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(54) Diverter module

(57) A ticket diverter for use in conjunction with a ticket processing apparatus. The diverter has an entry passage 34 through which a ticket enters and an exit passage 44 through which the ticket is expelled. A stationary diverter ramp 38 deflects the ticket from the entry passage to the exit passage. The ticket is propelled in the exit passage by a reversible exit drive roller 62 toward either a dispensing outlet 45 or a capture outlet 47.

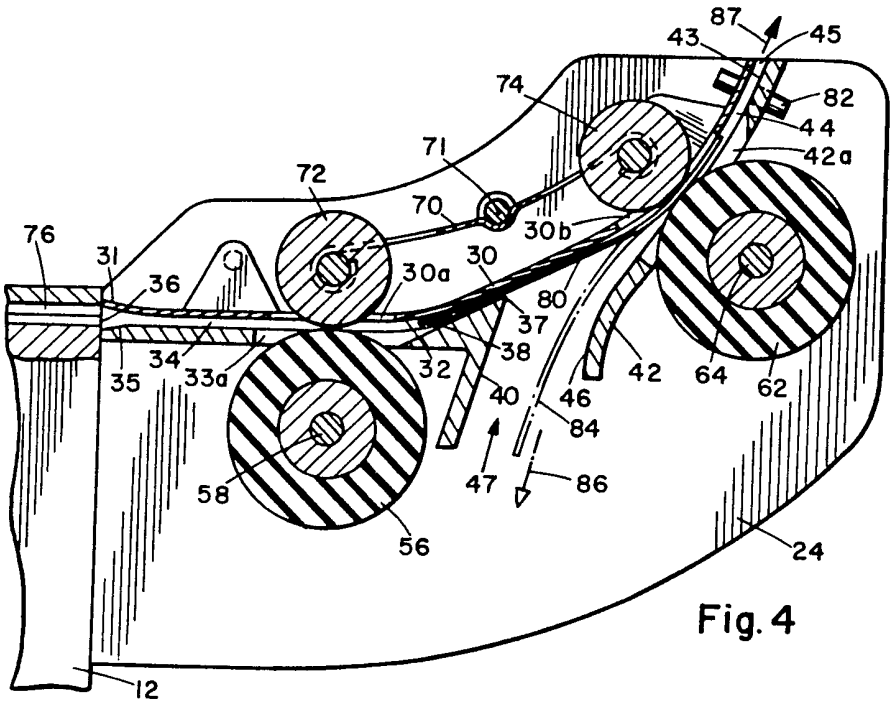

Fig. 4

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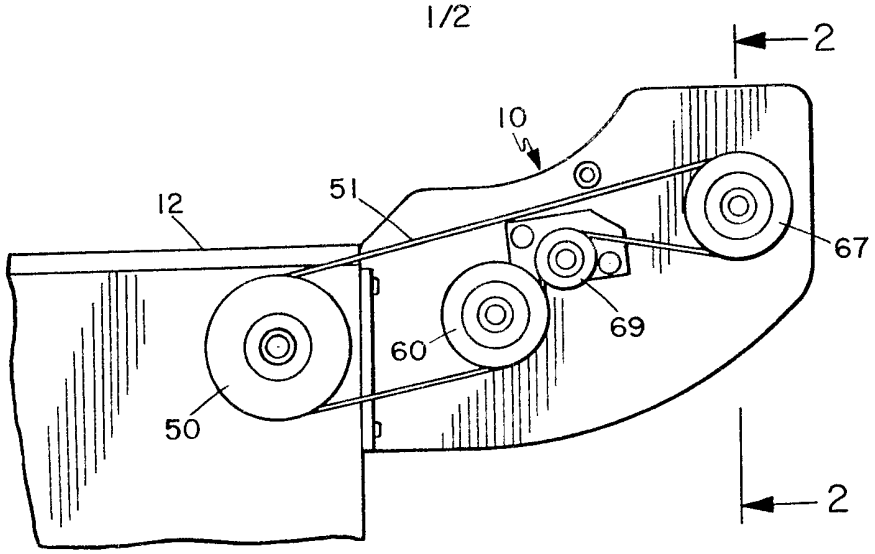
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67
69
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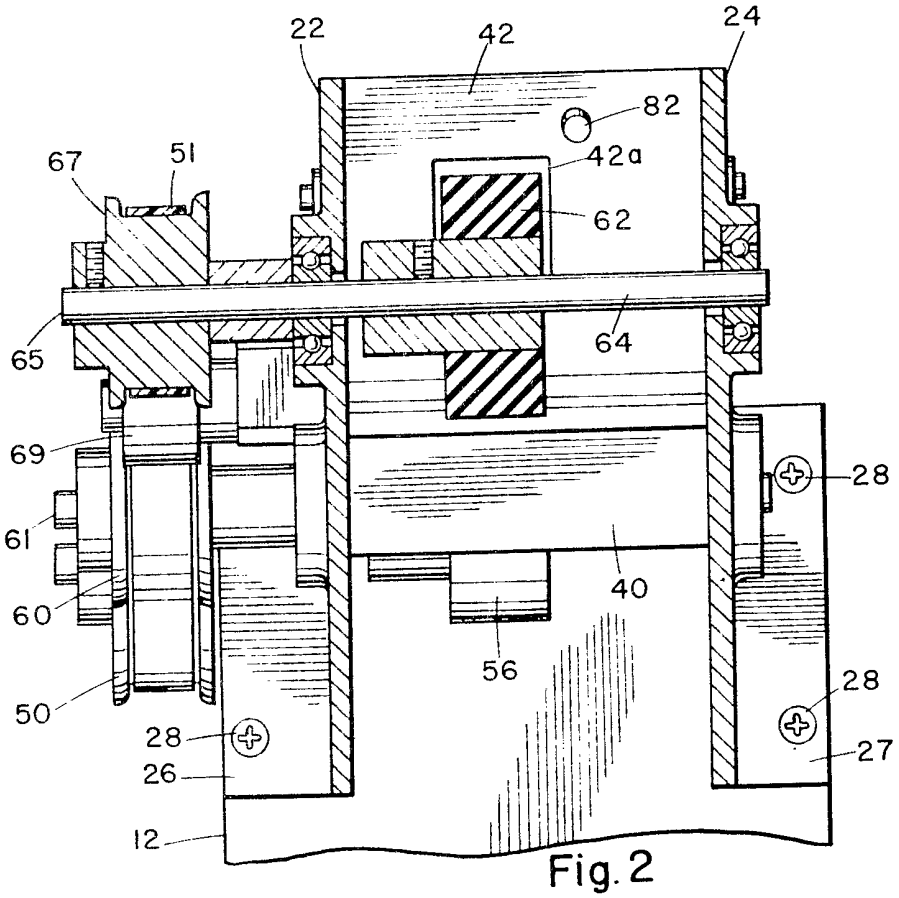
50
2

Fig. 1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42
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12

