Jan. 29, 1963 H. M. FREDERICK 3,075,760

SELF-ENERGIZED SHEET TRANSFERRING APPARATUS

Filed April 14, 1961 2 Sheets-Sheet 1

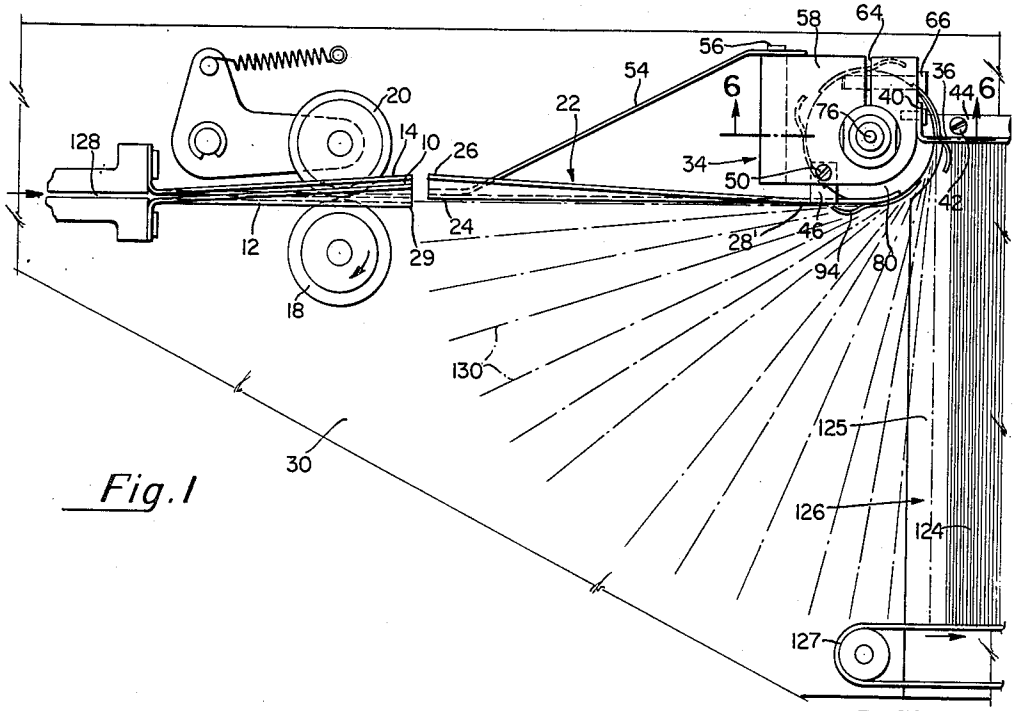

Fig. 1

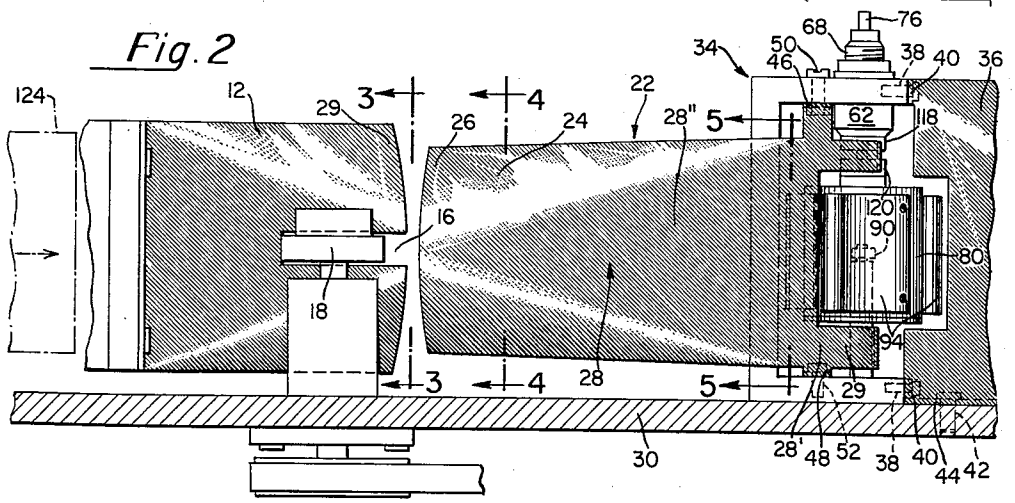

Fig. 2

