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An apparatus for receiving and storing notes

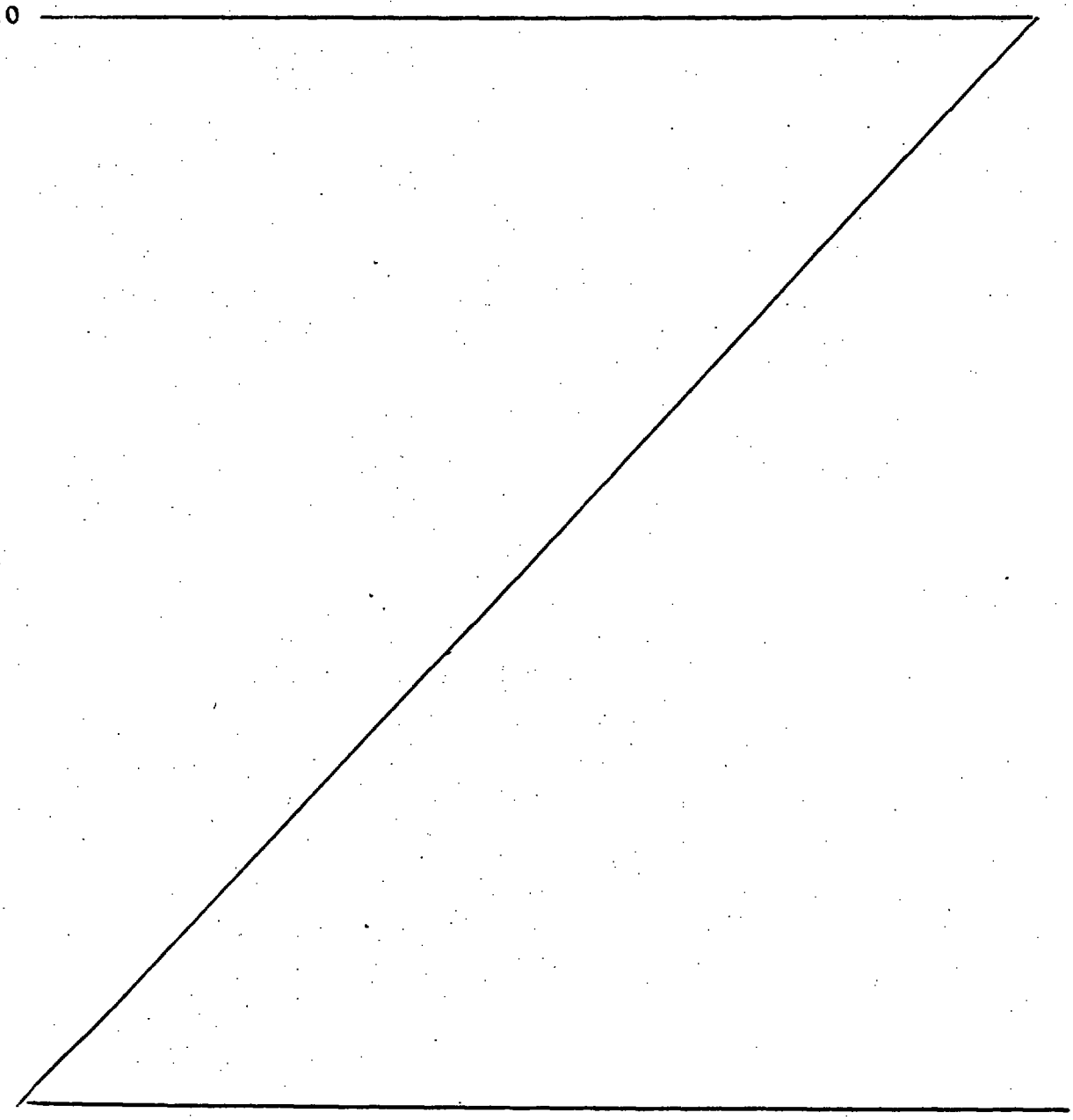
This invention relates to an apparatus for receiving and storing notes.

The invention (whose scope is defined in the appended claims) includes an apparatus for receiving and storing notes of different denominations in a note acceptor, comprising a receptacle for temporarily receiving a note, a pusher member reciprocatingly removable through said receptacle, receiving means on either side of said receptacle, one for each denomination of note to be stored, for receiving notes moved by said pusher member from said receptacle, and position sensing means operatively connected to said pusher member for monitoring the positional relationship of said pusher member with respect to said receptacle, said position sensing means comprising photodetectors interconnected with said pusher member, said photodetectors sensing predetermined positions of said pusher member, said position sensing means further comprising a pair of disks interposed between said photodetectors, said disks having openings therein in communication with said detectors, detection of said openings by said detectors establishing positions of said pusher member.

