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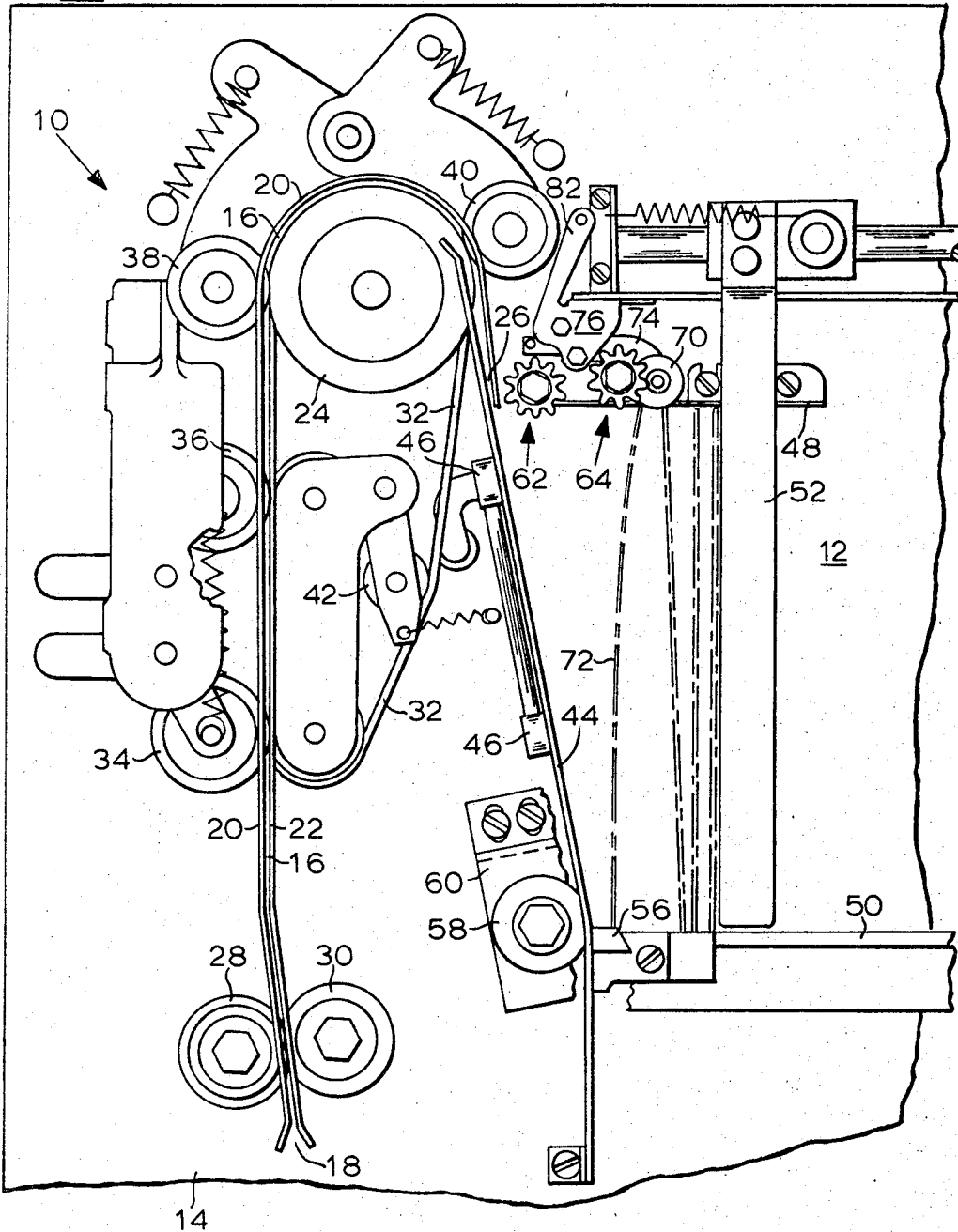
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SHEET ANTI-CREEP APPARATUS FOR SHEET  
STACKING MECHANISMS

3,421,755

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Sheet 1 of 2

Fig. 1



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## SHEET ANTI-CREEP APPARATUS FOR SHEET STACKING MECHANISMS

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2 Claims

### ABSTRACT OF THE DISCLOSURE

A resilient wheel is used to align sheets going into an expandable stacking hopper. As the sheets are discharged from the stacking mechanisms, the wheel engages the edges of the sheets and aligns them through a rolling tamping motion. The wheel is driven by continued growth of the stack of sheets.