Fig. 2

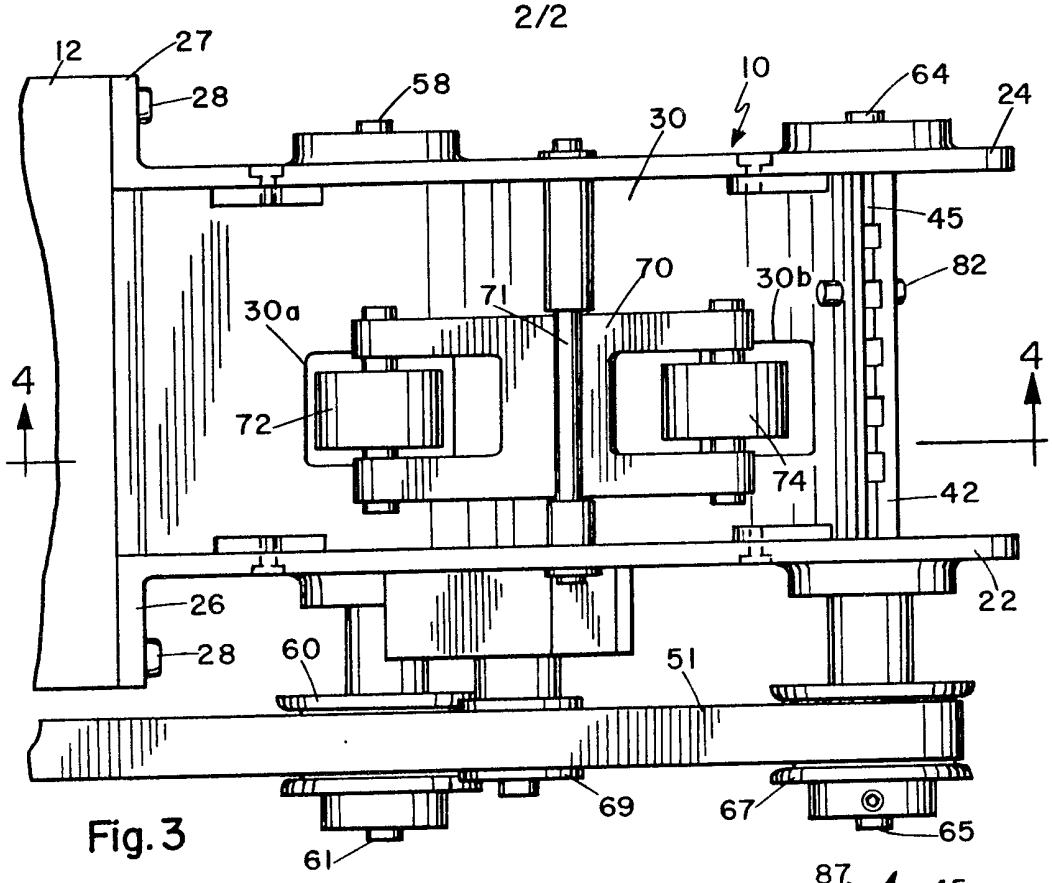
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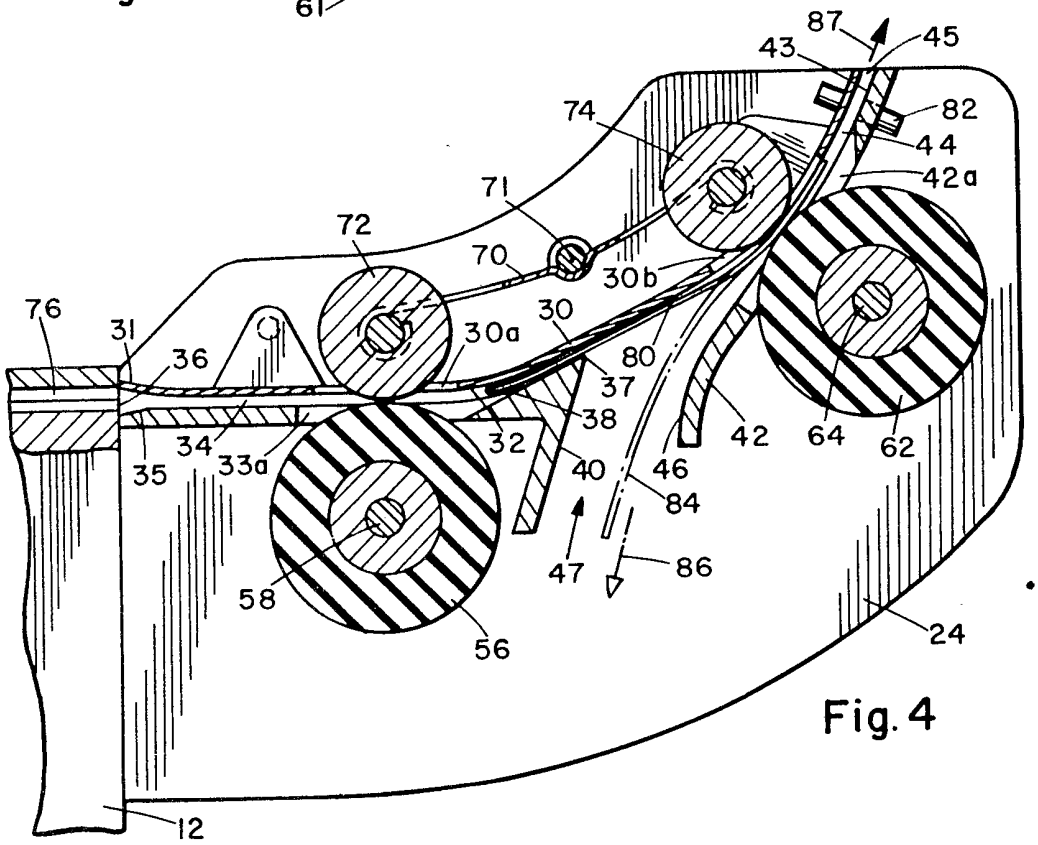
Fig. 3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42
64
62
34
33a
32
40
46
84
35
47
86
58
56
24
12