The invention also includes an apparatus for receiving and storing notes, comprising a receptacle, a pair of stacking means one on each side of said receptacle, a pusher member in reciprocal communication with said stacking

means, said pusher member including a crank arm and drive linkage, and position sensing means operatively interconnected with said crank arm and drive linkage for monitoring the position of said pusher member with respect to said receptacle, said position sensing means comprising a pair of disks in intercommunication with a series of photodetectors, said photodetectors responding to positional indicai on said disks .

Heretofore in the art, numerous types of



security validators have been known and used. Such validators are typically of the tray or slot acceptor types, the former receiving the currency or security into a tray which is then slid into a test position, while the latter receives such currency in a slot and then, by rollers or the like, passes the currency beyond the test station. In either assembly, once the currency or security has been validated and the determination has been made that goods and/or change is to be dispensed in exchange therefor, the currency must be retrieved and appropriately stored for future acquisition by the operator. Means for receiving and retaining such currency are typically referred to as stackers.

Of course, stackers have been previously known in the art and the same have been devised for both tray and slot acceptors. Indeed, known stackers operate on both a gravity feed and mechanically actuated concept. However, known stackers are not capable of efficiently performing in acceptors which are operative for testing and receiving currencies of multiple denominations. In many such acceptors, the multiple currencies are all received and stacked in the same location with the operator having to manually separate the various denominations. Of course, such a technique is extremely inefficient and time consuming. Additionally, in known stackers access to the stacked currency has generally been difficult. Finally, conceptions of stackers which maintain the bills vertically have been difficult to develop because of the tendency of such bills to break out of or spring sideways from the stack. A preferred embodiment of the invention provides a dual stacker for slot acceptors overcoming the above-described drawbacks.

In order that the invention may be well understood the preferred embodiment thereof, given by way of example, will now be described with reference to the accompanying drawings, in which :

Fig. 1 is a side sectional view of a note

acceptor of the slot acceptor type and including a dual stacker embodying the invention;

Fig. 2 is a top plan view of the same dual stacker with the note acceptor removed;

Fig. 3 is a side elevational view of a punch drive assembly of the same dual stacker;

Fig. 4 is a side elevational view of crank and punch position disks of the same dual stacker showing the same in operative interconnection between photo sensors and the crank gear shaft;

Fig. 5 is a top plan view of the structure of Fig. 4; and

Figs. 6 to 11 are illustrations of the inter-relationship between the punch, punch drive assembly, and position photo sensors of the same dual stacker in each of the respective positions of interest.

Referring now particularly to Figure 1 a note acceptor 10, which is of the slot acceptor type, includes a casing or cabinet 12, it being understood that the same is accessible in standard fashion by side access doors, opened by the operator through use of a key. As the name implies, the slot acceptor 10 includes a slot escutcheon 14 for receiving currency or other securities being tendered for validation. In standard fashion, a bill placed within the slot 14 travels along a note path 16 for ultimate receipt by a dual stacker 18. The details of the slot acceptor are not set forth herein for such specifics are unimportant to the teachings of this invention.

The stacker assembly 18 is also shown in top plan view in Fig. 2. As illustrated, the assembly 18 includes a pair of oppositely positioned plates 20, each having a pair of angled gate stops 22 extending therefrom. The plates and gate stops 20, 22 define there-between a temporary receptacle positioned beneath or at the end of the note path 16 for receiving a note once it has been

determined that the same is valid and authentic. Maintained on each side of the plates 20 and biased into contacting engagement with the gate stops 22 are respective stacking plates 24, 26. These stacking plates are biased by respective sets of springs 28, 30 carried by associated rods 32, 34. The biasing of the springs 28, 30 urges the plates 24, 26 toward contacting engagement with gate stops 22. It will, of course, be understood that each of the plates 24, 26 has associated therewith pairs of upper and lower biasing springs.

A pusher member 36, comprising an appropriate plate or the like, is operative through an opening 38 to reciprocatingly transverse the receptacle defined between the pairs of plates, 20, 22. A motor and associated drive mechanism is maintained within a bottom section 40 of the cabinet 12 and will be discussed in detail hereinafter. Suffice it to say at this time that such mechanism achieves the desired movement of the pusher member 36 through the receptacle and into bill-stacking engagement with an appropriate stacking plate 24, 26.

