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[54] **DOCUMENT SEPARATOR FOR ACCIDENTAL BUNCHING**

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[52] **U.S. Cl.** **271/36,** 271/39

[51] **Int. Cl.** **B65h 3/06,** B65h 3/52

[58] **Field of Search** 271/36, 37, 38, 39, 271/41, 34, 51, 40

[56] **References Cited**

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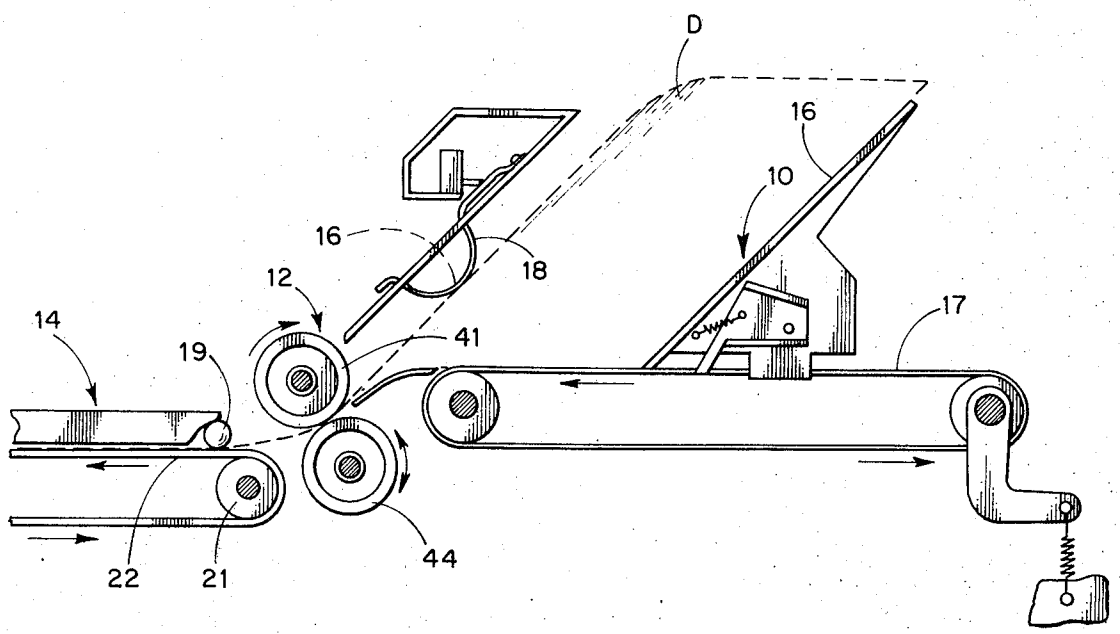
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[57] **ABSTRACT**

A document handling device is provided with a feed arrangement having a pair of rollers arranged to cooperate in feeding documents of varying size and thickness singly and sequentially from a stack, without adjustment of the device.