### BACKGROUND OF INVENTION

#### Field of invention

This invention relates generally to sheet stacking mechanisms and in particular to sheet alignment mechanism therefor.

#### Prior art

Various high speed sheet stacking machines, having a sheet transport system discharging sheets into a stacking hopper, utilize a pair of paddle wheel stacking members at the inlet to the stacking bin for removing a sheet from a transport system. In such a stacker, the second of the paddle wheel stacking members receives the incoming sheet from the first paddle wheel and transports this incoming sheet to the previously stacked sheets. During the stacking time, the previously stacked sheets remain in the stacked deck without any tendency to creep out of the deck. At other time periods when there are no sheets being stacked, the paddle wheel nearest the deck is rotating under power against the last sheet placed in the stacks, causing that particular sheet to be gradually driven out of the deck. When this happens, the sheet is out of sequence.

An example of such an application is in a high speed punch card reader serving as an input to a computer system. Each of the punch cards contains discrete information which is to be transferred upon command to the computer. For any given command, a predetermined number of punched cards is read into the computer. After reading this group of cards, the card reader is in a "stand-by" operation ready for the next command. During this stand-by period, the rotation of the paddle wheel against the stacked cards drives the last card out of the stack and, therefore, out of sequence.

### SUMMARY OF INVENTION

The invention disclosed herein is an improvement in the alignment mechanism whereby the sheet which is being driven out of the stack is arrested and subsequently returned to the stack in its proper sequence. To accomplish this, I have placed a deformable member adjacent to the stacking mechanisms and in cooperation with the stacked sheets, so that a sheet being driven out of the stack is arrested by the deformable member and retained in sequence.

It is, therefore, a principal object of my invention to arrest the sheets that are being driven out of the deck and, thereby, prevent the out of sequence sheet stacking which otherwise would result.

In many sheet stacking machines, the sheets which are used must be handled either by many different machines

or many times by the same or few machines. It, therefore, becomes important that the machines do not damage the sheets in any manner. Thus, it is another object of my invention to arrest the driven sheets without damaging their edges.

In a well organized data processing activity, the amount of time spent in handling the input decks of cards is most important. It is, therefore, necessary that the equipment which handles these cards keeps the edges of each deck aligned to allow them to fit easily into storage files. It is, therefore, an additional object of this invention to align each card positively and without damage, keeping all the trailing edges in a single plane.

### DRAWING DESCRIPTION

The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following detailed description taken in connection with the accompanying drawings in which:

FIG. 1 is a plan view showing a portion of a transport system and the stacking bin;

FIG. 2 is an enlarged plan view of the stacking wheels and an anti-creep wheel at the entrance to the stacking bin;

FIG. 3 is a bottom view of FIG. 2 partly in section and with parts broken away showing the relationship between the anti-creep wheel and the stacking wheels; and

FIG. 4 is an enlarged fragmentary plan view showing the embedding of a card into the anti-creep wheel.

### DETAILED DESCRIPTION

Referring to the drawings, a portion of a document handling card transport system 10 including a stacking hopper 12 is shown mounted on a suitable base plate 14. Sheets are transported singly and on edge in a guideway 16 from a flared inlet 18 to the stacking hopper 12. The sheets are received and stacked in the hopper in sequence. The guideway is defined by a pair of spaced apart upright plates 20, 22 mounted to the base 14 and extending from the flared inlet 18 to a power driven drum 24. The outside guide plate 20 extends around the drum, but spaced away therefrom, and terminates at the inlet 26 to the stacking hopper 12.

Adjacent to the inlet 18 of the guideway 16, and along the guideway, is a pair of opposed drive rollers 28, 30 for driving the sheet along the guideway 18. Wrapped around the drum and being driven thereby is a continuous belt 32 for transporting the sheets around the drum and into the stacking hopper 12. Along the periphery of the belt are a plurality of idler rollers 34, 36, 38, 40 which extend through the plate 20 of the guideway 16 and apply sufficient pressure to keep the sheet against the belt 32. The belt tension is adjustable by an idler take-up roller 42.

Forming one wall of the inlet 26 to the hopper 12 is the terminating portion of the outside guide plate 20. Forming the other wall of the inlet 26 to the hopper 12 is a fixed wall 44 extending from the drum 24 and into the hopper. As the sheet leaves the guideway 16 at high velocity, it passes through the inlet 26 and into the hopper 12 in free flight.