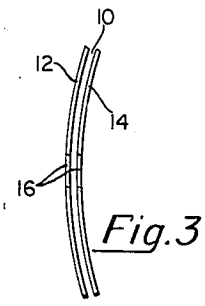

Fig. 3

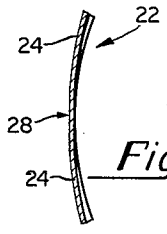

Fig. 4

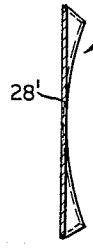

Fig. 5

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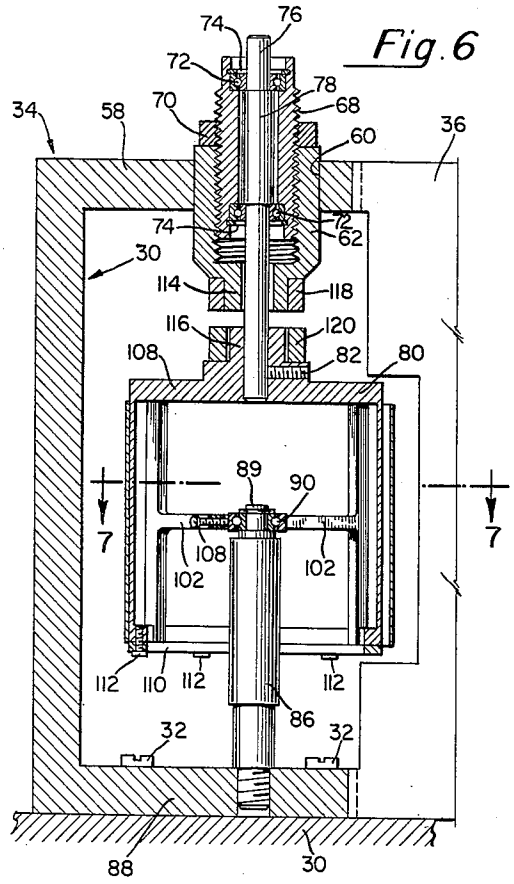
Fig. 6



