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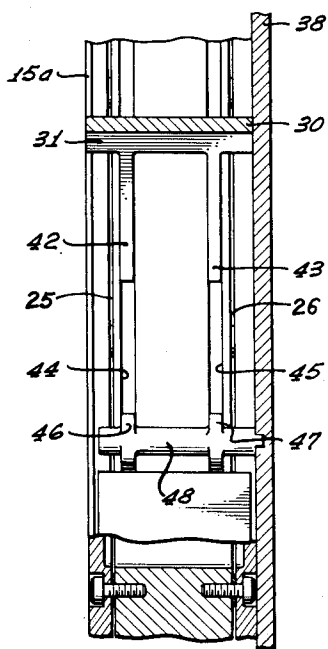
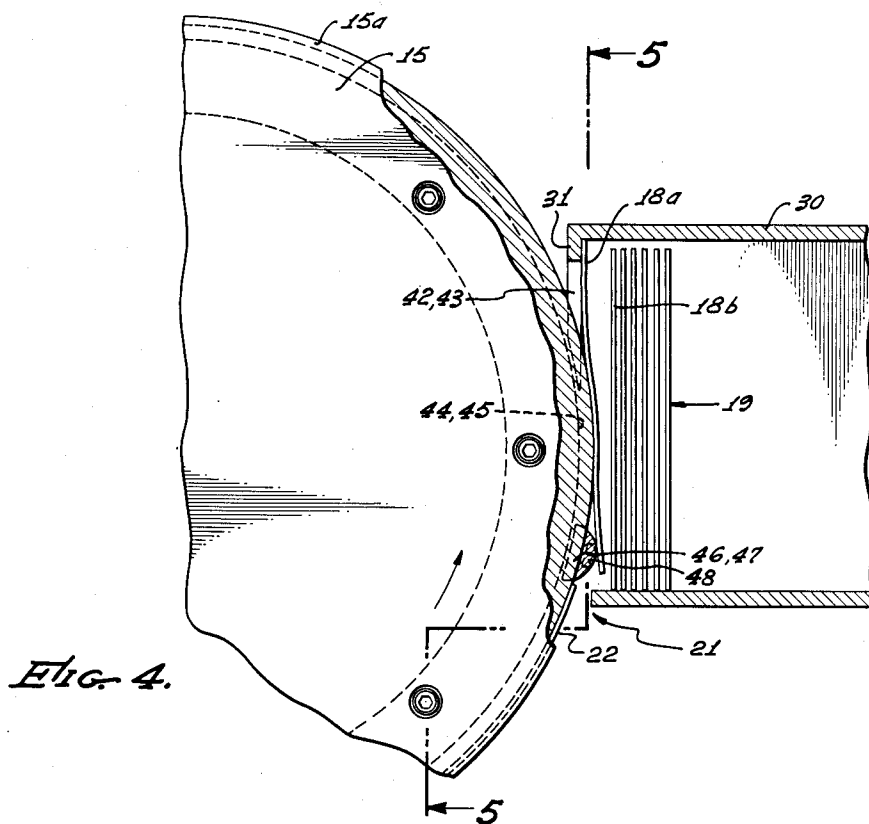
A. M. NELSON

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CARD RECEIVING STATION

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INVENTOR.
ALFRED M. NELSON
BY
Henry Heyman
ATTORNEY.

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CARD RECEIVING STATION

Alfred M. Nelson, Redondo Beach, Calif., assignor to Hughes Aircraft Company, Culver City, Calif., a corporation of Delaware

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6 Claims. (Cl. 271—74)

This invention relates to an output device for a vacuum drum card conveyor, and more particularly to a receiving station which has no moving parts and which is useful for receiving cards at a rapid rate from a fast moving conveyor.

It is well known in the prior art to employ vacuum-type conveyors for processing documents, photographs or cards in a continuous process. The vacuum conveyor principle is described, for example, in U. S. Patent 1,968,941, issued on August 7, 1934, to B. J. Hall et al., illustrating a series of evacuated drums used for transporting a set of papers from one position to another while various operations are performed thereon. The present invention relates specifically to a receiving station for receiving from a high-speed conveyor of the vacuum type a continuous stream of punched cards of the kind which are commonly used in electronic business data processing equipment.

In the prior art it is well known to employ, in combination with card handling equipment, a card receiving station which requires moving mechanical parts for handling each card individually. Such devices provide very satisfactory operation, but their maximum operating rate is limited to a few hundred cards per minute primarily due to the fact that each card must be received or handled by a moving member.

