

Jan. 4, 1966

D. E. RUTTER

3,227,344

DOCUMENT FEEDING DEVICE HAVING CLUTCH AND BRAKE MEANS

Filed Nov. 26, 1963

3 Sheets-Sheet 1

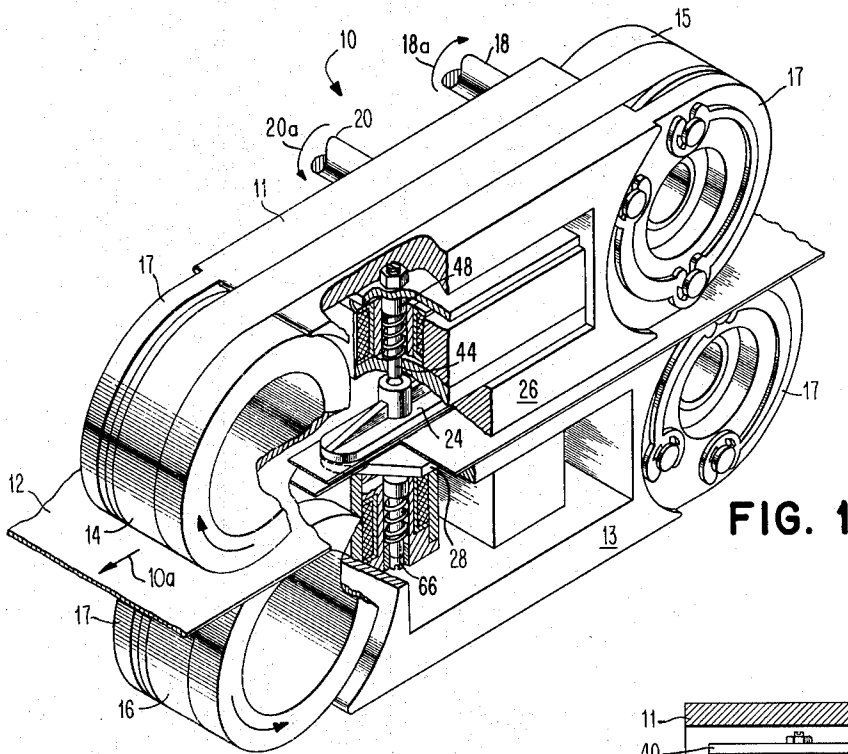


FIG. 1

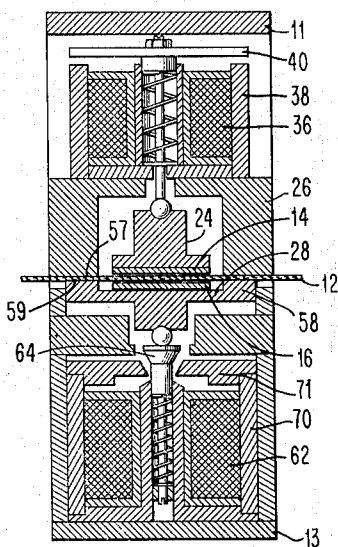


FIG. 4

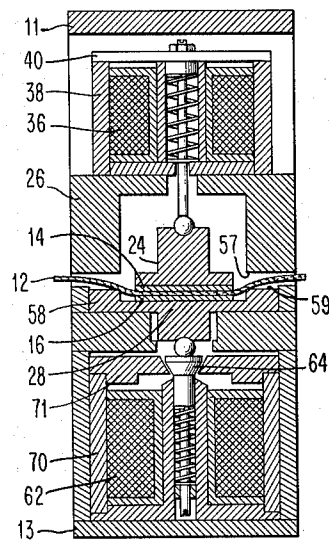


FIG. 5

INVENTOR

DONALD E. RUTTER

BY *J. Tencin Jr.*
ATTORNEY

Jan. 4, 1966

D. E. RUTTER

3,227,344

DOCUMENT FEEDING DEVICE HAVING CLUTCH AND BRAKE MEANS

Filed Nov. 26, 1963

3 Sheets-Sheet 2

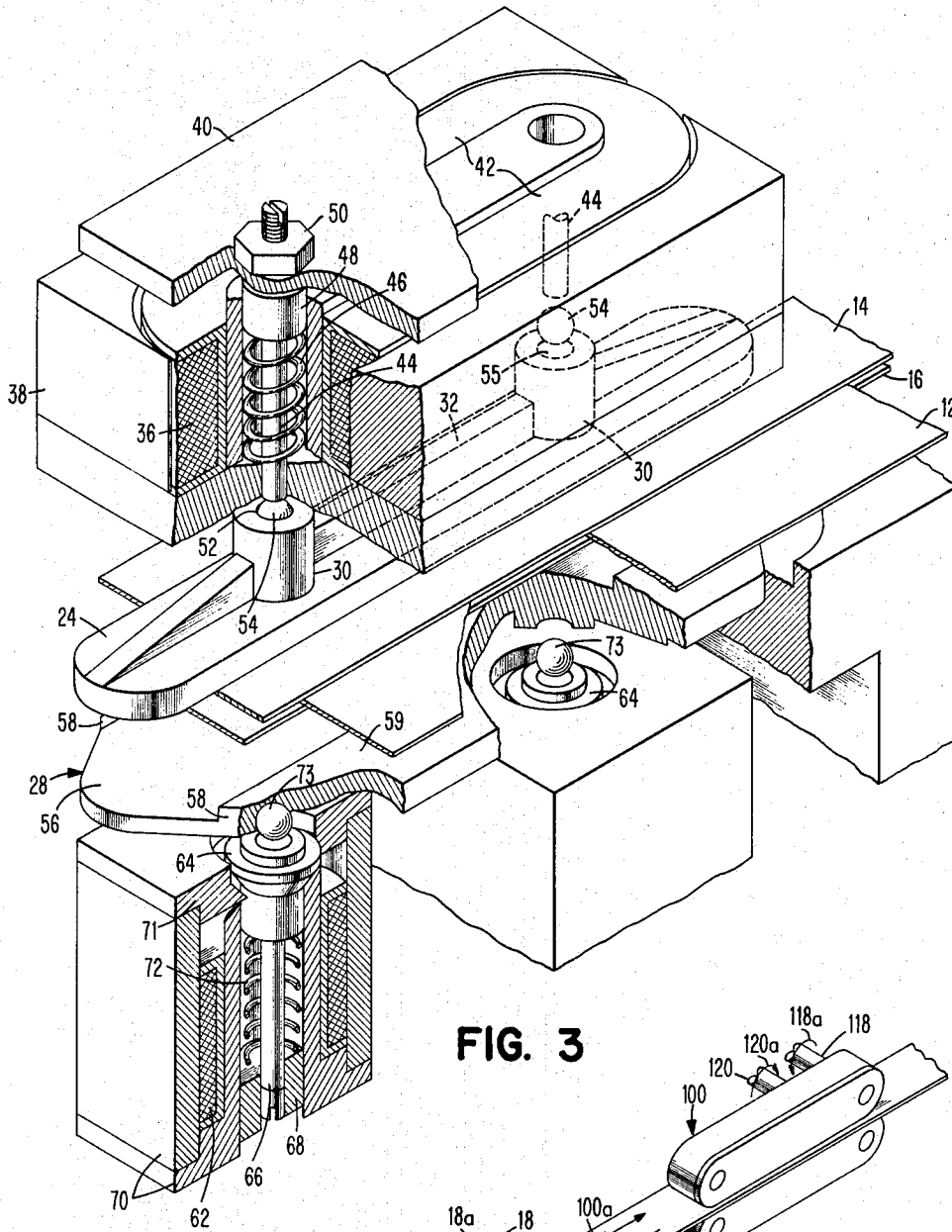


FIG. 3

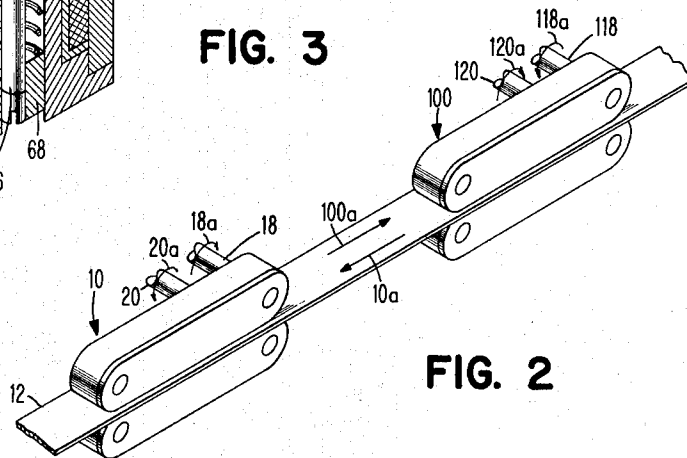


FIG. 2

Jan. 4, 1966

D. E. RUTTER

3,227,344

DOCUMENT FEEDING DEVICE HAVING CLUTCH AND BRAKE MEANS

Filed Nov. 26, 1963

3 Sheets-Sheet 3

FIG. 6

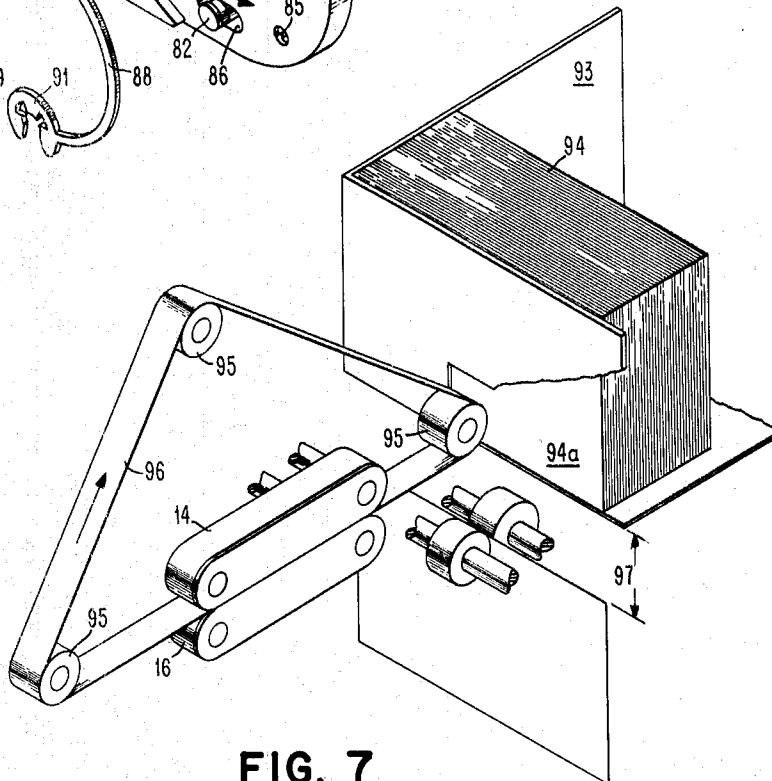
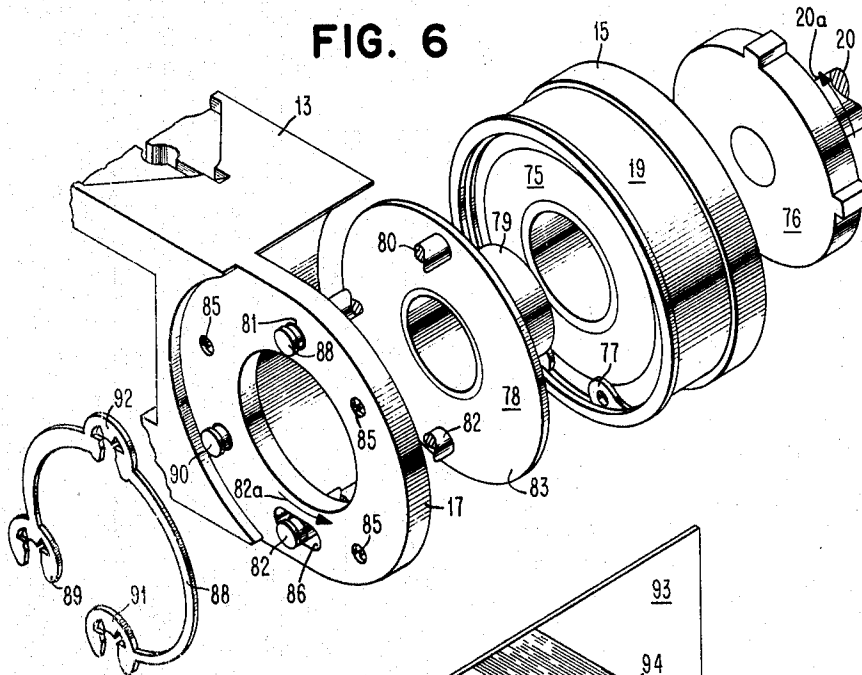


FIG. 7

1

2

3,227,344

DOCUMENT FEEDING DEVICE HAVING CLUTCH AND BRAKE MEANS

Donald E. Rutter, Vestal, N.Y., assignor to International Business Machines Corporation, New York, N.Y., a corporation of New York

Filed Nov. 26, 1963, Ser. No. 325,991

9 Claims. (Cl. 226—115)

This invention relates to transporting card, tape, and sheet material, and more particularly, relates to a device for feeding and arresting indicia bearing documents.

Feeding devices capable of feeding nonmagnetic card and sheet documents are well known. However, there is a problem in providing a feeding device which is capable of also handling tape material and documents of varying thickness and composition.

For example, one of the known feeding devices includes a pair of endless bands mounted adjacent each other to form, at their near adjoining surfaces, a document receiving passageway. Both of the bands are driven continuously in a common direction along the passageway. To bring the bands into feed gripping engagement with a document which has been received in the passageway, a magnetic clutch