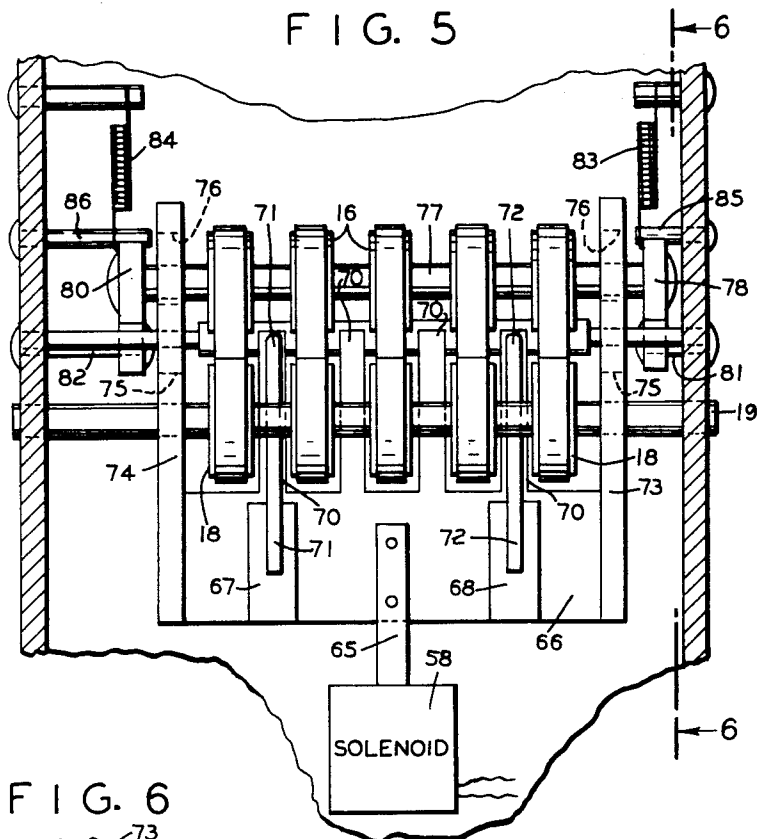


FIG. 6

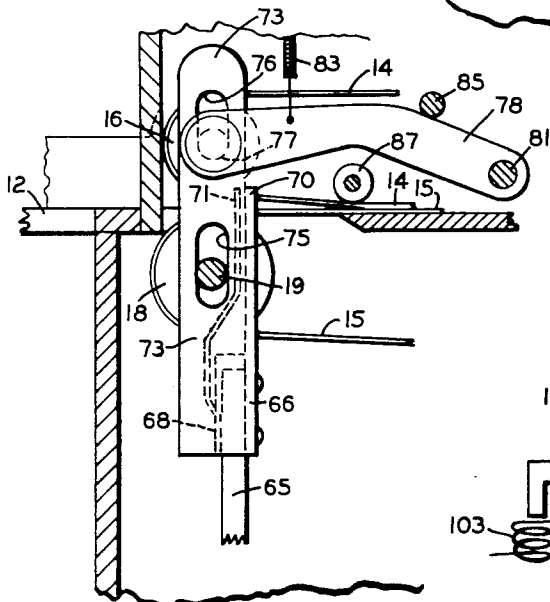
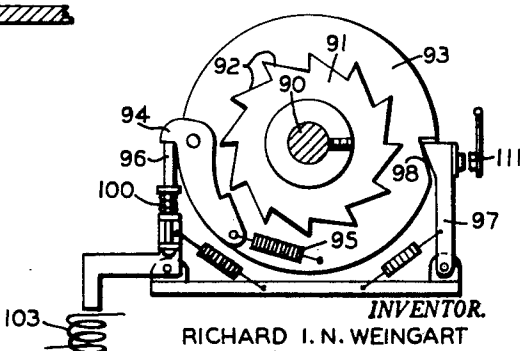


FIG. 7



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1

2,995,976

INSPECTION AND PROJECTION DEVICE

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Filed Jan. 30, 1957, Ser. No. 637,114

1 Claim. (Cl. 88—24)

This invention relates to an inspection device which is operated by paper money. It has particular reference to a means for receiving paper money from a customer, examining the article received for denomination and validity, and then projecting an enlarged image of the article on a viewing screen where it may be inspected by an operator.