Fig. 4

SPECIFICATION

Improved diverter module

BACKGROUND OF THE INVENTION

The present invention relates to ticket handling and processing equipment and pertains particularly to a ticket diverter for providing a branch in a path which a ticket follows through such equipment.

Automated systems for handling tickets, credit cards, and the like are increasingly in evidence. Such systems are normally useful with, for example, transportation systems and banking operations wherein they are utilized for automatically dispensing or processing tickets, credit cards, money, or similar objects. Such automatic systems increase the efficiency, security, and reliability of dispensing and processing operations. Because they are used frequently and over a long period of time, the equipment which makes up such systems must be simple, reliable, and maintainable.

One example of a ticket handling system for use in an automatic ticket processing system is found in U.S. Patent No. 4,357,530 wherein a ticket is propelled through a series of processing equipments in a generally linear path. In systems exemplified by the referenced patent, a need exists to provide a branching capability in the path traversed by a ticket, which is satisfied by the provision of a diverter apparatus including a pair of branching passageways which communicate with the throughput passageway of the ticket processing system.

Diverter modules which perform this branching function are known in the art and are represented by the devices disclosed in U.S. Patent No. 3,850,299 wherein an apparatus is disclosed which performs the branching function is implemented by means of a rotary member which is mounted on a solenoid for rotating between two positions. In a first position, a slot in the guide member communicates with a linear throughput passage through which a credit card is propelled toward an outlet. When it is necessary to capture the card, the guide member is rotated to its second position and deflects the moving card into a second passageway through which it travels to a collection box. A similar rotatable guide mechanism is disclosed in U.S. Patent No. 4,251,000 wherein two opposing plates are mounted upon a rotatable hub which is driven by a solenoid between two positions. U.S. Patent No. 4,374,564 discloses a diverter apparatus in which a rotatable diverter plate having a pair of angled diverter surfaces is turned in one direction to deflect a ticket from the throughput passageway to one diversion channel and turned in another direction to divert the ticket into a second channel. Manifestly, the reliability of the apparatus disclosed in these patents can be degraded if the rotating parts jam in one position or fail to rotate fully.

Another type of diverter apparatus is taught in U.S. Patent No. 4,318,484, wherein a device sorts out individual articles and diverts or captures articles which differ from a predetermined main article standard. This apparatus diverts nonstandard articles by reversing the direction of propulsion in a throughput passageway, which feeds the article to be diverted to a pair of rollers having axes disposed in a plane forming an acute angle to the throughput passage. The article is nipped by the canted rollers and diverted away from the throughput passageway. In this device the articles to be diverted during sorting depend upon the movement of a multiplicity of belts between which the article is nipped. As is known, such belts can stretch or break during operation which would result in the failure of the diverter to operate.