mechanism is disposed beneath one of the bands which is made of a nonmagnetic material. By energizing the clutch mechanism, the other band, which is made of a magnetic material, is attracted toward and drawn into engagement with the document so as to feed it in the direction of the bands. That is, magnetic flux must pass through the document to draw the magnetic band into engagement with the document. Thus, relatively thick documents and other documents composed of materials which present a high reluctance path to magnetic flux are not fed efficiently by this known device.

It is, therefore, a general object of this invention to provide a simple, yet efficient, document feeding device of the endless band type which is capable of operating on card, sheet, and tape material, which is not limited by either the thickness or the composition of the material to be fed, and which is capable of feeding and arresting the documents at a high rate of speed without causing the slightest damage to the documents.

Another general object of this invention is to provide a document feeding device of the endless band type which is operable without magnetic flux traversing the documents.

It is a further general object of this invention to provide a document feeding device having clutch and brake means so constructed that two document feeding devices may be positioned in series relationship to each other for feeding the documents in both forward and reverse directions and are capable of changing the feed of the documents from one to the other direction with practically no time delay.

A more specific object of this invention is to provide a document feeding device having a novel clutch means which is capable of forcing the bands into feeding engagement with the documents and, at the same time, initiating the release of the brake means.

A further specific object of this invention is to provide a document feeding device having a novel brake means which is capable of stopping the documents without arresting the continuous movement of the endless bands.

To achieve the foregoing objects, one aspect of the invention contemplates a device having a novel clutch means which, when activated, is operable for forcing one of the endless bands towards the other band so that both bands are brought into feed gripping engagement with the document. In addition, the device includes a novel brake

means which is constructed to arrest the moving document, but not the endless bands, and to receive the force exerted by the activated clutch means so as to release its braking action and again permit the document to be fed by the endless bands.

In accordance with another object of the invention, the document feeding device is constructed so that each of the endless bands is maintained in a taut condition during both the feeding and nonfeeding conditions of the device. According to this aspect of the invention, each of the endless bands is provided with at least one novel tensioning means which exerts an outwardly directed force against its associated band to maintain the band in a taut condition when the clutch means is inactive and which coacts with the clutch means such that they produce a resultant force to maintain the band taut when the clutch means is active.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of the preferred embodiments of the invention as illustrated in the accompanying drawings.

In the drawings:

FIG. 1 is a perspective view with broken away sections to show the document feeding device feeding a tape in the direction indicated by the arrow.

FIG. 2 is a perspective view of two alternately operating document feeding devices, one feeding the tape in a forward direction and the other feeding the tape in a reverse direction.