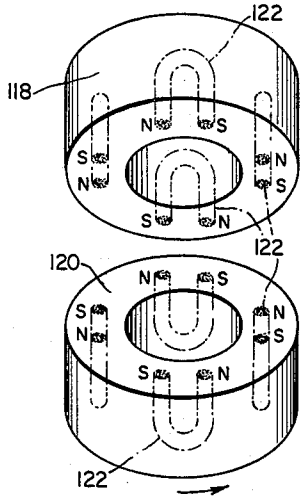


Fig. 9

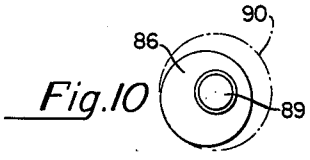


Fig. 10

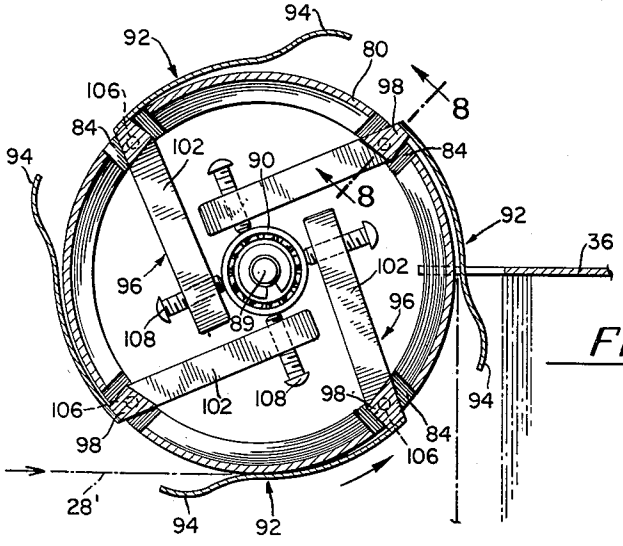


Fig. 7

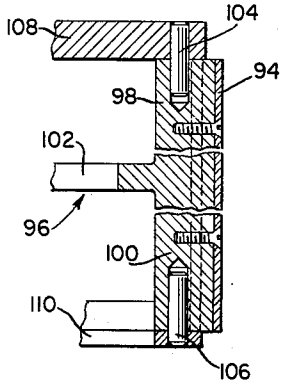


Fig. 8

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3,075,760
SELF-ENERGIZED SHEET TRANSFERRING APPARATUS

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8 Claims. (Cl. 271—71)

This invention relates generally to sheet feeding machines, and more particularly to apparatus for transferring moving sheets from a feeding path to a delivery station angularly displaced from the feeding path.

The principal object of the present invention is to provide an apparatus which will transfer a moving sheet from a feeding path to a delivery station without the aid of power.

Another object of the invention is to provide a sheet transferring apparatus which will utilize the energy of a moving sheet for transferring the sheet from its feeding path to another position.

Another object of the invention is to provide means for stiffening a flexible sheet item, to be delivered into free flight to a transfer device, so that the sheet will be better enabled to remain in its feeding path as it approaches the transfer device.

A further object of the invention is to provide guide means for the stiffened sheet which will direct the sheet to the transfer device and condition it for proper reception by the transfer device.

Another object of the invention is to provide a rotary sheet transfer device having sheet grippers thereon, and means mounting the rotary sheet transfer device in such manner that it will be rotated by the energy of a moving sheet, upon impact of the sheet with an operative sheet gripper and the rotary transfer device, to transfer the sheet from its feeding path to a delivery station.

Another object of the invention is to provide means for stopping the rotary sheet transfer device, preferably without the use of power, each time a sheet is delivered to the delivery station.

In accordance with the above objects, and first considered briefly in its broad aspects, the invention utilizes means for imparting a curvature to a flexible sheet item, or card, to stiffen the sheet so that it will not diverge from its feeding path as it emerges into free flight. Guide means are provided along the feeding path for receiving the curved sheet, conditioning its leading portion to a substantially planar form, and guiding the planar leading portion into the grip of a rotary sheet transfer device. The rotary sheet transfer device is mounted for free rotation about its axis, as distinguished from power rotation, so that it will be rotated by the energy of a moving sheet upon impact with the sheet. The rotary sheet transfer device is provided with a suitable number of sheet grippers thereon, one for each sheet-receiving position of the device. A detent means is provided for stopping the rotary sheet transfer device at each sheet-receiving position.

The invention will be more clearly understood when the following detailed description of the preferred embodiment thereof is read in conjunction with the accompanying drawings, in which:

FIG. 1 is a plan view of a sheet feeding apparatus embodying the principles of the invention;

FIG. 2 is a front elevation of the apparatus of FIG. 1 with certain parts omitted;

FIG. 3 is a view taken along line 3—3 of FIG. 2 illustrating a curved sheet guideway;

FIG. 4 is a sectional view taken along line 4—4 of FIG. 2 showing a curved surface of a sheet guide member merging with a central planar surface thereof;

FIG. 5 is a sectional view taken along line 5—5 of FIG. 2 showing the planar surface at its effective sheet guiding region;

FIG. 6 is a sectional view of the rotary transfer device, on an enlarged scale, taken along line 6—6 of FIG. 1;

FIG. 7 is an enlarged sectional view of the rotary transfer device taken on line 7—7 of FIG. 6;

FIG. 8 is a sectional view, on an enlarged scale, taken along line 8—8 of FIG. 7;

FIG. 9 shows enlarged isometric views of magnetic detent members; and

FIG. 10 is an enlarged detail view of an eccentric portion of a cam shaft member.

