# United States Patent

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[54] **JAM DETECTION DEVICE FOR DOCUMENT STACKING**
**7 Claims, 5 Drawing Figs.**


[52] **U.S. Cl.** ..... **271/87**
[51] **Int. Cl.** ..... **B65h 31/06**
[50] **Field of Search** ..... 271/87



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**ABSTRACT:** A stacking device capable of receiving documents, such as checks or standard data processing cards, and more specifically a sensor for detecting a jam of documents during a stacking operation. The sensor, which may be a leaf spring, extends outwardly from behind a kicker spring for propelling documents broadside on the fly onto a stack, into an area adjacent the normally stable position of the face of the accumulating stack. A crumpled document or an advance in the face of the stack will activate the sensor.

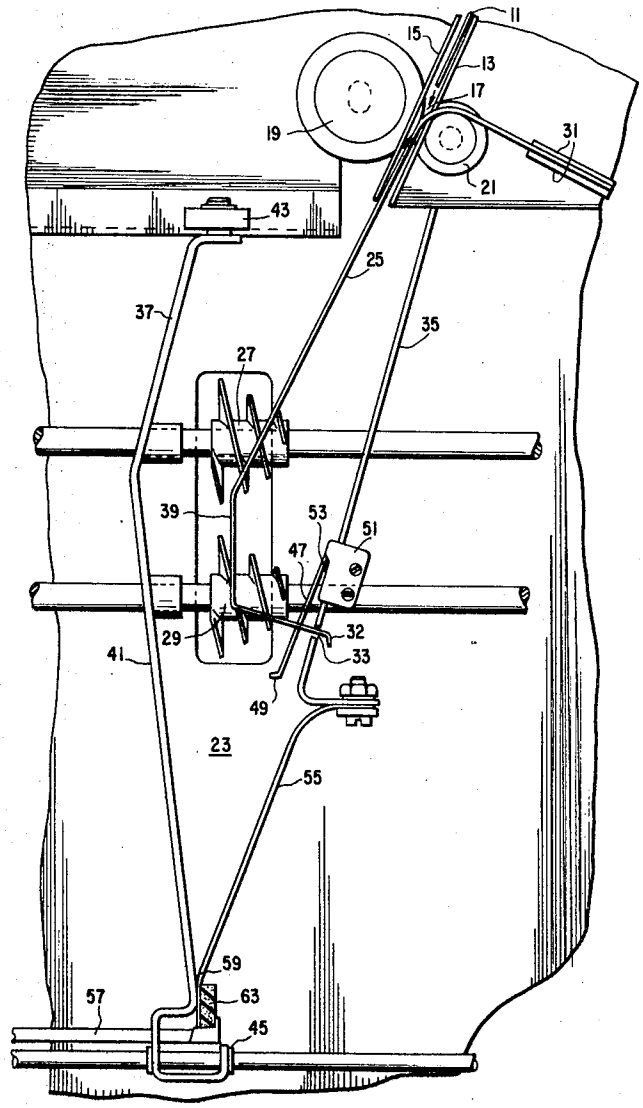
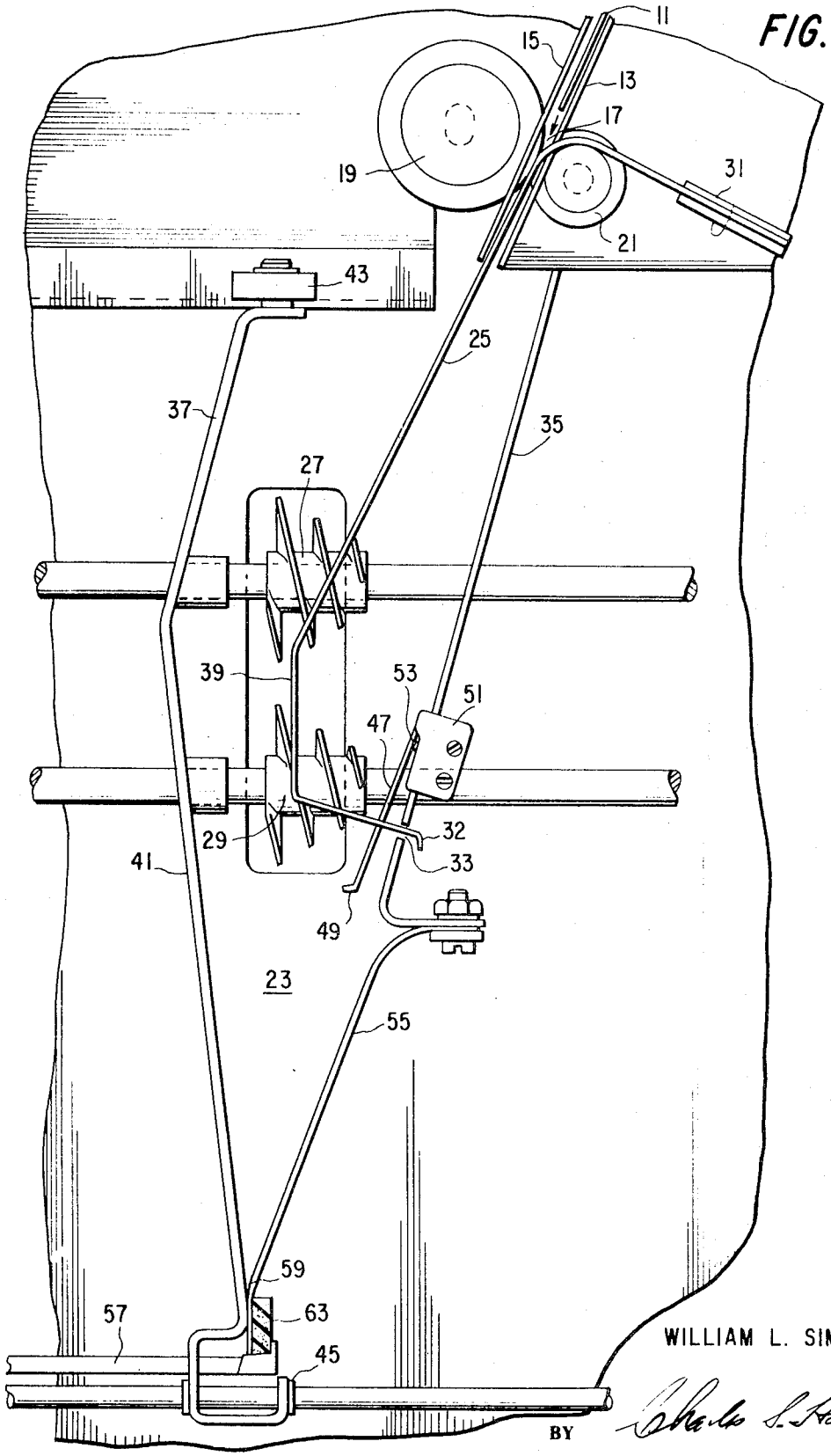