FIG. 3 is an enlarged, fragmentary, perspective view showing the arrangement of the clutch and brake means.

FIG. 4 is an end sectional view to show the relationship between the clutch and brake means when the brake means is applied to decelerate and stop the tape.

FIG. 5 is an end sectional view to show the relationship between the clutch and brake means when the clutch means is operating to feed the tape.

FIG. 6 is an enlarged exploded perspective view showing the parts of the band tensioning means.

FIG. 7 is a perspective view showing the document feeding device controlling an endless belt which is feeding the documents out of a hopper.

GENERAL DESCRIPTION

Unidirectional feeding.—As shown in FIG. 1, the numeral 10 generally designates a document feeding device which is used to feed card, tape, and sheet material, but for the purpose of this description only will be shown and described as feeding tape material referenced by the numeral 12. To form a passageway for receiving the tape 12, support means is provided and, preferably, includes upper and lower members 11, 13 which are spaced apart a distance slightly greater than the thickest document to be fed by the device. Both ends of the upper member 11 are recessed to form extensions 17. A pulley 15 is rotatably mounted on each extension 17. Similarly, the ends of the lower member 13 are recessed to form extensions 17, each of which rotatably supports a pulley 15. In order to provide a pair of movable surfaces for feeding the tape 12, an endless band 14 is disposed about pulleys 15 of the upper support member 11 and an endless band 16 is disposed about the pulleys 15 of the lower support member 13 so that the opposing, near adjoining surfaces of the bands lie along opposite sides of the tape receiving passageway and are adapted to move toward and away from each other. To maintain the endless bands 14, 16 on their pulleys 15, the outer surface of each pulley is provided with a groove 19 (FIG. 6) slightly wider than the width of the band and each groove is coated with a high friction material, such as rubber or a

relatively soft plastic, to increase the frictional contact between the pulley and the band. One of the pulleys 15 associated with each support member is connected to one of a pair of parallel mounted shafts 18, 20 which are oppositely rotated in the directions indicated by the arrows 18a, 20a and cause the pulleys 15 connected thereto and, in turn, the bands 14, 16 to move in the same respective directions and in a common direction along the passageway.

To move the opposing surfaces of the bands 14, 16 into feed gripping engagement with the tape 12 inserted in-between, a band engaging member or drive shoe 24 is disposed along the inner side of one of the bands, herein band 14. The upper support member 11 is provided with clutch means for moving the shoe 24 downwardly which, as best shown in FIG. 5, presses the band 14 against the tape 12 and moves the tape downwardly against the band 16. In this way, the tape is gripped by the opposing surfaces of the bands and is moved in the direction indicated by the arrow 10a.

To decelerate and stop the tape 12, brake means is provided in the lower support member 13 and includes a document engaging member or brake shoe 28 which, as best shown in FIG. 4, is constructed to press the tape against the bottom portion 26 of the upper support member 11. In the preferred form, the brake shoe 28 normally is biased upwardly as shown in FIG. 4 and pinches the tape between it and the bottom portion of the member 11. It is desirable, therefore, to retract the brake shoe and release the latter's braking action on the tape while the tape is being fed. To achieve the above, and, at the same time, feed the tape 12, the feeding device 10 is arranged so that when the drive shoe 24 is moved downwardly for feeding the tape, it forces the brake shoe 28 downwardly and as shown in FIG. 5, holds the shoe 28 away from the bottom portion 26 of the support member 11. When the clutch means releases the force exerted on the drive shoe 24 and it returns to its "at rest" position, the brake shoe 28 is free to move upwardly to its normal braking position and again presses the tape 12 against the bottom portion of the member 11. With this type of arrangement, the brake shoe 28 need only apply a frictional force sufficient to rapidly stop the "free running" movement of the tape 12 because, as shown in FIG. 4, the endless bands 14, 16 are not in feeding contact with the tape when the shoe 28 is in its braking position.

Bidirectional feeding.—While the document feeding device 10 as shown in FIG. 1 is capable of feeding the tape 12 in a forward direction, if desired, it could be capable of also feeding the tape in a reverse direction by driving each of its shafts 18, 20 with a bidirectional motor (not shown). However, this would produce a substantial time lag or delay in reversing the feed of the tape due to the time it takes for the motor to reverse its direction of rotation. To practically eliminate this time lag or delay while retaining the bidirectional feeding of the tape, two document feeding devices operated by unidirectional drive means, are positioned in series relationship to each other to serve as a unit for moving the tape in both forward and reverse directions.

To provide this bidirectional feeding of the tape 12, the feeding device 10 shown in FIG. 2 is mounted in series with the document feeding device 100 having a pair of endless bands 114, 116 schematically shown (the details are the same as shown in FIG. 1). The bands of the feeding device 100 are moved by a pair of shafts 118, 120 rotatable in the directions indicated by the arrows 118a, 120a and opposite to the directions of rotation of the corresponding shafts 18, 20 of the feeding device 10. A single motor may be used in conjunction with a suitable gear train for providing the indicated directions of rotation of the shafts 18, 20, 118, 120 or any well known way of driving the shafts in these directions, as for example, a motor on each shaft may be used.