Referring to the drawings, and more particularly to FIGS. 1, 2 and 3 thereof, a curved sheet guideway 10 is formed by means of fixed curved guide members 12 and 14. The rightward ends of the guide members 12 and 14 are provided with slots as at 16, through which project a power-driven delivery roller 18 and a cooperating pressure roller 20.

To the right of the guideway 10 and in the direction of sheet feeding is a fixed sheet guide plate 22 provided with a curved sheet guide surface 24 which blends or merges with a substantially planar surface 28, the effective sheet guiding portion of which is designated 28'.

The leftward end 26 of the curved guide surface 24 is in line with and substantially conforms in curvature to the exit end 29 of the curved sheet guideway 10. The curved guide surface 24 flattens gradually toward the right until it becomes fully planar at the effective planar surface 28'.

Secured to a base plate or supporting surface 30, as by screws 32 (FIG. 6), is a C-shaped frame 34 to which is attached a stripper plate 36 by means of screws 38 (FIG. 2) passing through lateral lugs 40 of the stripper plate, the stripper plate being secured additionally at its lower region to the base piate 30 by means of a screw 42 passing through a lug 44 of the stripper plate. The guide plate 22 is provided with lugs 46 and 48 which are secured to the frame 34, as by screws 50 and 52. A stabilizing strip 54 (FIG. 1) is secured at its rightward end to the frame 34, as by a screw 56, and is soldered or otherwise secured at its leftward end to the guide plate 22.

The upper arm 58 (FIG. 6) of the frame 34 is provided with a bore 60 in which is adjustably secured an internally threaded sleeve 62. The arm 58 is slotted as at 64 (FIG. 1) and provided with a clamping screw 66 to provide a split-type clamping arrangement, as is well known, for adjustably securing the sleeve 62.

An adjusting sleeve 68 (FIG. 6) is threaded into the sleeve 62 and secured in desired position by means of a locknut 70. The adjusting screw 68 is counter-bored at both ends and provided with anti-friction bearings 72 which are held in the counter-bores by means of retaining rings 74. A shaft 76 is mounted in the anti-friction bearings 72 and is provided with an enlarged diameter portion 78 which restricts the shaft against axial movement relative to the sleeve 68.

An open-ended rotary sheet transfer drum 80 is secured on the lower end of the shaft 76, as by a set screw 82, and is provided with a plurality of slots 84 (FIG. 7) in its periphery, in this case four, as illustrated. A suitable number of slots may be utilized, depending upon the number of sheet grippers desired in any particular application. As indicated by the leftward dot-dash line in FIG. 7, the planar sheet guide surface 28' is tangent to the periphery of the drum 80.

Extending upwardly into the lower open end of the drum 80 is a stub cam shaft 86 (FIG. 6) arranged coaxially with the drum shaft 76 and threadedly secured in the lower arm 88 of the frame 34. The upper end of the

cam shaft 86 is formed with an eccentric 89 (FIG. 10) on which is press-fitted an anti-friction roller 90 constituting a circular cam.

It is understood that the circular and anti-friction characteristics of the roller 90 are preferable, however, rigid cam means of other shape may be used, if desired. The extent of eccentricity of the eccentric 89 is exaggerated in FIG. 10 for purposes of illustration.

The drum 80 is provided with a plurality of sheet gripper devices 92 (FIG. 7), each pivotally mounted in a slot 84 of the drum. The gripper devices 92 are similar in construction and arrangement, therefore, a description of only one of them will be given.