As will become apparent hereinafter, when a bill is received by the receptacle between the plates 20, 22, the pusher member 36 directs the bill towards one of the stacking plates 24, 26, each such stacking plate being associated with a particular denomination of the bill. In fact, the pusher member 36 imparts a blow to, i.e. "punches", the currency into one stack or the other depending on the denomination of the bill. As such, the pusher member will hereafter be referred to as a punch member in the description of the preferred embodiment. The punch 36 moves the bill past the gate stops 22 with the bill deflecting as it moves thereacross and then into contacting engagement with previous bills which have been stacked on the appropriate stacking plate 24 or 26. The punch 36 then returns to a neutral position in line with one of the pairs of edges of

the gate stops 22 such that these edges then hold the stack of bills against the plate 24, 26. This urging of the stacks of bills between the plates 24, 26 and the associated edges of the gates 22 is by virtue of the biasing of the springs 28, 30 discussed above. It should be appreciated that the bills are thus stacked vertically, reducing the space required for the stacker assembly, and obviating the need for changing the posture of the bills as they are received from the note path 16.

It should now be apparent that the stacker 18 is divided into two sections 44, 46, one section

for each of two denominations of bills. For example, if the acceptor 10 were capable of receiving currency in one and five dollar denominations, the area 46 may be designated as that to receive the five dollar bills with the area 44 being designated for receiving the one dollar bills. With the areas 44,46 being of different size, it is obvious that the larger one will be designated for receiving and stacking the bills most commonly used.

As the bills stack between the appropriate plate 24,26 and the edges of the gates 22, there is a tendency for the bills to spring outwardly from the stack by sliding upon each other due to the pressure applied by the biasing of the springs 28,30. To prevent such outward springing, bill retaining bars 42 are placed on each side of the stacker 18 and are removably maintained by appropriate clips 43 at each end thereof. The pair of rods 42 are positioned in spaced relationship approximately equal to the width of the notes to be accepted so as to keep such notes properly aligned and to restrict the springing action. By being removable from the clips 43, an operator may open either of the side doors of the unit 10, remove one of the bars 42 and make access to the stacks of bills for removal through the side of the stacker 18. The operator may also reach down into the stacks for removal of the currency as apparent from the illustration of Fig. 2. In any event, there are three easy modes of access that an operator may make to the stacked currencies.

With reference now to Fig. 3, an appreciation of the drive mechanism for the punch 36 may be obtained. Here it is illustrated that a reversible motor 48 is operative for driving a crank gear 52 through a gear train 50. The crank gear 52 is connected to a crank gear shaft 54 having an end 56 thereat for receiving interrupt position disks to be discussed hereinafter. A

crank 58 is driven by the shaft 54 and is in pivotal driving interconnection with the punch link 60. With the end of the punch link 60 there is provided a punch slide 62 received within the opening 38 (best shown in Fig. 2) and guided thereby. The punch plate 36 is operatively connected to the punch slide 62. As can be seen, operation of the reversible servo motor 48 achieves movement of the punch plate 36 reciprocatingly within the opening 38 and transversing the receptacle defined by the plates 20,22. With the motor 48 being reversible, the shortest movement of the plate 36 to achieve the desired interaction with the stacking plate 24,26 may be obtained.

As illustrated in Figs. 4 and 5, the end 56 of the crank gear shaft 54 receives thereon a crank position disk 64 and a punch position disk 66. The former disk 64, as illustrated, has an outer circumferential portion removed about an arc of 180 degrees. The punch position disk 66 is characterized by a pair of slots 68,70 passing therethrough. In a preferred embodiment of the invention, the slots are spaced apart by 146 degrees while each is spaced 17 degrees from the perpendicular intersect line of the 180 degrees sector removed from the plate 64. Of course, the particular spacings of the slots 68,70 and their position with respect to the half-moon shaped disk 64 will be dependent upon parameters including the spacings of the photo detector 72-76. It will be appreciated that the photo detectors 72,76 are interposed across the punch position disk 66, while the photo detector 74 is interposed across the crank position disk 64. In other words, an output signal from the photo detector 74 is emitted for a full half cycle of the rotation of the disk 64, indicating the half cycle position of the crank 58. The outputs of the photo detectors 72,76 result from sensing the slots 68,70 of the

disk 66. These slots are spaced to indicate the position of the punch plate 36 at points when it is aligned with the edges of the gates 22.