With this series arrangement of two oppositely driven document feeding devices, the tape 12 is moved in the direction indicated by the arrow 10a when the clutch means of the feeding device 10 is activated. During the movement of the tape in this direction, the clutch means of the feeding device 100 is inactive while, preferably, its brake means is in its normal braking position and places a slight tension on the moving tape. When it is desired to reverse the feed of the tape to the direction indicated by the arrow 100a, the clutch means of the feeding device 10 is deactivated thereby removing its positive feed in the direction 10a. This also activates the brake means of the device 10 which, along with the already active brake means of the device 100, applies a sufficient frictional force to rapidly stop tape 12. Subsequently, the clutch means of the device 100 is activated and causes the release of the braking action by the device 100 and the instantaneous feeding of the tape 12 in the direction indicated by the arrow 100a. Preferably, the brake means of the device 10 will be left in its normal braking position to tension the moving tape. Also, it will complement the braking action of the brake means of the device 100 to permit a rapid deceleration of the tape when the clutch means of the device 100 is deactivated.

DETAILED DESCRIPTION

To achieve the foregoing, reference will now be made to the detailed structure of the preferred clutch and brake means of the feeding device 10 in FIG. 3, and their operation as best shown in FIGS. 4 and 5. It will be understood that this description will also apply to the clutch and brake means of the feeding device 100 (FIG. 2). As shown in FIG. 3, the drive shoe 24 preferably rests on the inner surface of the endless band 14 and is made of plastic or a similar low friction material so that its band engaging surface will only offer a minimum of frictional resistance to the movement of the band. On the other side of the shoe, a pair of abutments 30 and a supporting ridge 32 are formed integral therewith. To provide means for controlling the downward movement of the drive shoe 24 to clamp the endless bands 14, 16 into feed gripping engagement with the tape, an electromagnet 36 is housed in a casing 38 rigid with the support means 11 (FIG. 4) of the feeding device 10 and is adapted to attract a movably mounted armature 40. The armature 40 consists of a flat plate of magnetic material extending across and normally biased away from the pole faces 42 of the magnet 36 by a pair of plunger assemblies aligned with the abutments 30. When the electromagnet 36 is energized and the armature 40 is attracted downwardly toward the pole faces 42 of the magnet, the plunger assemblies transmit the downward movement of the armature to the drive shoe, which, in turn, presses the band 14 towards the band 16 so that both bands are brought into feed gripping engagement with the tape.

Although various types of plunger assemblies may be used, for purposes of illustration it is preferred that each of the assemblies include a plunger 44 extending from the armature 40 through the casing 38 of the electromagnet to its associated abutment 30 of the drive shoe. For biasing the armature 40 away from the pole faces 42 of the electromagnet, a spring 46 is coiled around each plunger and contained within the casing 38 by a bushing 48. To provide an adjustable connection with the armature 40 the upper end of each plunger 44, in this instance, is threaded into the bushing 48 and is attached to the armature by a nut 50. While the lower end 52 of each of the plungers 44 may be rigidly attached to the drive shoe, in the present instance, each end 52 only contacts a metallic ball 54 which is partially contained in a dished out portion 55 of the abutment 30 associated with the plunger. These balls 54 serve as flexible ball joint suspensions to compensate for any inaccuracies in the alignment of the plunger assemblies and their corresponding abutments 30.

5

In order to provide braking surfaces for decelerating and stopping the moving tape 12, the bottom portion 26 of the upper support member 11 as best shown in FIG. 5 includes surfaces 57 which are not covered by its associated endless band 14 and are adapted to engage the tape. The brake shoe 28 is formed with the shoulders 58 to provide opposing surfaces 59 which are movable above its associated band 16 toward the surfaces 57 so as to clamp the tape 12 therebetween and frictionally stop the tape. It will be apparent that only one pair of opposing braking surfaces on the upper support member 11 and the brake shoe 26 is sufficient to carry out the purposes of this invention, but it is preferred to use two pairs of opposing surfaces as shown. As stated previously, when the drive shoe returns to its "at rest" non-feeding position, the bands 14, 16 separate and move out of contact with the tape 12 and it becomes "free running." To permit the brake shoe 28 to move its braking surfaces 59 towards the braking surfaces 57 without either arresting the endless bands 14, 16 or causing the bands to contact the free-running tape, the shoulders 58 of the shoe 26 define a groove 56 to form a guideway for the band 16. With this arrangement, the braking surfaces 59 of the shoulders 58 can be applied to move the tape 12 toward braking surfaces 57 without the bottom of the groove 56 coming into engagement with the band 16.

To clamp the tape 12 between the braking surfaces 57, 59 as shown in FIG. 4, the brake shoe 28 preferably is biased upwardly by a pair of plunger assemblies abutting against the bottom side of the shoe 28. As best shown in FIG. 3, each plunger assembly is supported in a casing 70 and comprises a plunger 66, a spring 72 coiled around the plunger, and a spring seat 68 through which the lower end of the plunger 66 extends. With the springs 72 substantially expanded, the brake shoe 28 is urged into its braking position as shown in FIG. 4. The seats 68 are threaded into their respective casings 70 so as to be able to vary the spring compression and thereby adjust the pressure exerted on the tape 12 by the shoulders 58 of the brake shoe. Also, similar to the plunger assemblies of the clutch means, a pair of metallic balls 73 serves as flexible ball joint suspensions between the upper ends of the plungers and the bottom side of the brake shoe.