It is, therefore, an object of the invention to provide a device for receiving cards at a rapid rate from a fast moving conveyor of the vacuum type.

Another object of the invention is to provide a receiving station, having no moving parts, for receiving cards from a conveyor of the vacuum type.

The invention is illustrated in conjunction with a system wherein a number of punched cards of the type used with business data handling equipment is to be transported from one location to another in a continuous process. According to this system a stack of cards to be processed is arranged horizontally in an input magazine from whence the cards are picked up by a first rotating vacuum drum, passed on to a second rotating vacuum drum, and then received into a horizontally arranged output magazine. The surface of each rotating drum is perforated with holes or slots in order that the vacuum therein may produce a lower air pressure on the side of the card which is adjacent to the surface of the drum.

According to the present invention the receiving station includes a set of stationary projections or fingers which protrude from the surface of the drum at the point where the cards are to be delivered to the output magazine. As each card reaches the set of fingers it is separated from the surface of the drum, the suction action of the vacuum is lost, and the card is propelled into the output magazine by means of its own kinetic energy coupled with the rotational thrust from the drum.

A very high operating rate may be obtained with the card receiving station of the present invention because of the fact that no moving parts are required other than the conveyor drum. Another important advantage of the invention is that although the cards travel at a very high

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rate of speed they are stopped in such a way that they are not damaged. The stopping action is accomplished in several successive steps, with a substantial portion of the kinetic energy of the card being absorbed during each step.

The novel features which are believed to be characteristic of the invention, both as to its organization and method of operation, together with further objects and advantages thereof, will be better understood from the following description considered in connection with the accompanying drawings in which two embodiments of the invention are illustrated by way of example. It is to be expressly understood, however, that the drawings are for the purpose of illustration and description only, and are not intended as a definition of the limits of the invention.

Fig. 1 illustrates in a schematic top plan view a card transfer system wherein the card receiving station of the present invention may be utilized;

Fig. 2 is a detailed top plan view of one form of card receiving station in accordance with the present invention;

Fig. 3 is a vertical cross-sectional view of the card receiving station of Fig. 2 taken on line 3—3 thereof;

Fig. 4 is a detailed plan view of another form of card receiving station in accordance with the present invention; and

Fig. 5 is a vertical cross-sectional view of the card receiving station of Fig. 4 taken on line 5—5 thereof.

Reference is now made to the drawings wherein like parts are identified throughout by like reference numerals. In Fig. 1 an input magazine 10 contains a stack of cards 11 which is kept in place by means of a pressure device indicated by an arrow 12. A rotating vacuum pick-up drum 13 is arranged to pick up the cards from the input magazine, to send them through a chute 14 to a reversing drum 15. The direction of rotation of drums 13 and 15 is shown by the arrows. A vacuum pump 16 is utilized for maintaining a partial vacuum in each of the drums, and each drum surface has perforations or slots for holding the cards on the drum surface. An output magazine 17 is shown containing a stack of cards 18 which has already been transferred, the stack being maintained in position by another pressure device indicated by an arrow 19.

In the system of Fig. 1 a card feed station is indicated generally by means of an arrow 20, and a card receiving station adjacent to the output magazine is indicated generally by an arrow 21. For the purpose of the present invention it is necessary to describe in greater detail only the card receiving station, hence reference is now made to Figs. 2 and 3 for that purpose.

In Figs. 2 and 3 the drum 15 is shown as resting upon a supporting table 38 and having an upper flange 15a projecting slightly beyond the drum surface. The structure of the drum includes three working grooves 39, 40, and 41, each of which is an annular groove encircling the entire drum surface and recessed beneath the surface by a fixed amount. The drum structure also includes two relatively narrow vacuum slots 25 and 26. Although the relative locations of the grooves and slots is somewhat arbitrary, the drawings show the slots 25 and 26 located near the top and bottom edges of the drum, respectively, and all of the grooves located between the two slots.

The drum is fastened together by means of a number of bolts 50, together with a number of spacers or washers. A spacer is inserted at each point where a bolt passes through one of the vacuum slots 25 or 26. Thus the drum structure is actually comprised of a top section, a bottom section, and a middle section. The top section is fastened to the middle section by means of the bolts 50, the associated spacers providing slot 25 which extends throughout the drum. Similarly the bottom portion is connected by bolts 50 to the middle portion with spacers

providing the slot 26 which also extends throughout the drum.