As shown in Fig. 5, the outputs of the photo detectors or photo interrupts 72-76 are passed to gating circuitry 78 which is operative for buffering the outputs of the detectors 72-76, and raising the outputs to standard logic levels. These buffered outputs are then applied to the microprocessor 80 which is programmed to decode the outputs and determine therefrom the exact position of the punch plate 36. Through the motor control circuit 82, the microprocessor 80 may then control the reversible motor 48 to effect proper driving of the plate 36 to move bills from the receptacle defined by the plates 20 onto the appropriate stack.

As shown in Figs. 6-11, the position of the punch plate 36 and its associated drive assembly 58,60 is related by the interaction of the crank position interrupt disk 64 and punch position interrupt disk 66 with respect to the photo detectors 72-76. Figs. 6-11 proceed through the entire movement of the punch plate 36 in its entire reciprocating path, indicating that alignment of the slot 68 with the photo detector 72 provides an output signal to the microprocessor 80 that the punch plate 36 is in alignment with edges of the gate stops 22 on the one side of the receptacle between the plates 20. As the disks 64,66 continue to rotate clockwise, and the slot 68 comes into registration with the photo detector 76, the microprocessor is advised that the plate 36 is moved to the opposite edge of the receptacle defined by the plates 20. This is respectively illustrated in Figs. 6 and 7. With continued clockwise rotation, when an edge of the disk 64 comes into registration with the photo detector 74, allowing light to be sensed, the microprocessor 80 is

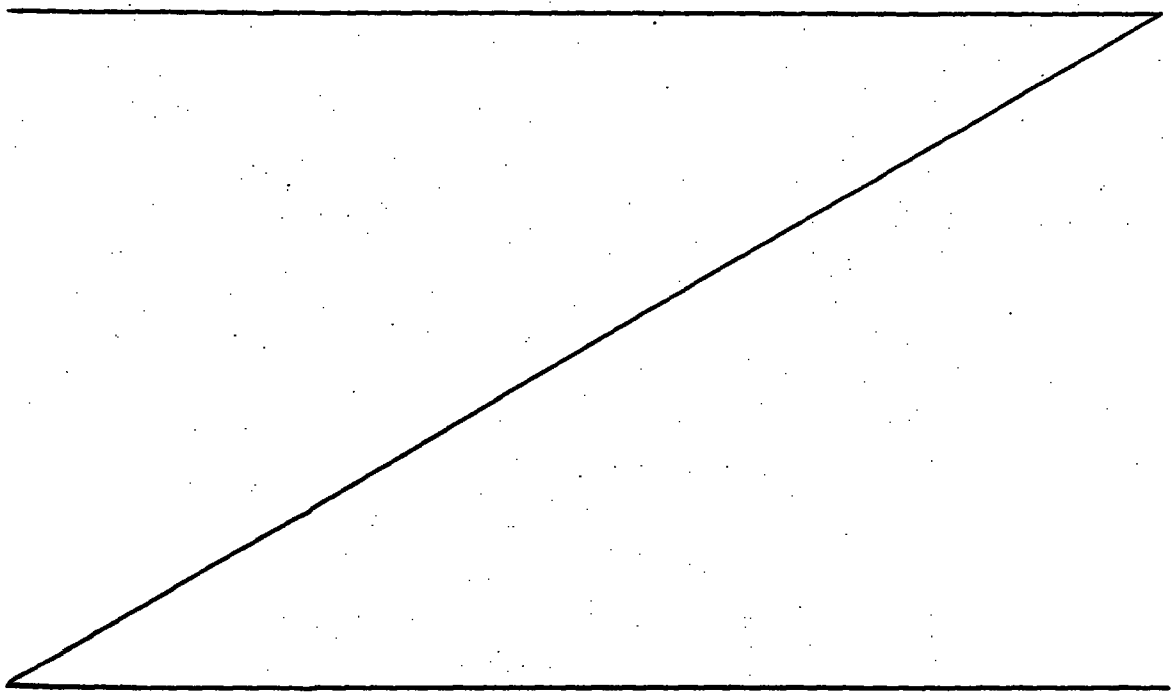
advised that the plate 36 has made its maximum extensive travel, having cleared gate stops 22 and stacked the bill.