Vending machines which receive various denominations of metallic coins are quite common and have been used for many years for dispensing merchandise, the purchase of tickets, and admissions to subway trains and places of entertainment. However, up to the present time, there has been no machine available which will accept any denomination of paper money such as a one or five dollar bill and give any of the articles or services enumerated above. The present invention comprises a machine which will accept a piece of paper money, examine it and if it is found to be valid, a service is rendered or an article is delivered to the customer. If the paper money tendered by the customer is found to be faulty, it is returned to the customer at once.

One of the components of this invention includes an optical examining device which scans a preselected portion of the bill and determines whether or not the bill is a valid article of paper money and whether or not it is of the correct denomination. Such a scanning device is described and claimed in U.S. Patent No. 2,646,717. This device employs a negative image of a predetermined denomination of a bill recorded on a photographic plate. An image of the proffered bill is projected against this negative image and the amount of transmitted light is examined by a photoelectric cell after the negative photograph and projected image have been brought into correct register. This sensing device also contains a switching means which sends an electrical current over one conductor when the bill is found to be valid and of the correct denomination and another current over another conductor when the bill is found to be a counterfeit or of the wrong denomination.

One of the objects of this invention is to provide an improved vending machine which avoids one or more of the disadvantages and limitations of prior art arrangements.

Another object of the invention is to provide a vending machine which will accept paper money and render a service or deliver merchandise.

A further object of the invention is to permit an operator to observe an enlarged projected image of the bill immediately after it has been accepted by the machine.

Yet another object of the invention is to provide a vending machine which can be operated at great speed and require a minimum of supervision.

The invention comprises a means for receiving a piece of paper money from a customer and transferring it to a sensing device which examines a portion of the bill to determine its validity. The transferring means is reversible and if the bill is found to be a counterfeit, it is returned immediately to the customer. If the bill is acceptable, it is transferred to a second sensing position where it is illuminated and its image focussed by an optical system onto a viewing screen where it may be observed by an operator. The bill remains in this second position until another bill is inserted into the machine, at which time it is transferred to a storage space.

2

In the drawings:

FIG. 1 is a perspective view of the machine showing the viewing screen and the entrance slot.

FIG. 2 is a cross sectional view of the machine taken along line 2—2 of FIG. 3 showing the transferring means.

FIG. 3 is a cross sectional view of the entire machine taken along line 3—3 of FIG. 2 and shows the operating mechanism in the base of the machine, the sensing device, the optical system, and the viewing screen.

FIG. 4 is a schematic diagram of connections showing the electrical components associated with the control and operation of the machine.

FIG. 5 is an enlarged front view of the transferring means with some parts in section showing the relationship of the entrance belts, the stop, and the two entrance microswitches.

FIG. 6 is a cross sectional view taken along line 6—6 of FIG. 5 and shows the operating mechanism which controls the machine when the two entrance switches are actuated.

FIG. 7 is a side view of a one-revolution clutch employed in the machine.

Referring now to the drawings, FIGS. 1, 2, 3, 5 and 6 show the machine and its operating components. All the components are housed within a cabinet 10 which includes an entrance slot 11 positioned just above a shelf 12 for receiving the bill. At the top of the cabinet a viewing screen 13 is positioned where the enlarged image of the bill is displayed. Inside the machine and close to the entrance slot 11 is a series of upper belts 14 (see FIGS. 3 and 6 and lower belts 15 supported by cylindrical rollers 16, 27, 18 and 20. A second series of belts is mounted to the rear of the first series and includes a set of upper belts 21 and lower belts 22. The upper belts 14 are supported by a set of rollers 16 and 27 which are free to move on shafts 24 and 77. The series of belts 21 is supported by idler rollers 25, 26, 27 and 28, these rollers all being free to move on their supporting shafts.