5 Claims, 3 Drawing Figures



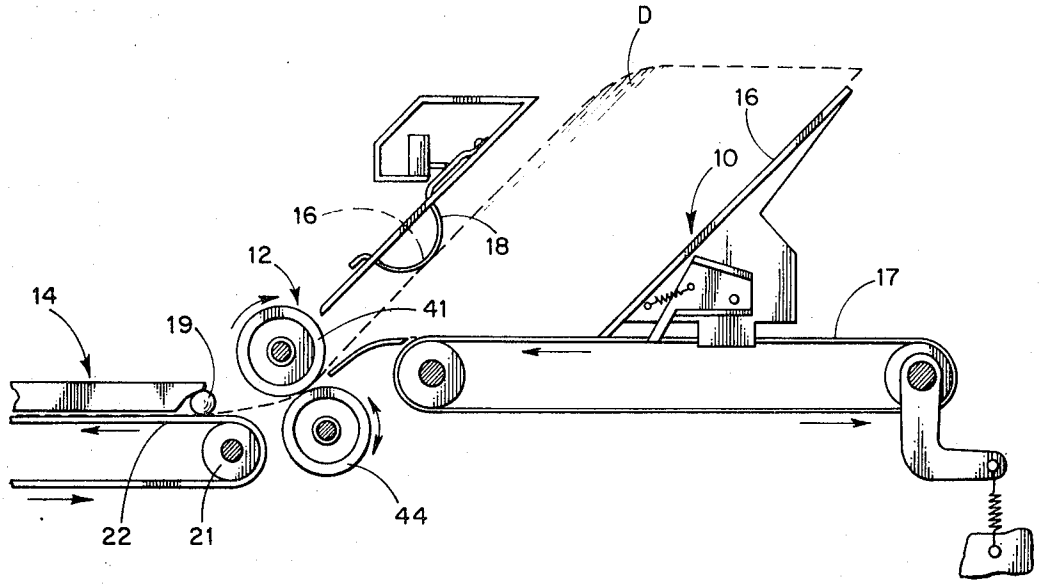


Fig. 1.

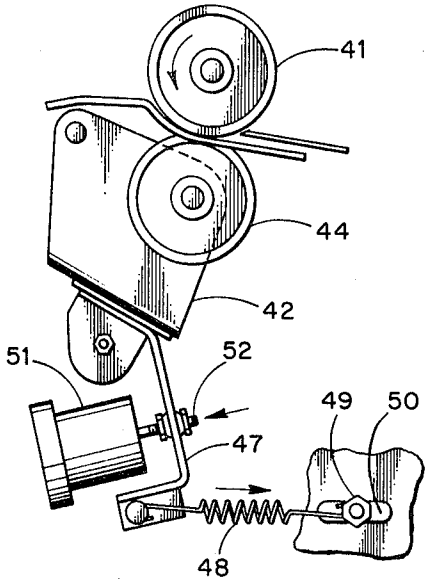


Fig. 3.