The hopper is defined on one side by the fixed wall plate 44 which extends from the drum 24 and contains a plurality of apertures through which one or more air jets 46 are provided and arranged to direct an air blast or blasts against an incoming card in the hopper 12. Parallel front 48 and rear 50 walls extending transversely to the fixed wall plate 44 form two other sides with the rear wall having adjustments (not shown) to accommodate stacks of different length sheets. Normal to the front 48 and rear 50 walls and forming the fourth side of the hopper 12 is

a movable back-up member 52 so as to allow the hopper to expand as the number of sheets in the stack increases. The previously mentioned fixed wall plate 44 extends from the drum 24 toward the rear wall 50 in a converging relationship with and at an acute angle to the expandable back-up member 52. At the junction 54 of this fixed wall and the rear wall is a rubber bumper 56 mounted in the rear wall. This bumper 56 softens the rebound force of the incoming sheets.

Located near the rubber bumper 56 and on the other side of the fixed wall 44 is a continuously rotating wheel 58. This wheel 58, which rotates in a clockwise direction, extends through the fixed wall 44 so as to make contact with the incoming sheet as the sheet rebounds from the rubber bumper 56. The wheel's function is to engage with the rebounding sheet and return it to the rear wall thereby aligning the leading edges of the stacked sheets along the rear wall. The wheel is mounted on an adjustable base 60 so that as the spacing of the rear wall is adjusted relative to the front wall for different lengths of sheets, the wheel 58 can also be adjusted so as to retain the proper spaced relationship with the rubber bumper 56.

The hopper front wall 48 terminates in a spaced relation to the fixed wall 44 at the sheet inlet 26 to the hopper. Two paddle wheel stacker assemblies 62, 64 are mounted on separate vertical shafts 66, 68 adjacent to the inlet 26. The function of these assemblies is to engage the trailing edge of the incoming sheet and pivot the sheet toward the back-up member 52. These two paddle wheel assemblies 62, 64 are always being driven under power. The second 64 of these assemblies, for the purposes of my invention, is a dual stacking wheel; that is, the central portion of an elongated stacking wheel has been removed in order that I may position an independently biased deformable wheel 70 therebetween. This additional wheel 70 is substantially the same diameter as the stacking wheels 65-67, but it is fabricated from a resilient material. In the preferred embodiment, I have used a solid urethane rubber wheel.

One function of my invention is to prevent the last stacked card 72 from creeping out of the stack. More briefly stated, this wheel 70 is an anti-creep wheel. The anti-creep wheel 70 in the preferred embodiment is axially mounted on one end of a first-class lever 74. A first-class lever is one that has its fulcrum or pivot point between the point at which a force is applied and the point at which the weight or load is connected. The lever 74 is pivoted on a frame 76 attached to the hopper base plate 14. The frame 76 is mounted so that the whole lever assembly can be adjusted to place the wheel in the most favorable position for the particular stack or stacks of sheets which are being stacked in the hopper.

On the end of the lever 74 opposite that of the wheel, I have provided means for mounting a spring 80 between the lever 74 and an extending arm 82 of the frame 76. The spring 80 provides a bias to have the wheel 70 ride on the edges 84 of stacked sheets and overcome the force of the creeping sheet 72. To prohibit the wheel from riding on the stacked sheets with as much force as the spring 80 is capable of delivering, and thus possibly damaging the edges of the sheets, I have added an eccentric 78 adjustment mechanism on the frame 76 to control the angular movement of the lever 76 about its pivot point which in turn controls the movement of the wheel toward the stacked deck. Through the use of this adjustment, the pressure of the wheel against the stacked deck is controlled.

The center 86 of the anti-creep wheel 70 is positioned between the axial center of the dual stacking wheel assembly 64 and the back-up member 52 or, as shown in FIG. 3, just to the right of the dual stacking wheel assembly 64. The wheel 70 must be positioned so that as the sheets leave the stacking wheels 65, 67, their trailing edges 84, if the sheets creep, will come in contact with the anti-creep wheel 70 to the left of its center 86, as

shown in FIG. 4. As the sheet 72 creeps out of the stack, it imbeds its trailing edge 88 into the wheel 70 and tries to rotate the wheel clockwise. Due to the fact that the biasing force of the wheel against the stacked deck is greater than the imbedding force of the sheet into the wheel, the wheel cannot rotate clockwise. Instead, the wheel is driven in a counterclockwise direction by the expansion movement of the deck. This counterclockwise movement of the wheel 70 will drive the creeping sheet 72 back into the deck. As the wheel continues to rotate in a counterclockwise direction, the trailing edges 84 of all the stacked sheets become aligned.