The vacuum slots are provided for the purpose of clamping to the drum surface the cards which are transported thereon. Sidewise slippage of the cards while in motion is prevented by supporting table 38 and flange 15a. Grooves 39, 40, and 41 are necessary to the operation of the card receiving station.

The receiving station includes three fingers 33a, 33b, and 33c which ride respectively within grooves 39, 40, and 41. As indicated in Fig. 2 by means of dotted lines, the major part of each finger rides beneath the drum surface. At one end, each of the fingers has a rounded tip which protrudes above the surface of the drum, forming a projection 32. The direction of rotation of the drum is such that a card 22 being transported thereon as shown in Fig. 2 will be deflected first by the projections 32.

The other ends of the fingers rise above the drum surface and may be made as an integral piece with a connecting member 31 which is in turn fastened to a stopping wall 30. Thus, card 22 is first deflected from the drum surface by the first projections 32; upon again returning to the drum surface it is deflected therefrom for the second time by a second projection comprising the other ends of the fingers 33a, 33b, and 33c; and it finally comes to rest with its leading edge abutting against the stopping wall 30.

In operation a card 18b and all other cards which were previously received in the output magazine 17 are no longer in contact with the drum surface, being shielded therefrom by the last-received card 18a. These previously received cards, therefore, rest within the output magazine in their normal flat shape, being held in place by the pressure device 19. The last-received card 18a, however, has a portion of its length clamped to the drum surface by means of the partial vacuum in slots 25 and 26. Thus the leading edge of card 18a abuts against the stopping wall 30; its trailing edge is separated from the drum and overhangs projections 32; and its middle portion remains in sliding contact with the exposed portion of the drum and therefore assumes a correspondingly curved shape as shown.

As the next card 22 approaches the receiving station, upon reaching projection 32 its leading edge is separated from the drum surface and strikes the exposed underside of the trailing edge of card 18a. The leading edge of card 22 then slides underneath card 18a and again comes into contact with the drum surface beyond projections 32. This reestablished contact with the drum surface provides a new driving force which ensures that card 22 is propelled into the position previously occupied by card 18a. Finally card 22 strikes fingers 33a, 33b, and 33c and is again separated from the drum and comes to rest against wall 30.

Thus according to the general concept of the invention there are provided a first projection fixedly positioned adjacent the surface of the rotating drum, and adapted to deflect away from the drum surface a card which is being transported thereon; and a second similar projection spaced from the first in the direction of rotation of the drum by substantially less than a card length. In the example shown the second projection is comprised of the other ends of fingers 33a, 33b, and 33c, which are integral with the connecting member 31. According to the general concept of the invention there is also provided a stopping wall, spaced beyond the second projection in the direction of rotation of the drum, and less than a card length from the first projection.

There are several operational requirements which the invention must fulfill. Regardless of the speed of rotation of the drum it is necessary to provide a proper balance between the driving friction provided by the drum surface and the stopping friction provided by the card receiving station. Thus, after the leading edge of card 22 strikes projections 32 it establishes sliding contact with

projections 32 and with the under-surface of card 18a; the frictional driving thrust imparted to the remaining portion of card 22 by the drum surface must be sufficient to overcome the friction involved in these sliding contacts. After the leading edge of card 22 re-establishes contact with the drum surface the driving force must be sufficient to ensure that card 22 moves into its final position, overcoming the frictional resistance of projections 32, of the underside of card 18a, and of the second projection including member 31.

When the drum is rotating at high speed the additional factor of the kinetic energy of the moving cards must be considered. It is necessary that each moving card as it comes into the output magazine must be stopped, and its kinetic energy absorbed, without crushing or damaging the card. This stopping action is accomplished in four successive steps, involving the absorption of the kinetic energy of the moving card by projections 32, by the previously received card, by the second projection, and by stopping wall 30.

A set of specifications which has provided satisfactory operation at the rate of 2,000 cards per minute is as follows. A drum diameter of 10 inches is used, and the drum is rotated at 700 R. P. M. The partial vacuum is selected to produce a pressure differential corresponding to 10 inches of water. The cards are made of flexible paper, being 7 $\frac{3}{4}$ inches in length, 3 $\frac{1}{4}$ inches in width and having a thickness of 7 to 8 mils. The exposed portion of the drum surface lying between the first and second projections is established at 3 $\frac{1}{2}$ inches, approximately half the length of a card. The stopping wall 30 is positioned slightly less than a card length away from projections 32 so that a stopped card such as 18a overhangs projection 32 by approximately $\frac{1}{8}$ inch. Projection 32 has a radius of $\frac{1}{2}$ inch and protrudes $\frac{3}{16}$ inch above the drum surface. It is important that projections 32 should not protrude too far beyond the drum surface, since otherwise the change of direction of an oncoming card such as 22 will be excessive in view of the kinetic energy of the moving card.