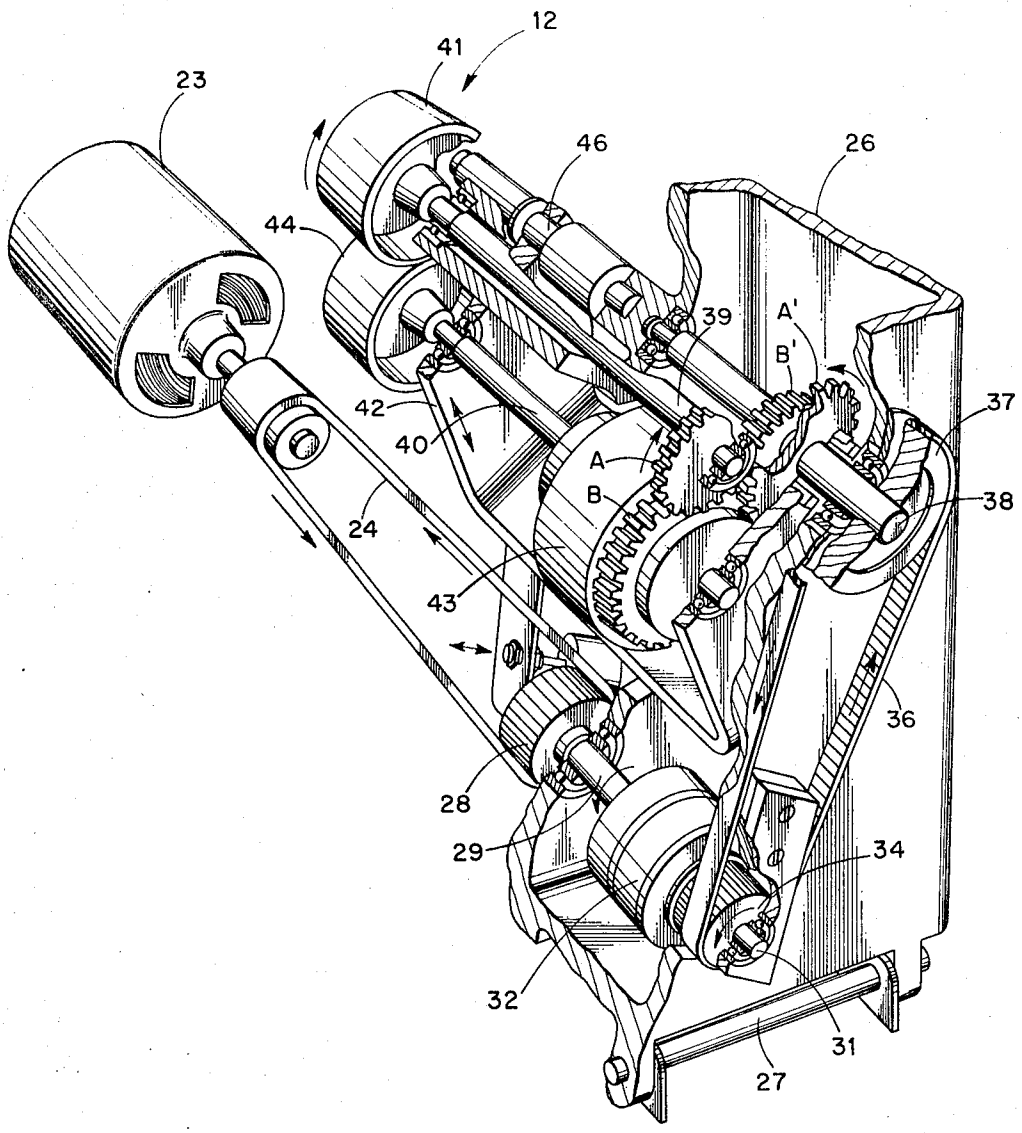


Fig. 2.

DOCUMENT SEPARATOR FOR ACCIDENTAL BUNCHING

BACKGROUND OF THE INVENTION

The present invention relates to sheet feeding devices, and more particularly to apparatus for feeding sheets of varying widths and thicknesses singly from a stack of sheets without adjustment to the feed mechanism and with a minimum wear of the contact surfaces of the feeding device.

In prior art devices employed for feeding sheet material singly from a stack, various combinations of rollers, belts and throating arrangements have been used to insure that double feeding (the feeding of two or more cards) does not occur during operation of a device. In card or sheet feeders which are to be employed in data processing equipment, it is necessary to attain relatively high speeds in the document feeding devices to satisfy the requirements of electronic or optical card readers which operate at speeds compatible with computer operation. It should be evident that a minimum of operator time spent in making adjustments to the feeder would be of major concern when providing a device which is to be acceptable to the industry. Thus, operation of the feeding device at a relatively high document output and the reliability required in the data processing area, serve to impose strict requirements on the design of such a device.

In the past, friction rollers have been combined with oppositely rotating rollers and stationary plates to perform single sheet feeding from a stack. However, in most of these designs, there is a high rate of wear on the moving parts due to continuous frictional contact between one roller and another, or between a feed roller and a stationary member. Many of these prior art arrangements may also prove to be detrimental to the document being fed in that roller slippage and other friction surfaces contracting the document are capable of smearing or erasing information located on the document surface.

Additionally, many of those devices of the prior art, which are intended to feed sheets singly from a stack, employ auxiliary belts, rollers, and fluid pressure means which tend to increase the physical size of the device and increase the cost of the equipment, while decreasing the reliability and efficiency of operation.

The present invention, therefore, has as an object to provide a device for feeding sheets singly and sequentially from a stack which is effective over a wide range of sizes and thicknesses of sheets without requiring external adjustment of the device.

It is a further object of the invention to provide a sheet feeding device of the type described wherein the contact surfaces of the feeding device are subject to a minimum of wear.

Another object of the invention is to provide a device of the type described wherein smearing, erasing or transferring of ink located on the printed surface of the sheets is minimized.

And yet another object of the invention is to provide a sheet feeding device which is less expensive, simpler in operation and more reliable than those of the prior art.