When there are no sheets being transported to the hopper, both stacking wheel assemblies 62, 64 are constantly rotating in a counterclockwise direction as viewed in FIGS. 1 and 2. The dual stacking wheels 65, 67 are rotating and striking against the previously stacked sheet 72 at the receiving end of the stack causing that sheet to creep away from the rear wall 50. The receiving end of the stack is defined as the end of the stack where the last sequentially stacked sheet is placed by the stacking mechanisms. This creeping sheet strikes the front wall 48 and is directed thereby along the stacked deck of sheets due to the frictional drive of the constantly rotating dual stacking wheels 65, 67 against the surface of the sheet. Thus, the sheet is driven out of the deck and lies between the front wall 48 and the trailing edges 84 of the stacked sheets in the hopper. When the next sheets are fed from the transport system, the stacked deck of sheets is now out of sequence due to the sheet or sheets which have crept out of the deck.

The anti-creep wheel 70, positioned as hereinbefore described, also prevents this creeping of the sheets. The sheet 72 would still try to creep because of the drive of the dual stacking wheels 65, 67, but instead of the sheet striking the front wall 48 of the hopper which wall 48 must be spaced away from the stack to allow the stack to expand without binding, the trailing edge 88 of the sheet 72 imbeds itself in the wheel 70 to the left of its center, as shown in FIG. 4. The biasing force of the spring 80 holding the wheel 70 against the deck overcomes the driving force of dual stacking wheel paddles 65, 67 against the surface of the sheet. When the next sheets are fed into the hopper and the deck expands, the anti-creep wheel 70 rotates counterclockwise, and the displaced sheet 72 will then be driven back into alignment with the stacked deck.

While I have herein described, as a preferred embodiment of the anti-creep apparatus, a deformable wheel 70 positioned between the stacking wheel assemblies 62, 64 and the back-up member 52, it is to be understood that the geometry of the anti-creep mechanism is not limited to that of a wheel. A continuous deformable belt guided by plurality of pulleys is an alternate means which was successfully developed and used. One pulley as would be mounted in the same basic document handling system 10 is placed between the two stacking wheel assemblies 62, 64 and a second pulley was positioned so that the belt extended over the trailing edges of sheets at the receiving end of the stack. The pulleys are mounted on individual axles which are in turn mounted to a bracket similar to that shown as 76, so that the belt assembly can be adjusted to the desired location relative to the trailing edges of the sheets. The belt is also driven by the growth of stack of sheets as is the wheel. The advantage of the wheel assembly over the belt assembly is governed solely by the cost of manufacture and not by efficiency of creep prevention.

In summary, I have described and disclosed an anti-creep device for use in sheet stacking apparatus for retaining and aligning sheets as they are received and stacked in expandable receiving hoppers. The anti-creep device is a biased deformable member which is positioned adjacent to and in contact with the receiving end of the stacked sheets in such a manner so as to arrest the creeping movement of the last sequentially stacked sheet. From this

position, the deformable member will align said sheet in response to the movement imparted thereto by the expansion of the sheets.

While a particular embodiment of the invention has been shown, it will be understood, of course, that it is not desired that the invention be limited thereto since modifications may be made, and it is, therefore, contemplated by the appended claims to cover any such modifications as fall within the true spirit and scope of the invention.

I claim:

1. A sheet stacking apparatus for singly stacking sheets on edge from a transport system comprising;
  - an expandable hopper receiving said sheets from the transport system, said hopper having an inlet at the termination of the transport system and a sheet stack back-up member,
  - stacking means proximate the inlet to the hopper for receiving said sheets from the transport system and stacking the sheets on edge against the back-up member, said stacking means tending to dislodge the last sequentially stacked sheet through a wiping motion against a surface of the sheet thereby causing said last stacked sheet to become out of sequence,
  - a deformable member laterally disposed from said

stacking means, and means for pivotally biasing said member against the edges of said stacked sheets, said member engageable to move the dislodged sheet into the stack during the continued growth of the stacked sheets.

2. The sheet stacking apparatus according to claim 1, wherein the deformable member is a resilient urethane wheel positioned within the cylindrical plane of the stacking means to receive a dislodged sheet in an area on the wheel circumference anterior with respect to the wheel rotation to the tangent point of the wheel on the stacked sheets and thereafter to restore said dislodged sheet by rotation of the wheel imparted thereto solely by the growth of the stack.

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