In order to overcome the upward bias of the springs 72 so as to retract the braking surfaces 59 away from the braking surfaces 57, the drive shoe 24, as shown in FIG. 5, is aligned with the brake shoe 28 so that, when the electromagnet 36 is energized, the drive shoe 24 transmits its downward movement through the endless bands 14, 16 and the tape 12 to the brake shoe. That is to say, when electromagnet 36 is activated to drive the tape, the drive shoe, as it is pressed downwardly, forces the brake shoe downward a distance sufficient to bottom the upper end portions 64 of the plungers 66 against the yokes 71 of the casings 70 rigidly mounted to the lower support member 13. Thus, not only are the braking surfaces 59 moved downward to release the braking action, but, as best shown in FIG. 5, the bottomed upper end portions of the plungers provide a solid, unyielding support to the brake shoe and, in turn, to the drive shoe to insure a tight gripping engagement by the bands 14, 16 with the tape 12.

With the electromagnet 36 de-energized, the pressure on the drive shoe 24 is removed and the brake shoe 28 is free to move to its normal position which, without the tape 12 inserted, places the braking surfaces 59 in abutment with the braking surfaces 57. In order to hold the brake shoe out of the passageway when the drive shoe is "at rest" so as to open it for initially inserting the tape 12, means for retaining the brake shoe 28 out of the passageway is provided and, herein, comprises a pair of electromagnets 62. Because these electromagnets need only perform a retaining function, "no work" electromagnets are employed so as to require only a minimum of electric current. The upper end portions 64 of the

6

plungers 66 are made of a magnetic material and serve as armatures for the electromagnets. Since these upper end portions or armatures normally are biased upwardly away from the electromagnets 62, it is necessary to first bring the armatures into close proximity with the electromagnets before they can be retained, because the generated magnetic field is not sufficient to overcome the upward bias of the springs 72. Accordingly, the electromagnet 36 of the clutch means is energized to press the brake shoe 28 and, in turn, the upper end portions 64 or armatures downwardly into proximity with the electromagnets 62. When the electromagnet 36 is de-energized the now energized electromagnets 62 retain the brake shoe in this retracted position, and thereby keep the passageway open for receiving the tape 12 to be inserted therein.

OPERATION

The operation of the document feeding device is best illustrated in FIGS. 4 and 5. As shown in FIG. 4, the electromagnet 36 of the clutch means is de-energized and both of the braking surfaces 57, 59 engage the tape 12. The drive shoe 24 is in its normal "at rest" position and, while the endless bands 14, 16 are moving, no pressure is exerted on the band 14 so that both bands are out of contact with the tape 12. When it is desired to feed the tape 12, the electromagnet 36 is energized and, as shown in cross section in FIG. 5, draws the armature 40 in contact with its pole faces thereby causing the plungers 44 to force the drive shoe downwardly into engagement with the endless band 14. The band 14, in turn, is moved towards the endless band 16 to pinch the tape 12 between the bands. At the same time, this downward motion is transmitted through the endless bands 14, 16 and the tape 12, to the brake shoe 28 which bottoms the upper end portions 64 of the plungers 66 against the yokes 71 of the rigidly mounted casings 70. Because the brake shoe 28 is bottomed against a solid support, the groove 56 provides a pressure surface for the band 16 and permits a tighter gripping of the tape 12 by the bands. While the braking surfaces 59 still engage the tape, they only offer a minor amount of resistance to the moving tape 12 relative to the driving force of the endless bands 14, 16. When it is again desired to decelerate and stop the moving tape, the electromagnet 36 is de-energized and as shown in FIG. 4, the plungers 44 spring bias the armature 40 away from the electromagnet 36 and return the drive shoe 24 to an "at rest" position on the endless band 14. The bands 14, 16 separate from the tape and the brake shoe 28, which is free to move upwardly, presses the tape 12 through its shoulders 58 against the upper support member 11. A sufficient frictional force is applied by their braking surfaces 57, 59 to rapidly stop the tape which now is only "free running."

BAND TENSIONING MEANS

To insure that each band is maintained in a taut condition and out of contact with the tape 12 when the clutch means is inactive, each of the endless bands 14, 16 in accordance with another aspect of this invention is provided with at least one tensioning means. In its preferred form as shown in FIG. 6 the pulley 15 includes a ball bearing 75 retained within the pulley by an expansion ring 77. Adjacent the pulley 15 is a movable member or disc 78 with a hub 79 integral therewith and having a pair of fixed studs 80, 82 projecting laterally from its face 83. The disc 78 is rigidly mounted with the ball bearing 75 by any suitable means such as keying the hub 79 to the inner race of the bearing 75 or by press fitting the hub within the inner race. In order to receive the studs 80, 82 the extension 17 of one of the support members, as for example support member 13, is formed with an aperture 81 for receiving the stud 80 and with a slot 86 for receiving the stud 82. With the pulley 15 and the disc 78 so mounted on the extension 17, means

is provided for forcing the stud 82 outwardly in the direction indicated by the arrow 82a to pivot the movable disc 78 about the stud 80. This movement of the disc 78, in turn, transmit a radially outward directed force through the hub 79 and bearing 75 against the pulley 15 and causes a corresponding movement of the pulley against the endless band associated with the pulley to place the band in a taut condition. Preferably, the studs 80, 82 are positioned 180° apart to permit the optimum force against the pulley 15 with a minimum movement by the sliding stud 82. If desired, screws 85 may be threaded into the extension 17 with their ends abutting the face 83 of the disc 78 to enable adjustment of the pulley's substantially parallel relationship with the extension 17 to bring the groove 19 of the pulley into complete contact with the band.