SUMMARY OF THE INVENTION

The aforementioned objects are achieved in the present invention by providing a device for feeding documents singly and sequentially from a stack which has in combination with means for supporting a stack of documents to be sequentially fed from the top of the stack, document feed means adjacent the stack, and means for guiding the top-most document and each successive document sequentially into the feed means. The feed means comprises a first roller means and a second roller means, each having surfaces juxtaposed one with the other, between which a document is guided and by which a document is subsequently fed. Means are provided for driving the first roller such that the juxtaposed surface rotates in a direction to move the document away from the stack when the document is disposed between the rollers and means are provided for driving the second roller to rotate its mating surface in the opposite direction from the first roller. Torque limiting means are connected between the second roller and the second roller driving means. The torque limiting means is adjusted such that the second roller driving means is not effective to rotate the roller when in contact with the first roller means either directly, or with a single document therebetween. The torque limiting means however is effective to rotate the second roller means when two documents are disposed between the surface of the rollers producing a low friction "slip" surface between the documents. A double feed therefore is prevented by the second document being moved back into the stack through rotation of the second roller means by operation of the second roller drive means.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the invention, reference should be made to the accompanying drawing wherein:

FIG. 1 is an elevational view showing a document feeding device having the present invention employed therein;

FIG. 2 is a perspective view, partially in section, showing a fragmentary portion of FIG. 1, in which details of the structure of the document feeder are taken on an enlarged scale for clarity; and

FIG. 3 is a fragmentary elevational view similar to FIG. 1 but taken on the opposite side of the document feeder, showing further details of the device and also taken on an enlarged scale for clarity.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, there is shown a device for feeding documents singly and sequentially from a stack which comprises a hopper **10** in combination with a feed device **12** and take-away transport **14.** The hopper **10,** feed device **12** and transport **14** taken together cooperate to remove the top card from a stack and present it to a station (not shown) downstream on the transport, at which work is performed on the document.

The hopper **10** which is shown in the present embodiment, is of a type which is the subject matter of copending U. S. Patent Application Ser. No. 209,808 filed Dec. 20, 1971 by J.A. Peterson which is assigned to the assignee of the present invention. The construction of the hopper **10,** as shown, is therefore explained in greater detail in the aforementioned patent application. However, for the purposes of the present invention it should be understood that any arrangement which will feed a stack of documents such that the top-most docu-

ments are moved into the feed device **12** could be employed with the present invention, as the invention is not limited to the details of the construction of the hopper itself.

For purposes of the present description, the hopper **10** is shown to include a follower plate **16** inclined at approximately 45° and supported for movement on a belt **17**. The plate when driven by belt movement in the direction of the arrows is effective to move a plurality of documents supported thereon toward the feed device **12**. Movement of the feed belt **17** is controlled by a switch or sensor **18** to properly position the first document with respect to the feed device **12**.

At the opposite side of the feed device **12**, the transport **14** is seen to comprise a pair of rollers **19** and **21** into which a document is fed after passing through the feed device. The roller **21**, also serves to support a transport belt **22** which is effective to move the document downstream of the arrangement described to a subsequent work station. The transport **14**, as shown, is exemplary in nature and is intended to merely indicate one suitable receptacle for single documents which have been fed by the feed device **12**. Other such devices for feeding, stacking or arranging the single documents flowing from the feed device **12** may be substituted, without departing from the spirit of the present invention.

Referring now to FIGS. **2** and **3**, in these views there are depicted details of the feed device **12**, shown in FIG. **1**. The feed device **12** is shown to be driven by a motor **23** which may be mounted on suitable structure adjacent the rollers **19** and **21** of the transport **14**. The motor **23** drives the feed device **12** by means of a continuous belt **24**, and may also be connected to the rollers **19** and **21** to effect operation of the transport **14**. In the device shown, the motor **23** is continuously in operation while the document feeder is activated.

It will be noted from FIG. **2** that the major portion of the feed device **12** is mounted in a housing **26** which is pivotable about a pin **27** when the belt **24** is disengaged from the motor **23** to facilitate access to the components of the feed device **12**.

The belt **24** is drivingly engaged to a pulley mounted on a shaft **29** which is supported for rotation in suitable bearings in the housing **26**. The shaft **29** is connected to a second shaft **31** through a permanent magnet clutch **32**.

The shaft **31** is mounted in suitable bearings in the housing **26** and has mounted thereon a pulley **34** in driving engagement with a second drive belt **36**. The belt **36** is further engaged with a pulley **37** mounted on a shaft **38**, also supported in the housing **26**.