Each sheet gripper device 92 comprises a resilient sheet gripper finger 94 secured at one end to a cam follower 96. As seen in FIG. 8, the cam follower 96 exhibits an inverted T-shaped formation and is provided with upper and lower legs 98 and 100, respectively, and a central follower arm 102. Press-fitted in the legs 98 and 100 are journal pins 104 and 106, respectively. The outer end of the pin 104 is journalled in a suitable bearing hole in the closed end 108 of the drum 80. The outer end of the journal pin 106 is similarly journalled in a bearing hole in an annular bearing ring 110 (FIG. 6) secured to the lower open end of the drum 80, as by screws 112. The follower arm 102 is provided at its inner end with an adjusting screw 108 (FIG. 7) which is set relative to the periphery of the circular cam 90 to obtain the desired gripping force of the associated gripper finger 94. When a gripper finger 94 is in an operative sheet- receiving position, shown as the lowermost position in FIG. 7, it will be urged against the periphery of the drum 80 by the circular cam 90. In the other three inoperative positions, it will be spaced from the periphery of the drum.

The sleeve 62 and drum 80 (FIG. 6) are provided with reduced diameter portions 114 and 116, respectively, on which are cemented or otherwise secured circular magnetic members 118 and 120 which cooperate to form a detent for the rotary transfer device or drum 80. The magnetic members 118 and 120 are of a commercially available variety, known as ceramic magnets, and may be obtained, for example, from such companies as Indiana Steel Company or Stackpole Carbon Company. As shown in the enlarged detail views in FIG. 9, the magnetic members 118 and 120 are provided with corresponding magnetized regions 122, in this case four in number, corresponding with the number of gripper devices 92. Each magnetized region 122 represents a detent position of the drum 80 and comprises a U-shaped magnetized region having north and south poles designated N and S, respectively. It is understood that the detent represented by the magnetic members 118 and 120 is illustrative only, and that other types of detents may be used, if desired.

The apparatus is illustrated for stacking flexible sheets or cards 124 (FIG. 1) which preferably, as in the present embodiment, are stacked on edge as on a plate 125 secured on the base plate 30. In this connection, the plate 125 may be regarded as the base of a stacking bin 126 for the cards 124, in which case the stripper plate 36 may represent a sidewall of the bin. A second sidewall of the stacking bin 126 may take the form of a slowly-rotating endless belt 127.

In the operation of transferring a sheet or card 124 from a feeding path to a delivery station, in this case to the stacking bin 126, a card 124 is delivered to the apparatus by associated devices, not shown, through a chute 128 (FIG. 1) and into the curved sheet guideway 10 where it is engaged by the delivery rollers 18 and 20 and thereby fed out of the guideway 10 toward the rotary drum 80. The curved guide members 12 and 14 will impart a corresponding curvature to the sheet or card so that it will then ride along and be guided by the curved guide surface 24, and will clear the ineffective portion 28" of the planar surface 28. As the card approaches the drum 80, its leading portion will be gradually flattened by the surface 24 so that it will be in substantially flat condition against the planar sheet guide surface 28' and suitable for gripping by the operative sheet gripper finger 94. By imparting to the card a curvature in the guideway 10, the card will be made more rigid so that it will stay in the feeding path against the guide plate 22 as it emerges into free flight from the curved guideway 10. At the time the trailing edge of the card 124 leaves the exit end 29 of the curved guideway 10, or shortly thereafter, the leading end portion of the card will enter into the bite of the operative sheet gripper finger 94. The energy of the moving card 124 will overcome the inertia of the drum 80 and the detenting force of the magnetic members 118 and 120 and rotate the drum a quarter turn to the next sheet-receiving position, at which position the drum will again be magnetically detented by the magnetic members 118 and 120 and the card 124 stripped from the sheet gripper finger 94 by the stripping plate 36. The dot-dash lines 130 (FIG. 1) indicate successive positions of the card as it is being transferred from the guide plate 22 to the stacking bin 126. The slowly-moving belt 127 urges the trailing edge of the card into the stacking bin.