In the diverter disclosed in U.S. Patent No. 4,211,024, which is assigned to the assignee of this application, a flexible leaf spring extends from a diversion channel into a diverter throughput channel which communicates with the throughput passage of a ticket transport apparatus. A ticket is propelled through the diverter and over the spring. The spring is thereby biased downward to permit the ticket to pass. When the ticket passes, the spring flexes up to contact the top of and close the diverter throughput passage. If the ticket is rejected and propelled back to the diverter from the transport apparatus, the spring curvature guides it from the throughput passage to a diversion channel. The flexible spring can lose flexibility or be jammed short of the top of the passageway. In either case, a ticket might not be diverted, thus causing the apparatus to malfunction.

Hence, the prior art discloses the need for a reliably operating diverter. Preferably, the diversion performed by the apparatus would be effected without the use of moving diverter parts or belts, either of which can fail to operate properly when diversion of an object is required.

SUMMARY AND OBJECT OF THE PRESENT INVENTION

The present invention provides an improvement over the foregoing diverter modules by utilizing a stationary diverting mechanism which will deflect a ticket or other flat, flexible object from a throughput passageway into an exit passageway within which the ticket or other object may be propelled to one of two exits. One of the two exits constitutes a throughput outlet, the other, a diversion outlet. Thus, the reliability of the present invention is enhanced by the provision of a diverting or branching capability which does not depend upon a positionable, flexible, or

movable diverter mechanism to accomplish the desired deflection.

Accordingly, it is a principal objective of the present invention to provide an improved diverter having a stationary diversion mechanism.

The invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a side plan view of the diverter illustrating it positioned in an operable adjacent relationship with a ticket transport apparatus.

Figure 2 is an enlarged sectional view of the diverter taken along line 2–2 of Fig. 1.

Figure 3 is a top plan view of the diverter.

Figure 4 is a sectional view taken along line 4–4 of Fig. 3, illustrating the arrangement of the forward and exit passages of the diverter module and the stationary ramped diversion surface.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Turning to Fig. 1 of the drawings, there is illustrated the diverter apparatus of the invention, indicated generally by the numeral 10, in operable engagement with an adjacent transport device 12. This arrangement represents the normal positioning of the diverter in a typical ticket processing system. However, it should be obvious to those skilled in the art that the diverter may be positioned at various positions within and in cooperative relationship with various units of such a system. As will be further understood, such systems are useful for handling, for example, tickets, credit cards, or money, and use of an exemplary term to indicate the object which is being acted upon should not be limiting in the conventional sense, but should also extend to other similar items.

The primary function of the apparatus of the invention is to provide an alternate route for placement of a ticket being provided from the transport mechanism 12 to the diverter mechanism 10 such as when the ticket is invalid or unverified.

Turning now to Figs. 2, 3 and 4, the transport apparatus comprises a housing including two side plates 22 and 24 each having end mounting flanges 26 and 27, respectively, which permit the diverter apparatus to be mounted to, for example, the transport 12 by means of screws 28. The housing further comprises an upper channel plate 30 having a pair of apertures 30a and 30b and a slightly flared end 31. The plate 30 is held between the side plates 22 and 24 by any appropriate means, for example, the upper plate may be welded or braised to either or both of the side plates. As is evident in Fig. 1, the upper plate 30 has a generally arcuate shape which gives one of its surfaces 32 a generally concave outline.

A lower forward plate 33, having a rectangular aperture 33a, is also fixedly held between the side plates 22 and 24 in a spaced position relative to the flared end 31 of the upper plate 30 to form a passageway 34 therebetween. The forward plate 33 includes a flared end 35 which cooperates with the flared end 31 of the upper plate 30 to define an inlet 36. As is evident in Fig. 4, the lower plate 33 also includes a forward tip 37 to which the lower forward plate 33 transitions over a ramped diverter portion 38. Extending downwardly from the tip 37 is an angled channel section 40.