A pair of gears A′ and B′ are mounted on the shaft **38** for rotation thereby, and in meshing engagement with a pair of gears A and B which are mounted for rotation on shafts **39** and **40**, respectively. The shaft **39** is rigidly supported by bearings in the housing **26** for rotation, and has a feed roller **41**, attached at one end thereof.

It will be noted that the shaft **40** is not supported rigidly in the housing **26** but is mounted for rotation in a pivotable support **42**. The shaft **40** has mounted on it a magnetic particle clutch **43** with the gear B mounted on the input hub of the clutch and a separator roller **44** mounted on that portion of the shaft at the opposite side of the magnetic particle clutch. Thus, the rotation of the separator roller **44** and the portion of the shaft **40** on which it is mounted takes place by torque transmitted through the magnetic particle clutch **43**, when the gear B is driven.

The support **42** is mounted for pivotable rotation, having one flange provided with an opening for receiving the shaft **38** and the opposite flange being supported by a shaft **46** which is fixed to the housing **26**. The shaft **46** is located on the same center line as the shaft **38**, and therefore it should be evident that the support **42** is so supported as to pivot about the center line of the shaft **38**.

Referring now to FIG. **3**, it will be seen that the pivotable support **42** is provided with an angle member forming an arm **47** extending outwardly from the support. A helical spring **48** is disposed with one end attached to the lower portion of the arm **47** and the opposite end attached to a threaded member **49** which is movable in a slot **50** in the housing **26** to adjust the spring tension. Intermediate of the spring **48** and the support **42**, a shock absorber **51** having its piston rod **52** attached to the arm **47** is provided. The shock absorber **51** may be of any type known in the art, either adjustable or chosen to produce a stiffness in the range to provide a dampening effect on the system when a document is released and the spring **48** biases the roller **44** into engagement with the roller **41**.

For a detailed description of a typical sequence of operation, reference should be had to FIGS. **1**, **2** and **3** taken in sequence. As shown in FIG. **1**, the hopper **10** is loaded with a plurality of documents which rest at substantially a 45° angle on the follower plate **16** and a portion of the structure (not shown) adjacent the belt **17**. With the motor **23** in operation and the clutch **32** disengaged, both the feed roller **41** and the separator roller **44** are inactive. The sensor which is downstream of the feed device **12** is substantially set up to control the spacing between documents and as such, operates to initiate engagement of the clutch **32** and thereby feed a document from the hopper **10**.

When the clutch **32** is engaged, the motor **23** is effective through the belts **24** and **36** to rotate the pair of gears A–A′ and the feed roller in the direction shown in FIG. **2**. Simultaneously, the gear set B–B′ is rotated such that the separator roller **44** is rotated in the same direction as the feed roller **41** with the magnetic particle clutch **43** engaged, provided that the rollers **41** and **44** separated.

It should here be noted, that by pivoting the support **42** about the center line of the shaft **38**, the roll **44** is movable relative to the roll **41** without disengagement from the drive gears B–B′, as the shafts **40** and **38** which retain the drive gears are maintained a fixed distance apart on centers.

It will further be noted that the separator roller **44** is not directly driven by the shaft **40** but is driven through the magnetic particle clutch **43**. The magnetic particle clutch **43** is shown as illustrative of an adjustable torque limiting device which restricts the torque at the separator roller **44** to a value less than the torque which is put into the system at the gears B–B′. The device used is a model 97015-012 Fast Step Clutch and Brake Unit, manufactured by Lear Siegler Incorporated and has a rated torque of 15 pound-inch. As is known to one familiar with this type of magnetic power clutch, the application of a voltage to the device causes engagement of the clutch and torque to be applied from the input shaft to the output shaft. When the torque set

up by the particular voltage is overcome by the rotated portion of the shaft, the clutch will slip, acting as a drag-type clutch or torque limiting device. As indicated above therefore, with the roller **44** out of contact with the roller **41** (either through slippage between a pair of documents therebetween or by being manually held apart), and the clutch **43** energized, the roller **44** is rotated in the same direction as the roller **41.**