Herein, the stud forcing means takes the form of an expansion clip spring of C washer 88 having one end 89 anchored to a stud 90 fixed on extension 17. To mount the other end 91 of the C washer on the sliding stud 82, the washer is compressed thereby closing the C configuration. Once the end 91 has been clipped on the stud 82, the compressed C washer 88 attempts to return to its normal configuration and, in doing so, slides the stud 82 in the direction of arrow 82a. This movement pivots the movable disc 78 about the stud 80, also attached to the clip spring or C washer 88 by its portion 92, and transmits the tension of the spring to the endless band in the manner previously described.

When the pulley 15 is rotated by a toothed sprocket 76 which engages teeth (not shown) in the pulley, a frictional force is applied to the movable disc 78 tending to move it in the same direction of rotation. To take advantage of this frictional force to complement rather than oppose the band tensioning force, each tensioning means is preferably arranged with its associated endless band so that the disc 78 is pivoted by the clip spring 88 in the same direction as the direction of rotation of the endless band. As shown in FIG. 6, a shaft, for example shaft 20, is rotated in the direction indicated by the arrow 20a and causes the pulley 15, and, in turn, its associated band to rotate in the same direction as the direction 82a of the sliding stud so as to complement the pressure exerted by the clip spring 88. The tensioning means for the other endless band traveling in the opposite direction is constructed substantially the same as the one shown in FIG. 6 except that the slot 86 and the aperture 81 formed in the extension 17 are reversed. This change is necessitated to allow the opposite direction of rotation of the endless band to complement the spring pressure of the sliding stud 82 associated therewith.

It will be apparent that the tensioning means is needed to keep the endless bands 14, 16 out of contact with the tape 12 when the clutch means is inactive and the tape is "at rest" as shown in FIG. 4. Otherwise, because of the slight "out-of-contact" distances between the bands and the tape, any slack in the bands would permit them to slap against the tape with sufficient force to overcome the braking action of the brake shoe 28 and cause sporadic movement of the tape. In addition, it will be noted that there is a cooperation on coaction between the clutch means and the band tensioning means associated with each of the endless bands 14, 16 so as to maintain the bands in a taut condition when the former means is activated. That is, the downward movement of the drive shoe 24 distorts the bands' configuration as indicated by comparing FIGS. 4 and 5, thereby applying a force to the bands substantially perpendicular to the force exerted by their individual tensioning means. However, because of the pivotal construction of the band tensioning means as shown in FIG. 6, the disc 78 is able to respond to this additional force and pivots in opposition to the clip spring or C washer 88 to reduce the force exerted by the tensioning means on its associated band. The advantages

accruing from this cooperation or coaction are threefold. First, it permits the band to be brought into feed gripping engagement with the tape more easily than with an unyielding type tensioning means. Second, it prevents the possibility of the bands being overstressed when the clutch means is activated. Finally, it provides a resultant force which is sufficient to maintain the endless bands in a taut condition while feeding the tape.

INDIRECT FEEDING

Heretofore, the document feeding device 10 has been described as acting directly upon the documents for causing feeding thereof. If desired, the feeding device may operate indirectly on a plurality of stacked documents for feeding them individually out of the stack. As shown in the embodiment of FIG. 7 a hopper 93 is filled with a stack of documents, such as punch cards 94. Triangularly mounted on a triad of rollers 95 is a movable endless belt 96 which has a portion of its path adjacent one end of the stack of punched cards and which preferably has a high friction surface. To control the movement of the belt 96, the endless bands 14, 16 (shown schematically) of the feeding device 10 are disposed on opposite sides of the belt 96 between two of the pulleys 95. As the device 10 moves the belt 96 past the stack of punched cards, the belt frictionally engages the card 94a on the end of the stack thereby drawing it off the stack and pushing it into engagement with feed rolls 92. The pulley 95 adjacent the hopper may be a drum perforated about its periphery and suitably connected to a vacuum source in order to attract the endmost card against the belt for improved frictional engagement therewith. The belt 96 is perforated in this instance or made of a loosely woven material through which air may be drawn.

For feeding the cards 94 continuously without a spacing between them, the clutch means of the device 10 is activated. This causes the drive shoe 24 (FIG. 3) to force the endless band 14 towards the endless band 16, so that both bands are brought into gripping engagement with the belt, and, to move the brake shoe 28 (FIG. 3) to an inactive position. The bands 14, 16 transfer their motion to the endless belt 96 and drive the belt continuously in the direction indicated by the arrows so that in passing the hopper 93 it peels one card after the other from the stack.

If, however, a spacing 97 is desired between the leading and trailing edges of the adjacent cards as shown in FIG. 7, the feeding device 10 serves as an incrementor. In other words, the feeding device 10 stops the movement of the belt 96 after a card is fed from the hopper 93 and, after a slight delay, restarts the movement of the belt for feeding the next card. The cycle of operation of the feeding device 10 as an incrementor is as follows. The clutch means is activated to transmit the motion of the bands 14, 16 to the belt 96. As the trailing edge of the card reaches the bottom of the hopper 93, the clutch means is deactivated. This releases the pressure on the drive shoe 24 and causes the brake shoe 28 to apply its braking action to the belt and arrest its movement. Depending on the spacing 97 desired between the leading and trailing edges of adjacent cards, the clutch means is again activated after a slight time delay to allow for this spacing. The cycle then is continued for feeding the remaining cards in the stack out of the hopper.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention.

I claim:

1. In a document feeding device wherein a pair of endless bands are mounted on first and second support members disposed adjacent each other so that the bands

form, at their opposed, near adjoining surfaces a narrow passageway capable of receiving a document and each is driven in a common direction along the passageway so as to feed the document in that direction, said document feeding device comprising:

means disposed with said second support member and operable to move the document toward and into engagement with said first support member for stopping the moving document and holding it at rest without arresting the movement of the bands; and means disposed with said first support member and operable to move the endless band associated therewith toward said other endless band so that both bands are brought into feeding engagement with the document and to release said above-mentioned means and disengage the document from the first support member.