A lower exit plate 42, having an aperture 42a, is also fixedly held between the side plates 22 and 24 adjacent the upper plate 30 at the end opposite the flared end 31. The exit plate 42 has an upper surface 43 which cooperates with the upper plate 30 to form an exit passageway 44, one end of which opens to an outlet 45. The exit plate 42 also includes a curved lower surface 46 which cooperates with the lower channel section 40 of the forward plate 32 to provide a second exit aperture 47.

The drive mechanism of the diverter of the invention can be understood with reference to Figs. 1, 2, 3 and 4. The drive mechanism includes a reversible drive motor (not shown) having an output pully 50 which is shown located on the transport apparatus 12 in Fig. 1. This arrangement is presented only for the purposes of illustrating the operational cooperation which the diverter can have with an associated piece of equipment, and is not intended to be limiting. It should be evident that such a motor and its controlling circuitry, which will be described in greater detail hereinbelow, can be positioned at any desirable point relative to the diverter, or on the diverter itself. The motor can comprise both a reversible electric motor and a control circuit (not shown) which responds to signals provided by sensors (also not shown) located in the passageway of the transport 12 through which a ticket or other object is propelled. Such motors and associated control circuits are well-known in the art. Illustrative examples of motors and control circuits are found, for example, in U.S. Patent No. 4,357,530 and U.S. Patent No. 4,377,828, both of which are incorporated herein by reference. The drive power from the motor pulley 50 is supplied by means of an endless drive belt 51.

The drive mechanism for the entry passage 34 includes a roller 56 mounted on a drive shaft 58 which is journaled in bearings in the plates 22 and 24. The drive roller 56 extends through the aperture 33a in the lower forward plate 33. A pulley 60 is journaled to one end 61 of the drive shaft 58 on the outside of the side plate 22. The drive mechanism for the exit passageway 43 consists of a drive roller

62 mounted on a drive shaft 64 which is journaled between the side plates 22 and 24. One end 65 of the shaft 64 which extends through to the outside of the side plate 22. A pulley 67 is journaled to the outside end 65 of the drive shaft 64. An idler pulley 69 is rotatably journaled to the outside of the side plate 22 and may be utilized to adjust or maintain tension in the belt 51 which extends around and engages the pulleys 60 and 67, as illustrated in Fig. 1.

A tensioned pinch roller assembly 70 is mounted on a stationary shaft 71 which extends between the side plates 22 and 24. The pinch roller assembly 70 includes pinch rollers 72 and 74 which are urged by the spring bias of the assembly through the upper plate apertures 30a and 30b, respectively. The pinch rollers 72 and 74 contact the rollers 56 and 62, respectively, in a biased contacting engagement.

In operation, the motor may be drivingly coupled to propelling rollers (not shown) in the transport apparatus 12 which propel a ticket in a transport passage 76 toward the inlet 36 of the diverter 10. At the same time, the pulleys 60 and 67, which are drivingly coupled to the motor pulley 50 by the belt 51, rotate in a direction which will cause the ticket to be nipped between the rollers 56 and 72 and propelled thereby through the entry passage 34 in the direction of the forward tip 37.

As the ticket moves toward the forward tip 37, the ramp 38 causes its forward motion to be deflected toward the upper surface 43 of the lower exit plate 42 and therealong into the exit passage 43. The disposition of the ticket on the ramp 38 is indicated by 80. In the exit passage, the leading edge of the ticket 80 is nipped between the rollers 62 and 74 and propelled through the exit passageway 44 in the direction of the outlet 45. When the leading edge of the ticket 80 passes a sensor 82 (which can comprise, for example, a light emitting diode and a photodetector) the sensor provides a signal over a conductor pathway (which is not shown) to the control circuit of the drive motor.