Referring to FIG. **3,** the rollers **41** and **44** are seen to be forced into engagement by virtue of the spring **48** and its adjustment relative to the arm **47.** Thus, the feed roll **41** and the separator roller **44** impart to one another a normal force which is readily adjustable through movement of the fixed end of the spring **48** along the slot **50** of the housing **26.** Each of the juxtaposed rollers **41** and **44** is provided with a surface of high friction material to provide a high tangential resistance between the rollers when in contact. The normal force between the rollers **41** and **44** is adjusted such that the torque at the roller **44** provided through the clutch **43** is overcome by rotation of the roller **44** when in contact with the separator roller, or in contact with the separator roller with a single document therebetween. During normal feeding operations, when a single document is introduced between the feed roller **41** and the separator roller **44** (roller **44** being rotated by roller **41** and the clutch **43** slipping) the document is transferred downstream in normal fashion.

However, when a double feed occurs, and two documents enter between the rollers **41** and **44,** slippage occurs between the two documents, and the roller **44** no longer has the proper torque applied to it by the roller **41** to overcome the torque produced at the clutch **43.** Thus, the shaft **40** takes over, and rotates the roller **44** in an opposite direction to its feeding direction and sends the document back into the hopper **10** from which it is fed on the next feed cycle.

Both the feed roll **41** and the separator roller **44** have high friction materials bonded to their circumferential surfaces. Therefore, when the separator roll **44** is spring loaded against the feed roll **41,** the amount of torque transferred to the separator roll in the counter-clockwise direction (as viewed in FIG. **2**) is adjusted by varying the spring force such that it is greater than the torque applied in the clockwise direction by the magnetic particle clutch **43.** The separator roll **44** now rotates in a counter-clockwise direction, driven by the feed roll **41** due to the friction between the two rolls, creating no relative motion between the two rolls which could cause wear.

From the foregoing, therefore, it should be evident that the present invention provides a device which overcomes objectionable features of prior art feed devices and which operates in a simple manner to provide sequential feeding from a stack of documents.

This normal feed condition exists when the juxtaposed rolls are in contact and there is no document between them and also when there is a single document being driven through. If only a single document is present, the torque may still be transferred through the document due to the fact that the friction between the single document and the rolls is also great enough to overcome the torque applied in the clockwise direction by means of the magnetic particle clutch. However, when two or more documents enter between the rolls, the separator roll immediately reverses in the clockwise direction and feeds the excess document back into the stack until there is only a single document between the rolls which is the proper, or next document. The separator roll then is again driven in the counter-clockwise direction by the mating surface of the feed roll. Thus, there is no relative movement between the rolls or auxiliary rolls, etc., as the above takes place completely and passively due to the lesser amount of friction between two or more sheets of paper or other material of which the documents comprise. As paper to paper or document to document friction is not enough to overcome the torque applied by the magnetic particle clutch, the separator roll rotates clockwise until a multi-sheet feed has been cleared.

No adjustment is necessary to accommodate narrow document thicknesses due to the self-adjusting gap between the rollers, and the spring tension applying the normal force between the rolls need seldom be made after the device is in operation.

What is claimed

1. In a device for feeding documents singly and sequentially from a stack, feed means comprising a first roller and second roller each having surfaces juxtaposed one with the other for imparting motion to a document placed there between,

a first gear interconnected to said first roller and a second gear interconnected to said second roller,

a drive shaft having one drive gear engaging said first gear and another drive gear engaging said second gear,

said second roller and said second gear being mounted in a housing and said housing being pivotably mounted for rotation about the axis of said drive shaft to bring said juxtaposed surfaces into mating engagement whereby said second gear and said other drive gear are maintained in driving engagement and a fixed distance apart on centerlines during rotation of said housing.

2. The device of claim **1** which further includes torque limiting means connecting said second roller to said second gear.

3. The device of claim **2** which further includes biasing means attached to said housing for urging first and second rollers into mating engagement.

4. The device of claim **3** wherein said torque limiting means is a magnetic particle clutch.

5. The device of claim **1** which further includes means for rotating said drive shaft, and

clutch means interconnecting said drive shaft with said means for rotating said shaft.

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