What is claimed is:

1. A sheet transferring apparatus comprising, a rotary drum, a plurality of resilient gripper fingers carried by said rotary drum and spaced about its periphery, each gripper finger arranged to be operative at a sheet receiving position of said rotary drum, cam means pressing an operative gripper finger toward said periphery for receiving and simultaneously gripping a freely moving sheet delivered from a feeding path, permanent magnet means detenting said rotary drum in successive sheet receiving positions, a single elongated guide plate along the feeding path for directing a sheet into the grip of an operative gripper finger and said periphery, one end of said guide plate having a planar sheet guide surface tangent to the periphery of said rotary drum, the opposite end of said guide plate having a curvature transverse to the direction of sheet feeding providing a curved sheet guide surface merging with said planar sheet guide surface, means forming a curved sheet guideway for bowing a sheet transversely to the direction of sheet feeding and conforming substantially in curvature to said curved sheet guide surface and in line therewith, means for feeding a sheet through said curved sheet guideway to said guide plate so that the sheet will ride successively against said curved sheet guide surface and said planar sheet guide surface until it is in free flight and enters the grip of said operative gripper finger and periphery, means mounting said rotary drum in such manner that the latter will be rotated, by the energy of said sheet upon impact of the sheet with said operative gripper finger and periphery, to the next successive sheet receiving position, and means at said last mentioned sheet receiving position for stripping the sheet from said operative gripper finger and periphery, and wherein the energy imparted to said rotary drum by said sheet is sufficient to overcome the detenting force of said permanent magnet means.

2. A sheet transferring apparatus comprising, a rotary drum, a plurality of movable gripper fingers carried by said rotary drum and spaced about its periphery, each gripper finger arranged to be operative at a sheet receiving position of said rotary drum, means pressing an operative gripper finger toward said periphery for receiving and simultaneously gripping a freely moving sheet delivered from a feeding path, magnetic means detenting said rotary drum in sheet receiving positions, an elongated guide plate along the feeding path for directing a sheet into the grip of an operative gripper finger and said periphery, one end of said guide plate having a substantially planar sheet guide surface substantially tangent to the periphery of said rotary drum, the opposite end of said guide plate having a curvature transverse to the direction of sheet feeding providing a curved sheet guide surface merging with said substantially planar sheet guide surface, means

forming a curved sheet guideway for bowing a sheet transversely to the direction of sheet feeding and conforming substantially in curvature to said curved sheet guide surface and in line therewith, means for feeding a sheet through said curved sheet guideway to said guide plate so that the sheet will ride successively against said curved sheet guide surface and said substantially planar sheet guide surface until it is in free flight and enters the grip of said operative gripper finger and periphery, and means mounting said rotary drum in such manner that the latter will be rotated, by the energy of said sheet upon impact of the sheet with said operative gripper finger and periphery, to the next sheet receiving position, the energy imparted to said rotary drum by said sheet being sufficient to overcome the detenting force of said magnetic means.

3. A sheet transferring apparatus comprising, a rotary drum for transporting a sheet from a feeding path to a delivery station, a sheet gripper device carried by said rotary drum and having a yieldable gripping portion urged into substantial contact with the periphery of said rotary drum when the latter is stationary, said gripping portion being in line with said feeding path when said rotary drum is stationary for receiving a sheet, moving in free flight, from the feeding path, a guide plate along the feeding path having a planar sheet guide surface substantially tangent to said periphery for directing said sheet into the grip of said gripping portion and said periphery, means for delivering a sheet to the guide plate until the sheet is in free flight and enters the grip of said gripping portion and said periphery, means imparting a curvature to the sheet, while it is being delivered to said guide plate, in such manner that the leading end portion of the sheet will press against said planar sheet guide surface until the sheet reaches said gripping portion, means mounting said rotary drum in such manner that the latter will be rotated by the energy of said sheet upon impact of the sheet with said gripping portion and said periphery, thereby to transport said sheet to said delivery station, and permanent magnet means for stopping said rotary drum when it has transported said sheet to said delivery station.