Reference is now made to Figs. 4 and 5 showing another embodiment of the invention. The distinguishing feature of this embodiment is that each of the first and second projections is a separate structure. Another variation is that the embodiment of Figs. 4 and 5 includes only two working grooves 44 and 45 in the surface of the drum 15.

Thus, as illustrated in Fig. 5 the first projection is provided by a pair of fingers 46 and 47, respectively riding within grooves 44 and 45, and maintained in position by means of a connecting member 48. The member 48 is in turn fastened to the supporting table 38.

The second projection is provided by a pair of short fingers 42 and 43 connected to the member 31 and riding within grooves 44 and 45, respectively. Fingers 42 and 43 do ride beneath the surface of the drum so as to deflect therefrom the leading edge of each card being transported thereon. It will be noted that grooves 44 and 45 are not required to be as deep as the corresponding grooves of the previous embodiment, since no connecting structure is required to ride within them.

What is claimed is:

1. A card transporting and receiving system comprising, in combination, a rotatable drum having at least two annular grooves in the surface thereof; means for creating a partial vacuum on the surface of said drum; a stationary receiving hopper fixedly positioned adjacent to the drum and including first and second members each having at least two fingers extending partially into associated ones of said annular grooves, said first and second members respectively providing first and second projections protruding from the surface of the drum, said second projection being spaced from said first projection in the direction of rotation of said drum by substantially less than a card length; and a stopping wall associated

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with said receiving hopper and fixedly positioned beyond said second projection less than a card length in the direction of rotation of said drum from said first projection, whereby a stopped card has its leading edge abutting against said stopping wall, its trailing edge overhanging said first projection, its fore and aft portions resting upon said second and first projections, respectively, and its middle portion clamped by means of said partial vacuum in sliding contact with the surface of said drum betwixt said first and second projections, thereby to cause a succeeding card being transported upon the surface of said drum when said drum is rotating to assume the position previously occupied by said stopped card.

2. The system claimed in claim 1 wherein said means for creating a partial vacuum comprises a pair of annular slots in said drum, respectively located near the ends of the drum on the surface thereof.

3. The system claimed in claim 1 wherein said first and second projections are interconnected by a plurality of fingers, each of said fingers riding within an associated one of said annular grooves, said first projection being formed by first ends of said fingers protruding above the surface of said drum, said second projection being formed by second ends of said fingers protruding above the surface of said drum.

4. The system claimed in claim 1 which includes a supporting table for supporting said drum, and wherein said first and second projections are separate from each other and are individually fastened to said supporting table.

5. The system claimed in claim 1 wherein said rotatable drum has a diameter of 10 inches, said partial vacuum creates a pressure differential corresponding to 10 inches of water, and said first projection has a radius of one-half inch and protrudes three-sixteenths inch above the surface of said drum.

6. A system for transporting and receiving flexible cards at a rapid rate, comprising in combination: a rotat-

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able drum card conveyor having an annular groove in the surface thereof; vacuum means coupled to the inner portion of said conveyor for maintaining a partial vacuum therein; a stationary receiving hopper fixedly positioned adjacent to the drum and including first and second members each having a finger extending partially into said groove, said first and second members respectively providing first and second projections protruding from the surface of the drum, said second projection being spaced from said first projection in the direction of rotation of said conveyor by substantially less than a card length, whereby the leading edge of a card being transported upon said surface becomes separated therefrom upon reaching said projections in succession; means for feeding a succession of cards to said conveyor, said conveyor having portions of the surface thereof in communication with the inner portion thereof, thereby supplying a partial vacuum at said surface for clamping thereto the cards being transported thereon; said second member further including a stopping wall fixedly positioned adjacent the surface of said conveyor, whereby a stopped card has its leading edge abutting against said stopping wall, its trailing edge overhanging said first projection, and its mid-portion in sliding contact with the exposed surface of said conveyor between said first and second projections, and whereby a succeeding card being transported upon the surface of said conveyor is operative to assume the position previously occupied by said stopped card.

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