The lower set of entrance belts 15 is driven by shaft 31 to which is secured a set of rollers 32. Belts 22 are driven by shaft 33 to which are secured a series of rollers 34. Shaft 31 is driven by a beveled gear combination 35 which in turn is driven by a vertical shaft 36, coupled to a reversible mechanism 37, shown in greater detail at the bottom of FIG. 4. Shaft 33 is driven by a similar set of beveled gears 38 which is driven by an inclined shaft 40, coupled to a single-revolution clutch 41.

The upper and lower entrance belts 14 and 15 pass over a base plate 42 and are in contact in this position. The belts are arranged to receive the bill between the upper and lower sections and first move it to a position midway between rollers 16 and 27, at which point a sensing device 43 is operated to determine the validity of the bill. The presence of a bill at this portion of the machine is determined by a microswitch 44 which is operated by an extended arm 45 positioned close to one of the belts 15 and operated by the bill as it passes through the machine.

The details of the sensing device 43 will not be described here because they have already been described in the above mentioned patent and are not a part of this invention.

A similar base plate 46 is positioned under belts 21 and 22 to act as a support for the belts when the bill has been moved to a position which is midway between rollers 27 and 28. At this position lamps 47 and 48 are adjusted to illuminate the bill so that an optical system 50 will project the reflected image therefrom and direct it vertically to a reflecting mirror 51 and the viewing screen 13.

At the rear of shaft 33 and rollers 34 is a storage chamber 52 where the accepted bills are kept until such

time as an operator may remove them by unlocking a rear door 53 supported by hinges 54. The front side of compartment 52 is enclosed by a wall 55 which includes projections 56 extending upwardly through the spaces between rollers 34. These projections act as a stripper means and prevent the bills from being carried toward the front of the machine by belts 22.

Motive power for operating the machine is obtained from an electric motor 57 and a solenoid 58. The motor operates through a gear box 60 which reduces the speed of the motor shaft and turns a vertical power shaft 61. Coupled to this shaft are two beveled gear assemblies 62 and 63, the former operating one-revolution clutch 41, and the latter operating a second one-revolution clutch 64.

Solenoid 58 operates an armature 65 to which is secured a stop plate 66. The stop plate supports two microswitches 67 and 68 and contains four tines 70 which extend upwardly between rollers 18 to act as a stop to prevent the bill from being pushed into the space between the two rollers and to aid in the alignment of the bill. In front of the two end tines, two arms 71 and 72 are positioned which operate microswitches 67 and 68. These switches are connected in series as is evident from the diagram of connections shown in FIG. 4 and operate the solenoid and stop only when both of them are simultaneously actuated.

The end portions of stop plate 66 are bent over at right angles to form vertical rods 73 and 74, as indicated in FIGS. 5 and 6. Each of these rods contains a cut-out portion 75 surrounding shaft 19 which holds rollers 18. At the upper end of the rods a second cut-out portion 76 encloses a movable shaft 77 which holds rollers 16 and is secured to rockable arms 78 and 80. The rockable arms are pivoted on stub shafts 81 and 82 and are urged upwardly by springs 83 and 84, being restrained by stops 85 and 86. It will be noted that belts 14 and 15 are in contact above base plate 42 but diverged in their unactuated position near the entrance slot. An idler roller 87 holds the two series of belts in contact near the front edge of base plate 42. When current is sent through solenoid 58 and the base plate 66 pulled downwardly, the tines 70 and the switch arm 71 are first lowered below the plane of the intersection of the two belts. Then the upper surface of slot 76 makes contact with shaft 77 and pulls it down until the two belts 14 and 15 are in contact with each other and grip the proffered bill firmly at its leading edge. At this point an electrical contact, to be described later, is closed and one-revolution clutch 64 is operated, thereby turning the belts a predetermined amount which moves the bill to a position directly under the sensing unit 43.