4. A sheet stacking apparatus comprising, a rotary drum for transporting a sheet from a feeding path to a stacking bin, a sheet gripper device carried by said rotary drum and having a gripping portion urged into substantial contact with the periphery of said rotary drum when the latter is stationary, said gripping portion being in line with said feeding path when said rotary drum is stationary for receiving a sheet, moving in free flight, from the feeding path, a guide plate along the feeding path for directing said sheet into the grip of said gripping portion and said periphery, means for delivering a sheet to the guide plate until the sheet is in free flight and enters the grip of said gripping portion and said pheriphery, means imparting a curvature to the sheet, while it is being delivered to said guide plate, in such manner that the leading end portion of the sheet will press against the guide plate until the sheet reaches said gripping portion, means mounting said rotary drum in such manner that the latter will be rotated by the energy of said sheet upon impact of the sheet with said gripping portion and said periphery, thereby to transport said sheet to said stacking bin, and magnetic means for stopping said rotary drum when it has transported said sheet to said stacking bin.

5. A sheet stacking apparatus comprising, a rotary transfer device for transporting a sheet from a feeding path to a stacking bin, a yieldable sheet gripper carried by said rotary transfer device and having an operative position in line with said feeding path for receiving a sheet, moving in free flight, from the feeding path and for simultaneously yieldably pressing the sheet against said rotary transfer device to be transported thereby, a single guide plate having a surface in line with said feeding path for directing said sheet into the grip of said sheet gripper and said rotary transfer device, means for delivering said sheet to the guide plate in such manner that the leading end portion of the sheet will press against said surface until the sheet is in free flight and enters the grip of said sheet gripper and said rotary transfer device, and means mounting said rotary transfer device in such manner that the latter will be rotated by the energy of said sheet upon impact of the sheet with said sheet gripper and said rotary transfer device, thereby to transport said sheet to said stacking bin.

6. A sheet stacking apparatus comprising, a rotary transfer device for transporting a sheet from a feeding path to a stacking bin, a resilient sheet gripper carried by said rotary transfer device and having an operative position in line with said feeding path for receiving a sheet from the feeding path and for pressing the sheet against said rotary transfer device to be transported thereby, a guide member for directing said sheet into the grip of said sheet gripper and said rotary transfer device, means for delivering said sheet to the guide member in such manner that the leading end portion of the sheet will press against the guide member until the sheet enters the grip of said sheet gripper and said rotary transfer device, and means mounting said rotary transfer device in such manner that the latter will be rotated by the energy of said sheet upon impact of the sheet with said sheet gripper and said rotary transfer device, thereby to transport said sheet to said stacking bin.

7. Apparatus for transferring sheets in succession from a feeding path to a delivery station comprising, a sheet transporting drum having a plurality of sheet receiving positions, a plurality of movable sheet gripping elements carried by said transporting drum, one gripping element for each said sheet receiving position, each said gripping element being arranged to be actuated when the drum is in a said sheet receiving position for receiving and pinchingly gripping a moving sheet delivered from said feeding path, means for releasably detenting said transporting drum in each said sheet receiving position, and means rotatably mounting said transporting drum in such manner that the latter will be rotated from one said sheet receiving position to another by the energy of the moving sheet upon impact of the sheet with a gripper element.

8. Apparatus for transferring a moving sheet item from a feeding path to a delivery station comprising, a rotary device for transporting said sheet to said delivery station, movable sheet gripping means carried by said rotary device and arranged to be actuated for receiving and pinchingly gripping said sheet from the feeding path, means mounting said rotary device in such manner that the latter will be rotated by the energy of said sheet upon impact of the sheet with said sheet gripping means, and means for stopping said rotary transfer device when it has transported said sheet to said delivery station.

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