2. A document feeding device comprising:

first and second members supporting a pair of rotatable pulleys and mounted in parallel relationship to each other;

a pair of movable endless bands, one disposed about each of said pulley so that the opposing, near adjoining surfaces of said bands form a narrow passageway for receiving the documents, said pulleys being rotated in opposite directions for moving the bands in the same direction along said passageway;

a clutch means disposed adjacent the inner surface of the endless band associated with said first support member and having a shoe movably mounted to urge said one band toward the other band, so that both of said bands engage the document for causing the movement thereof; and

a brake means disposed adjacent the inner surface of the endless band associated with said second support member and having a shoe movably mounted to urge the document into engagement with said first support member for stopping its movement without arresting the motion of either of said moving bands.

3. In a document feeding device wherein first and second endless bands are mounted adjacent each other to form a narrow passageway capable of receiving the document and are driven in a common direction along the passageway, the combination of:

clutch means disposed along said passageway adjacent the inner surface of said first band and operable for moving the first band toward said second band so that both of said bands are brought into feeding engagement with the document; and

brake means disposed along said passageway adjacent the inner surface of said second band and operable for decelerating and stopping the document, said brake means being responsive to the band movement of said clutch means for releasing its braking action on the document when the clutch means is operating to feed the document.

4. In a document feeding device wherein first and second endless bands are mounted adjacent each other to form a narrow passageway capable of receiving the document and are driven in a common direction along the passageway, the combination of:

a clutch means having a movable drive shoe disposed along said passageway adjacent the inner surface of said first band and capable of urging the first band toward said second band so that both of said bands are in feeding engagement with the document;

a brake means having a movable shoe disposed along said passageway adjacent the inner surface of said second band and formed with at least one portion extending beyond the outer surface of the second band for applying a braking force to the document

when another portion is in close proximity with the inner surface of the band; and

control means for operating said clutch means so that, when the clutch means is operated, said drive shoe urges said first band into feeding engagement with the document, rendering said brake shoe ineffective, and, when the clutch means is inoperative, the brake shoe applies a braking action to the document.

5. The combination of claim 4 wherein said control means comprises electromagnetic means for operating said clutch means.

6. A document feeding device comprising:

a pair of rotatable shafts mounted in parallel relationship to each other;

a pair of movable endless bands, one disposed about each of said shafts so that the opposing, near adjoining surfaces of said bands form a narrow passageway for receiving the document, said shafts being rotated in opposite directions for moving the bands in the same direction along said passageway; actuatable clutch means disposed adjacent the inner surface of one of said inner bands and having a shoe slidably mounted to move said one band toward the other band, so that both of said bands engage the document for causing movement thereof; and

a pair of band tensioning means, one associated with each of said endless bands and both operable for exerting an outwardly directed force against their respective bands so as to maintain the near adjoining surfaces of the bands away from the document when the clutch means is inactive.

7. In a document feeding device wherein a pair of endless bands are mounted on support members disposed adjacent each other so that the bands form, at their opposed, near adjoining surfaces, a narrow passageway capable of receiving a document and each is disposed about a pair of pulleys and driven by one of the pulleys in a common direction along the passageway so as to feed the document in that direction, a band tensioning apparatus comprising:

a fixed member forming a portion of said support member associated with the endless band;

a movable member disposed within one of the pulleys associated with the band and pivotally mounted on said fixed member; and

means for urging said movable member to pivot relative to said fixed member and to move said pulley against said band thereby placing the band in a taut condition.

8. In a document feeding device wherein a pair of endless bands are mounted on support members disposed adjacent each other so that the bands form, at their opposed, near adjoining surfaces, a narrow passageway capable of receiving a document, with each band disposed about a pair of pulleys and driven by one of the pulleys in a common direction along the passageway so as to feed the document in that direction, said document feeding device including, for each of said bands, a band tensioning means comprising:

a fixed member forming a portion of said support member associated with the endless band and having an aperture and slot therein and an anchor stud integral therewith;

a movable member having a pair of studs thereon and disposed within one of the pulleys associated with the band, one of said pair of studs being pivotally mounted in said aperture and extending through said fixed member, the other of said pair of studs extending through said slot; and

a resilient element having one end attached to said anchor stud, a portion intermediate the ends of said spring attached to said pivotally mounted stud and the other end of the spring attached to said other stud, said spring forcing said other stud to move

11

outwardly to pivot said movable member about said pivot stud relative to said fixed member thereby causing a radially, outwardly directed force against said pulley to place the band in a taut condition.

9. A document feeding device wherein a pair of 5 document feeding devices of claim 1 are mounted in series relationship to each other and are oppositely driven; with the clutch means of one device being inactive when its brake means is in its normal braking position to stop the document, the clutch means of the other de- 10 vice being in feeding engagement with the document to feed said document in a given direction when the brake means of the other device is in inactive position to thereby feed documents in both forward and reverse di-

12

rections and to feed the documents from one to the other direction without time delay.

References Cited by the Examiner

UNITED STATES PATENTS

3,078,983 2/1963 Philips ----- 198—208

FOREIGN PATENTS

242,874 2/1963 Australia.

M. HENSON WOOD, JR., *Primary Examiner.*

W. F. MCCARTHY, A. KNOWLES,
Assistant Examiners.