The one-revolution clutches 41 and 64 may be constructed in accordance with any of the well-known designs. FIG. 7 shows a type of clutch which may be employed in the present machine. It comprises a driven shaft 90 to which is secured a driver wheel 91 formed with teeth 92. The driven shaft is connected to a circular plate 93 on which is pivotally mounted a pawl 94, resiliently urged by a spring 95 to engage the teeth of the driver wheel. When the clutch is in its disengaged position pawl 94 is held away from the engaging position by a control lever 96. A second pawl 97 engages a cut-out portion 98 in plate 93 and aids lever 96 to maintain pawl 94 in its disengaged condition. When the clutch is actuated, lever 96 is withdrawn from its contact with pawl 94 and spring 95 pulls the pawl into engagement with the driver wheel 91, thereby actuating the clutch. After a single revolution, the extending portion of pawl 94 again engages lever 96 and the pawl is rotated a small amount to disengage it from the tooth of the driver wheel. The inertia of plate 93 carries it slightly beyond its normal position, this motion being taken up by spring 100 in the control lever 96. This additional motion permits pawl 97 to be positioned in recess 98,

thereby restoring the clutch to its non-actuated condition.

The operation of the machine is controlled by four solenoids and three relays. A start relay 101 has its winding 102 connected in series with entrance switches 67 and 68, the ends of this circuit being connected to a source of power which may be an alternating current supply line 103 connected through a rectifier bridge 104. Relay 101 also includes two normally open pairs of contacts 105 and 106. Contacts 105 are connected in series between supply conductor 107 and winding 108 of solenoid 58. When this solenoid is actuated, contacts 109 are closed, thereby sending current from conductor 107 through winding 103 to the second power conductor 110. This current actuates clutch 64 and closes contacts 111 which are operated by a movement of pawl 97 associated with clutch 64 (see FIG. 7).

Microswitch 44 contains one pair of normally closed contacts 112 and a pair of normally open contacts 113. Contacts 112 are in series with holding contacts 106 in relay 101 and normalize the relay when the microswitch 44 is operated by arm 45. Contacts 113 are in series with the scanning device 43 and cause its operation as soon as these contacts are closed. The scanning device 43 is arranged to send current over two output conductors 114 and 115 operating a reject relay 116 when the bill is found to be invalid and operating an accept relay 117 when the bill is found to be valid. Relay 116 includes three normally open pairs of contacts 120, 121 and 122, and these contacts are connected in series with circuits which cause the bill to be returned to the customer. The accept relay 117 includes two normally open pairs of contacts 123 and 124 which cause both one-revolution clutches 41 and 64 to be operated and move the bill from its sensing position to the projecting position.

In order to reverse the direction of motion of the bill so that it can be returned to the customer, the reversing gear 37 is coupled between one-revolution clutch 64 and shaft 36 (see FIG. 3). This gear is controlled by a pivoted arm 125 stressed by spring 126 and includes an armature 127 which is moved by solenoid 128.

The operation of the machine is as follows: The customer places a bill on the shelf 12 and pushes it through the slot 11 until it makes contact with switches 67 and 68. As soon as both switches are closed, a current flows from conductor 107, through both switches in series, through the winding 102 of relay 101, to conductor 110. This causes the actuation of relay 101 and contacts 105 and 106 are closed. Contacts 105 complete a circuit which can be traced from conductor 107, through contacts 105, through winding 108 of solenoid 58, to conductor 110. This current causes armature 65 to be lowered, thereby lowering the stops 70 together with switch arms 71 and 72, and also lowering shaft 77 to grip the bill. When armature 65 is lowered, a projection thereon causes contacts 109 to be closed and then a circuit may be traced from conductor 107 through contacts 109, winding 103, to conductor 110. This current actuates one-revolution clutch 64 by drawing the operating lever 96 toward the winding and causing a single revolution of shaft 36 through coupling gear box 37 to turn shaft 31 and move the bill from table 12 to a position under sensing device 43. When the solenoid 58 is actuated and the arms 71 and 72 are lowered, switches 67 and 68 will be opened but relay 101 is held in its operated condition by a holding circuit which may be traced from conductor 107 through contacts 112, through contacts 106, through winding 102, to conductor 110. This holding circuit insures that the bill will continue its movement until arm 45 of switch 44 is actuated. As soon as contacts 112 are broken the holding circuit is broken and relay 101 together with solenoid 58 are normalized, as is also the one-revolution clutch 64.