At this point in the passage of the ticket 80 through the diverter 10, the control circuit makes a decision to permit the ticket 80 to be propelled out of the diverter 10 through either outlet 45 or outlet 47. For example, if the ticket is invalid or fully subscribed, as may have been detected by transducers (not shown) adjacent the passageway 76 of the transport which are capable of sensing fare information placed on the ticket, the ticket can be diverted through the capture outlet 47 by reversing the direction of rotation of the motor pulley 50. Reversal of the direction of rotation will cause the drive roller 62 to reverse its direction of rotation and to propel the ticket along the lower surface of the lower exit plate 42 and through the capture outlet 47 which may communicate with, for example, a chamber wherein invalid tickets are held. Movement of the ticket in this direction is indicated by the dashed outline 84 and arrow 86. Alternatively, should the ticket be valid or not yet fully subscribed, the control circuit may cause the motor and pulley 50 to continue to rotate in the forward direction thereby rotating the drive roller 62 in the direction which propels the ticket 80 toward and through the exit outlet 45, as indicated by the arrow 87. Motor control circuits and sensors having the described capabilities, are fully disclosed in the patents incorporated hereinabove by reference.

The diverter apparatus above-described can be used in a variety of ticket processing systems, or at different points in a given processing system. The diverter can, for example, be used in an entry gate, into a transportation system to return partially cancelled tickets to a system patron through the exit outlet 45, or to capture fully cancelled tickets in a disposal bin positioned under the capture outlet 47.

CLAIMS

1. A diverter for handling flexible tickets, cards, or the like, comprising:

housing means for defining an entry passage through which a ticket enters said diverter and an exit passage through which said ticket exits from said diverter;

selectively reversible drive means for propelling said ticket through said passages; and

stationary diverter means adjacent said entry passage for deflecting said ticket from said entry passage into said exit passage.

2. The diverter unit of claim 1 wherein said entry passage is spaced apart from said exit passage and comprises an inlet through which said ticket enters said channel and a forward end toward which said ticket is propelled, and said diverter means comprises a stationary ramp means adjacent said end for deflecting said ticket in a direction from said entry passage into said exit passage.

3. The diverter of claim 2 wherein said exit passage includes at least a first and second outlet and said drive means comprises a forward drive roller means for engaging and propelling said ticket through said entry passage toward said forward end and an exit drive roller means for engaging and selectively propelling said ticket toward said first or said second outlet.

4. The diverter of claim 2 wherein said ramp means comprises a ramped section formed in said forward end of said entry passage.

5. The diverter of claim 2 wherein said exit passage comprises a first exit and a channel having a first surface portion substantially colinear with said direction for guiding

said ticket into said exit passage toward said first outlet when said ticket is diverted.

6. The diverter of claim 5 wherein said exit passage further comprises a second outlet and a second surface section for guiding said ticket toward said second outlet and said drive means includes reversible exit drive roller means for engaging and selectively propelling said ticket toward said first or second outlet.

7. The diverter of claim 6 further comprising sensor means for detecting said ticket in said exit passage and for providing a signal indicating said detection, and wherein said drive means includes means responsive to said signal for operating said drive roller means to propel said ticket toward said first or second outlet.

8. The diverter of claim 6 wherein said first direction is substantially an upward direction and said second direction is substantially a downward direction.

9. The diverter of claim 7 wherein said second outlet communicates with a means for holding said ticket.

10. The diverter of claim 1 or 9 wherein said diverter is disposed in communication with a ticket processing unit for receiving said ticket from said processing unit and transporting it to said first or said second outlet.

11. A diverter for handling flexible tickets, cards, or the like, comprising an entry passage through which a ticket enters an exit passage through which a ticket is expelled, a stationary diverter means which deflects the ticket from the entry passage to the exit passage, a dispensing outlet and a capture outlet downstream of said diverter means, and selectively reversible drive means intermediate the dispensing outlet and the capture outlet for propelling the ticket, card or like either to the dispensing outlet or to the capture outlet.

12. A diverter for handling flexible tickets, cards or the like substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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