The removed sector of the plate 64 indicates via the photo detector 74 that the plate 36 is on its return half cycle. As rotation continues in a clockwise manner and as shown in Fig. 9, the plate moves until it is again in alignment with the same side of the plates 20 as illustrated in Fig. 7. At this time, the slot 70 indicates to the microprocessor 80 via the photo detector 72 that alignment has been made. If clockwise rotation were to continue until the slots 70 were sensed by the photo detectors 76, such would indicate that the punch plate 36 is in alignment with the side of the plates 20 illustrated in Fig. 10. It should be noted that this is the same position for the plate 36 as illustrated in Fig. 6. Finally, as shown in Fig. 11, as the plates continue their clockwise rotation, the plate 36 continues on to its maximum travel in a direction opposite that shown in Fig. 8, which situation is determined by blocking of the photo detector 74 by the plate 64. Continued clockwise rotation would then achieve the positioning shown in Fig. 6.

As can be seen, there is a monitoring of the position of the punch plate 36 as well as the crank arm assembly by means of the plates 64,66. In operation, the microprocessor 80 determines the validity of a note tendered and, if it is valid, it determines the position of the punch plate and the crank assembly to prepare the plate for stacking of the bill. While the bill is maintained in escrow by the note acceptor, the motor 48 is moved such that the punch plate 36 is on the opposite side of the receptacle defined by the plates 20 of the stack which is to receive that denomination of bill. Knowing the position of the crank

assembly 58, 60 and the punch plate 36, the microprocessor 80 drives the reversible motor 48 in the direction which most quickly attains the desired position. A microprocessor 20 then issues a vend signal, passing the note or bill down the note path 16 and into the receptacle between the plates 20. The motor 48 is then again actuated to cause the plate 36 to push the bill against the gate stops 22 and onto the proper stack. The plate 36 continues to move to its maximum extension of either Figs. 8 and 11 and thence returns to the appropriate neutral position of either Fig. 6 or 9.

The motor 48 may be prepared by the microprocessor 80 to receive and stack the currency once the validation test has been completed and while the currency is held in escrow. Hence, when the vend signal is issued, the bill is immediately received and stacked, making efficient use of time and operation. It will also be appreciated that with the motor 48 being reversible, the microprocessor 80 may prepare the position of the punch plate 36 with the least amount of rotational movement of the motor 48 and resultant movement of the crank assembly, again hastening the operation time.



CLAIMS

1. An apparatus for receiving and storing notes of different denominations in a note acceptor, comprising a receptacle for temporarily receiving a note, a pusher member reciprocatingly removable through said receptacle, receiving means on either side of said receptacle, one for each denomination of note to be stored, for receiving notes moved by said pusher member from said receptacle, and position sensing means operatively connected to said pusher member for monitoring the positional relationship of said pusher member with respect to said receptacle, said position sensing means comprising photodetectors interconnected with said pusher member, said photodetectors sensing predetermined positions of said pusher member, said position sensing means further comprising a pair of disks interposed between said photodetectors, said disks having openings therein in communication with said detectors, detection of said openings by said detectors establishing positions of said pusher member.

2. An apparatus as claimed claim 1, wherein said receptacle comprises a pair of plates positioned opposite each other, each having diverging gate stops extending from side edges thereof.

3. An apparatus as claimed in claim 1 or claim 2, which further includes control means connected to said pusher member for selectively positioning said pusher member on a selective side of said receptacle.

4. An apparatus as claimed in claim 3, wherein said control means further drives said pusher member in said reciprocating movement.

5. An apparatus for receiving and storing notes, comprising a receptacle, a pair of stacking means, one on

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each side of said receptacle, a pusher member in reciprocal communication with said stacking means, said pusher member including a crank arm and drive linkage, and position sensing means operatively interconnected with said crank arm and drive linkage for monitoring the position of said pusher member with respect to said receptacle, said position sensing means comprising a pair of disks in intercommunication with a series of photodetectors, said photodetectors responding to positional indicai on said disks.

6. An apparatus as claimed in claim 5, wherein said stacking means each comprises a spring biased plate.

7. An apparatus as claimed in claim 6, wherein said pusher member comprises a plate in parallel relationship to said spring biased plate.

8. An apparatus as claimed in claim 6 or claim 7, wherein said receptacle comprises a pair of oppositely positioned plates, each having diverging edges.

9. An apparatus as claimed in claim 8, wherein each of said spring biased plates is biased towards contacting engagement with one of said edges of each of said oppositely positioned plates.

10. An apparatus as claimed in any of claims 5 to 9, which further includes a reversible motor connected to and driving said pusher member.

11. An apparatus for receiving and storing notes substantially as herein described with reference to the accompanying drawings.

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