FIG. 1

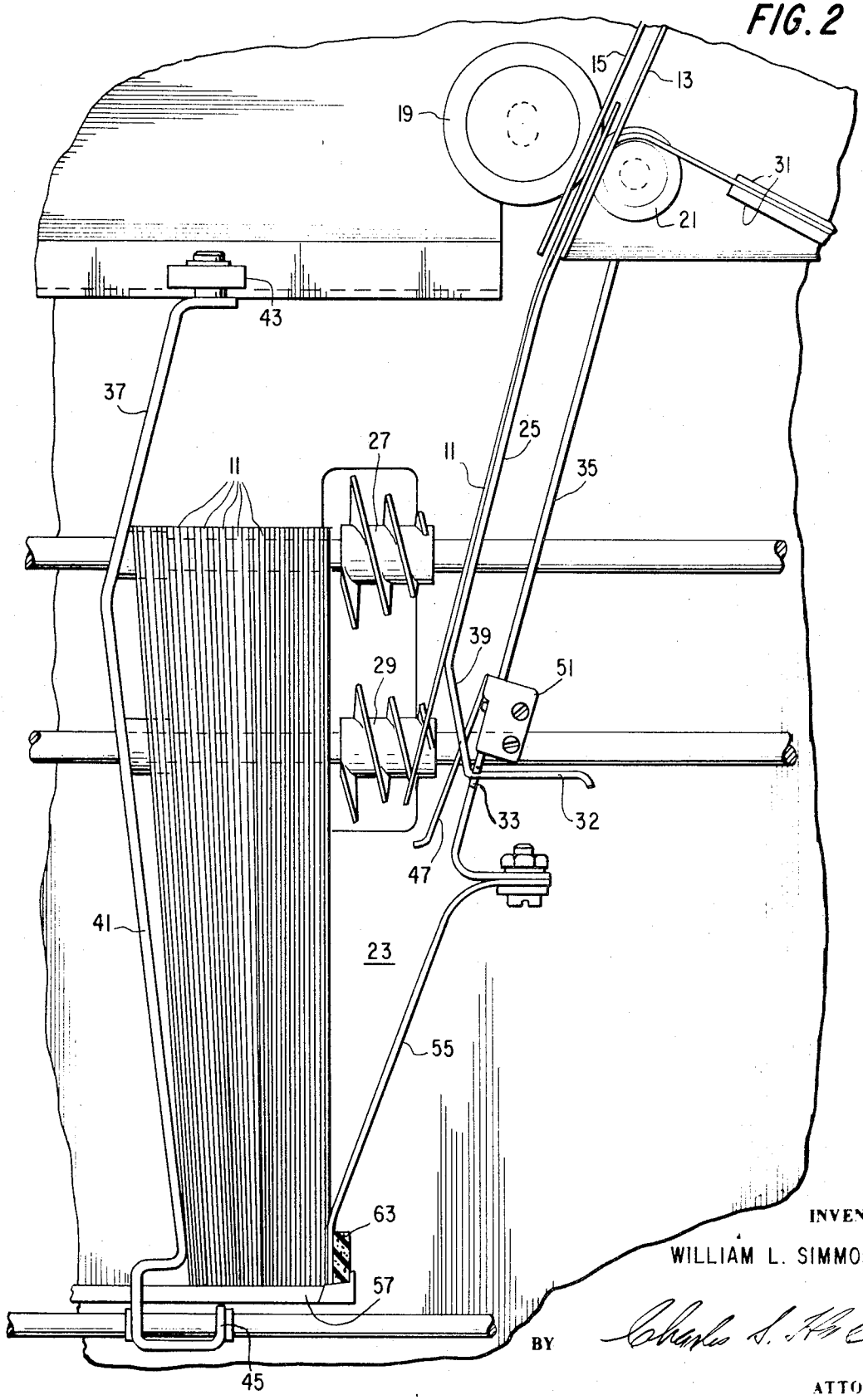



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FIG. 2




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FIG. 3

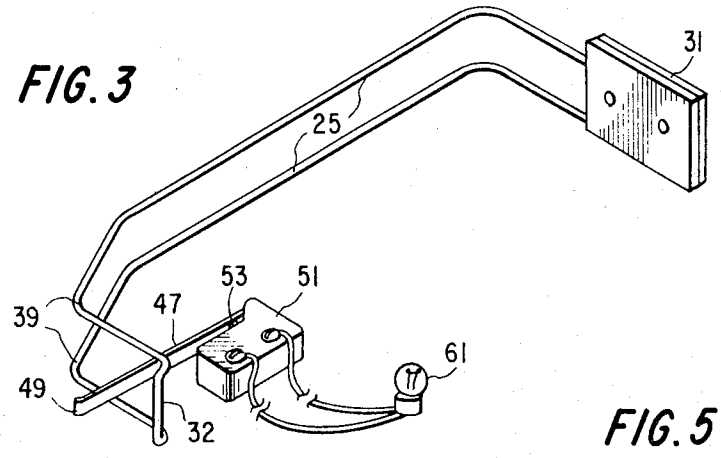



FIG. 4

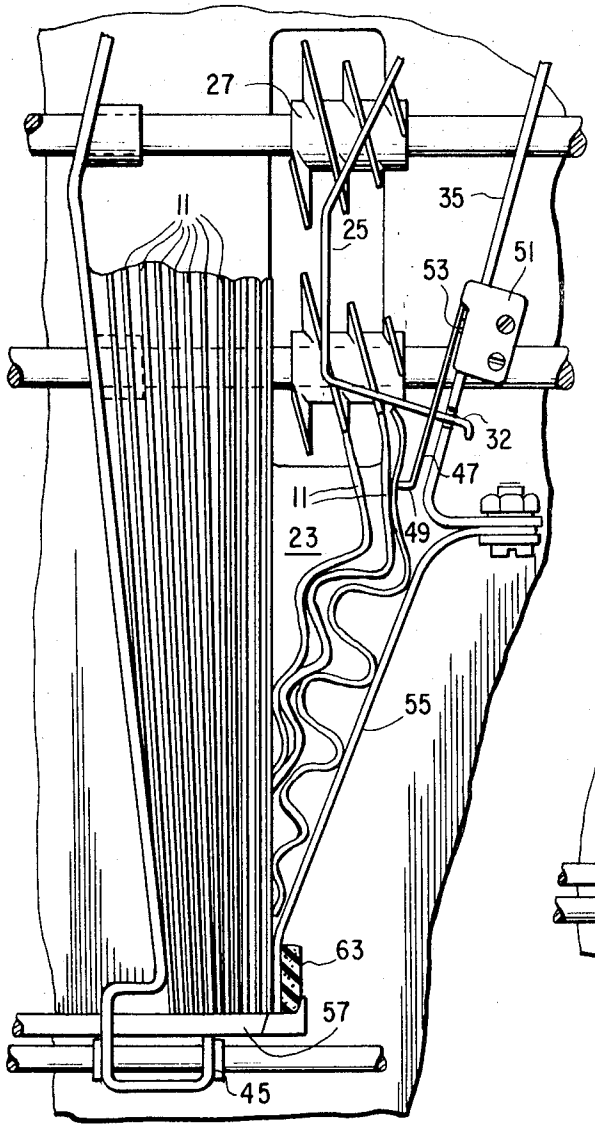
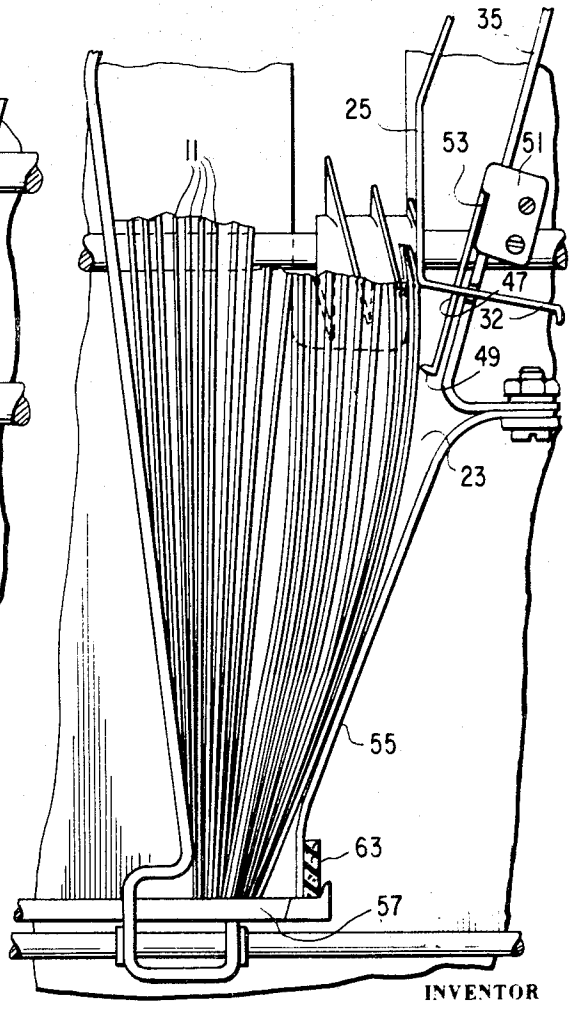



FIG. 5




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# JAM DETECTION DEVICE FOR DOCUMENT STACKING

## BACKGROUND OF THE INVENTION

In modern equipment for processing documents such as checks or data processing cards, they must be moved from one location to another at high speed and with a great degree of accuracy. Often in a document sorter, for example, these cards or checks are separated into a number of groupings corresponding to various coding criteria. The order to achieve the maximum utility from these operations it is essential that the stacked documents be neatly aligned and kept free from damage. It is particularly important, in document sorters, that the various stacking bins are filled in an even and regular manner. Jamming of documents may occur in the stacking operation due to many causes such as slightly crumpled or otherwise damaged documents. In the past, jams have been detected after a number of documents have "backed up" to a sensor somewhere in the main feed channels of the machine resulting in possible damage to many documents prior to detection of the difficulty.

It is the principal object of this invention to provide in a document-stacking apparatus an improved device for quickly detecting a jam in a stacking bin.

Another object is to incorporate a jam-sensing device into a stacking bin of a high-speed document-handling apparatus wherein the apparatus utilizes means for kicking an incoming document broadside onto the stack.

## SUMMARY OF THE INVENTION

In high-speed document-handling apparatus wherein documents are ejected in succession from a transport channel against a resilient member, which kicks the documents broadside onto the normally stable face of a stack in a bin, the invention incorporates a sensing member being activated when the resilient member is depressed by an accumulation of documents against it, or when a document is crumpled against the face of the stack.

The following drawings show the preferred embodiment of the invention.