The bill is now under the scanning device 43 and this sensing arrangement proceeds through a cyclic program of inspection to determine if the bill is valid and if it is

the proper denomination. If the scanning device finds that the bill is valid a switch 130 is closed, completing a circuit which may be traced from the conductor 107, through the winding of accept relay 117, conductor 115, switch 130, to conductor 110. Current through this circuit causes the closing of contacts 123 and 124. Contacts 123 send current through winding 103 of clutch 64 while current through contacts 124 send current through winding 131 of one-revolution clutch 141, thereby causing both clutches to be actuated and moving the bill from its position under sensing device 43 to a position directly above base plate 46 where the bill is illuminated and its image projected to viewing screen 13. The above described operation moves the bill from the shelf 12 to the second sensing position where the bill remains until a subsequent operation moves it into storage chamber 52.

If the scanning device 43 determines that the bill is not valid a second switch 132 is closed and current is sent from conductor 107, through winding 133 of reject relay 116, through switch 32 to conductor 110. This current causes the actuation of the reject relay 116 and normally open contacts 120, 121 and 122 are closed. Current through contacts 120 passes through winding 128 of the solenoid which reverses the motion of shaft 36 through coupling device 37. Current through contacts 121 passes through winding 103 and actuates one-revolution clutch 64. This clutch acting through reversing mechanism 37 turns belts 14 and 15 in a reverse direction and sends the bill back to the customer. Contacts 122 of reject relay 116 form a holding circuit for retaining the reject relay 116 in its actuated condition until one-revolution clutch 64 has completed its movement. This circuit may be traced from conductor 107, through relay winding 133, through contacts 111 on pawl 97, then through contacts 122, to conductor 110. This holding circuit is broken by the opening of contacts 111 as soon as the one-revolution clutch 64 has completed its movement.

From the above description of the various components and of their operation it will be evident that the machine accepts a proffered bill from a customer, examines it for validity and denomination, then projects an enlarged image on a viewing screen and then, when another bill is entered into the machine, the inspected bill is moved to a storage compartment.

The above described machine includes no provision for the issuance of merchandise or for accomplishing a service. Such an operation may be performed by including an additional set of contacts 133 in the accept relay 117. This set of contacts is connected in series between conductor 107 and terminal 134. Terminals 134 and 135 may be connected to an issuing machine which will issue

merchandise or a ticket, or to a gate to a place of amusement, or may perform any other predetermined service. The additional merchandise or service mechanism is indicated generally by box 136.

While there have been described and illustrated specific embodiments of the vending machine it will be obvious that various changes and modifications can be made in the cycle of operations, in the sensing system 43, and in the projection system without departing from the field of the invention which should be limited only by the scope of the appended claim.

What I claim is:

A projection and storage device for sensing and displaying an enlarged image of a document on a viewing screen, comprising, a first transferring means including a belt conveyor which moves the document from an entrance position where the document is manually deposited, consecutively to a sensing station and a projection station, said belt conveyor including a plurality of endless belts, an electric motor for driving said belts, a double contact switch device which is operated by the leading edge of the document and controls the motion of said conveyor and a one-revolution clutch for moving the document to the sensing station, means to move the document from said sensing station to the projection station, a projection system which projects a real image of the document on a viewing screen where it may be viewed by an operator, said projection system including illuminating means for applying light to the document, and an optical system which focuses light rays reflected from the document onto said viewing screen, and a second transferring means including a portion of said conveyor for moving the document from the projection station to a storage chamber, said second transferring means being held inoperative until another document is entered into the device.

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