FIG. 1 is a top plan view of the document-stacking apparatus.

FIG. 2 is a top plan view of the apparatus partially filled with documents.

FIG. 3 is a detailed perspective view of the jam detector and kicker spring arrangement.

FIG. 4 is a top plan view showing a possible jamming condition illustrating crumpled checks in the bin.

FIG. 5 is a top plan view showing a possible alternate jamming condition.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1 documents, such as checks 11, are transported at high speed between parallel guide members 13, 15 which together form a pathway 17. Drive roller 19 is in rolling contact with idler roller 21 through openings in the pathway walls. These rollers cooperate to eject the documents in succession from the pathway, on the fly, into the stacking pin.

Pathway 17 contains means, not shown, for bowing the documents as they are ejected from the pathway, as is known in the art. Providing a curve in the documents parallel to the direction of movement rigidifies and strengthens the document as it flies into the stacking area 23. It also tends to overcome crumpling of the checks at points where they have been folded. Stiff business cards may not require the rigidification necessary for paper checks and often have the required strength for rapid handling.

The moving documents 11, usually referred to hereafter as checks for simplicity of description, follow each other in rapid succession into the stacking bin. Known means are provided for kicking the trailing edge of each check out of the path of the next-incoming document and for continually pressing the stack broadside into the bin.



Kicker spring 25 is positioned at the end of the feed channel. When the check clears the pathway 17 and continues out into the stacking area, the transport mechanisms impart enough force to the checks to load the spring. The arcuate shape of the check, or in the case of business cards the card material itself, as it leaves the feed channel gives it sufficient strength to move the spring into its unrelaxed or deflected position. When the check clears the feed channel, the spring is allowed to relax and flick the document into augers 27 and 29 moving the trailing edge of each document clear of the following check.

The kicker spring 25 is preferably a long wire in a U shape having both ends anchored behind mounting bracket 31, as shown in detail in FIG. 3. The closed end 32 of the folded spring is threaded through a slot 33 in the backing plate 35. The intermediate portions of both legs of the U-shaped spring act as extensions of the sorter channel. As the check shoots out of the channel, it flexes the spring toward the backing plate 35 forcing the closed end of the spring backward and away from the plate. When the document is out of the chute, the spring flicks it into the threads of the stacking screws 27 and 29. The closed end portion 32 of the spring then bottoms against the rear face of the plate at slot 33.

As can be seen in FIG. 1, a portion of kicker spring 25 lies within pathway 17 and extends outwardly into the stacking area. Checks in the pathway start to deflect the spring as soon as they leave the feed channel 17. The spring in this deflected position is substantially parallel to stacker plate 37. The check follows this path and remains contiguous to the spring to area 39 of the spring. This corresponds to area 41 of stacker plate 37. The check when substantially on area 39 of the kicker spring is free from the feed channel and with the return of kicker spring 25 is urged sideways toward area 41 of the stacker plate.

As shown in FIG. 2, stacker plate 37 permits the document bin size to vary according to the number of items in the bin. When the bin is empty, the stacker plate is adjacent to the right side of the stacking area, as shown in FIG. 1. As the documents fill the bin, the distance between the stacker plate and the base of the stacking area increases, providing the proper pressure on the checks. The stacker plate 37 moves to the left, as shown in the drawings, with the aid of roller 43 and slide assembly 45, until it reaches a capacity limit. The checks will normally be aligned along wall 41.

Guide rail 55 extends from backing plate 35 and forms an acute angle with flat area 41 of stacker plate 37 when the bin is empty. The check first will move along the flat area 41 of the stacker plate and be directed, with the aid of guide rail 55, towards aligning base 57. Each succeeding check will move along the face of its preceding check with the aid of guide rail 55. As the stacker plate is pressed backwardly during the stacking operation, the checks will be evenly aligned along base 57. Sponge rubber 63 will yield when the checks strike curved portion 59 making room for each incoming check and holding it securely. The bottom curved portion 59 of guide rail 55 will abut the last check in the stack forming one end of a normally stationary stack face. Open chute area 23 is thus defined by the intersection of the guide rail 55 and stacker plate flat 41 when the bin is empty. As checks fill the bin, the normal position of the face of the stack intersects with guide rail 55 and defines area 23.

As shown in FIG. 4, for example, checks which have been damaged or weakened by folding, may crumple in area 23 and hinder further alignment. The checks following will also tend to bend as they shoot into the crumpled checks thus filling area 23. This open chute area 23 is normally free of checks while checks are stacking against plate 37. Once the checks are fed by augers 29 and 27 the area 23 remains clear. Crumpling checks may clog this normally free area. Since documents may be entering the stacker at rates up to 300 inches per second, a crumpled check will prevent subsequent documents from seating against the stacker plate 37, or face of the document stack, at the proper position 41, quickly backing up following checks into the transport chute if the jam is not detected immediately.

Infrequently, but in a similar manner, as shown in FIG. 5, a torn area in a document may catch and retain the succeeding documents. Overfilling the bin will have the same result but other means are usually provided for sensing the position of the stacker plate when a bin is nearly full. As documents accumulate abnormally advancing the face of the stack the kicker spring 25 is pressed backwardly toward the backing plate 35.

The present invention provides a sensing device for detecting a jam in a document-stacking bin resulting from any of these causes as soon as it begins to develop.

A sensor 47, such as a long leaf spring or wire member, has one end affixed to the backing plate 35, behind the kicker spring 25 near its closed end 32. As shown in FIG. 3, the unattached end of sensor 47 extends outwardly beyond the closed end of the kicker spring and into area 23 where a jam would first begin to develop. The tip end 49 of sensor 47 may be bent out of the plane of the leaf spring into a plane substantially orthogonal to the normal face of the accumulating stack of checks. The tip end 49 of the sensor 47 may be positioned as closely to the face of the stack as desired, keeping in mind that the kicker spring 25 is flexed by the entry of every document and the inflowing checks may not be entirely flush with the stack. It is important that the tip end 49 of the sensor 47 be normally noncontiguous with and spaced away from both the stack face and the normal flow of incoming documents.

Positioned between the sensor 47 and the backup plate, preferably near the point where the sensor is affixed, is a contact 53 forming part of a switch 51. Depression of the sensor 47 toward the backup plate 35 closes the switch. This closing of the switch may be utilized to shut off the equipment, or merely to activate a signal, such as an indicator lamp 61 connected to the leads of switch 51 If the shown in FIG. 3.

The sensor 47 may, for example, extend well into the area 23 so that any crumpling document may be immediately detected. In case of checks being caught on a torn document, the stacking plate 37 is not forced back, the kicker spring 25 is depressed and the tip end of the sensor is exposed to the jamming documents. Thus the improperly moving stack face, normally stationary, abnormally deflects spring 25 exposing sensor 47. If the bin is allowed to overfill, the advancing face of the stack will contact the sensor and close switch 51.

Applicant's sensor detects any incipient jam of documents before there is jamming into the transport chute. This not only alleviates damage to other incoming documents but prevents the choking up of the chute which may entail the dismantling of the chute to remove the packed-in documents.

While the switch and feeler are located on backing plate 35 in the preferred embodiment it can be seen that other positions along the backwall of the bin are available. The switch need not be directly behind kicker spring 25, but may be in any convenient location. The feeler member 47, as well, may be of a different shape and length and still perform the primary object of the invention, i.e., quickly detecting a jam in a stacking bin.

I claim:

1. In a machine for transporting documents to a storing area wherein said documents are impelled on the fly into a stacking bin having a normally stationary stack face, a jam-sensing device comprising:

resilient means normally deflected only by the force of said incoming documents for depositing said documents onto said stack face, and

means normally spaced away from said stack face and outside the range of said normal deflection of said resilient means for detecting a jam condition in said bin upon abnormal deflection of said resilient means by the advance of the face of the stack and document contact with said means.

2. The device according to claim 1, wherein said means for detecting a jam condition includes a feeler member adjacent said stack face.

3. The device according to claim 2, wherein said means for detecting a jam includes signalling means activated by said feeler means.

4. In a document-stacking device having a moveable stacker plate and having a surface at an acute angle thereto forming an open chute area for directing documents onto a stack, a jam detection apparatus comprising:

spring means for deflecting incoming documents onto said stacker plate, and

jam detection means disposed in said open chute area and associated with said spring means for sensing document crumpling in said open chute area or abnormal deflection of said spring means by accumulating documents.

5. The device according to claim 4, wherein said jam detection means includes a feeler member and switching means activated by said feeler member.

6. The device of claim 4, wherein said spring means includes a substantially U-shaped wire secured only at the open end, and said jam detection means includes sensor means extending through the unattached closed end of said wire into said open chute area.

7. The device of claim 6, wherein said sensor means includes a feeler member and switching means activated by said feeler member.

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