March 12, 1968 H. J. DE VRIES ETAL 3,372,925

APPARATUS FOR SEPARATING AND GUIDING A VARIETY OF DIFFERENT DOCUMENTS

Filed April 12, 1967

3 Sheets-Sheet 1

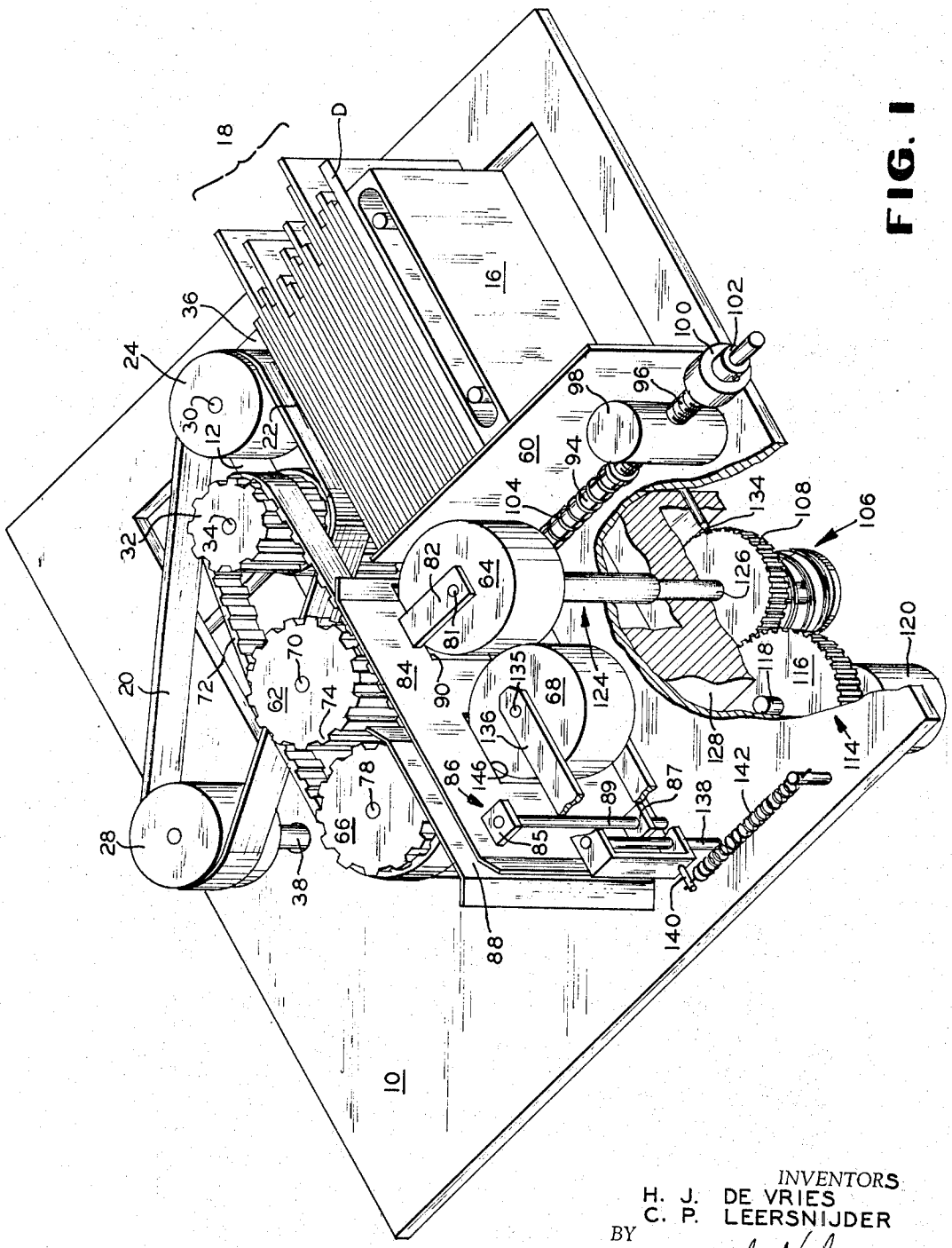

FIG. 1

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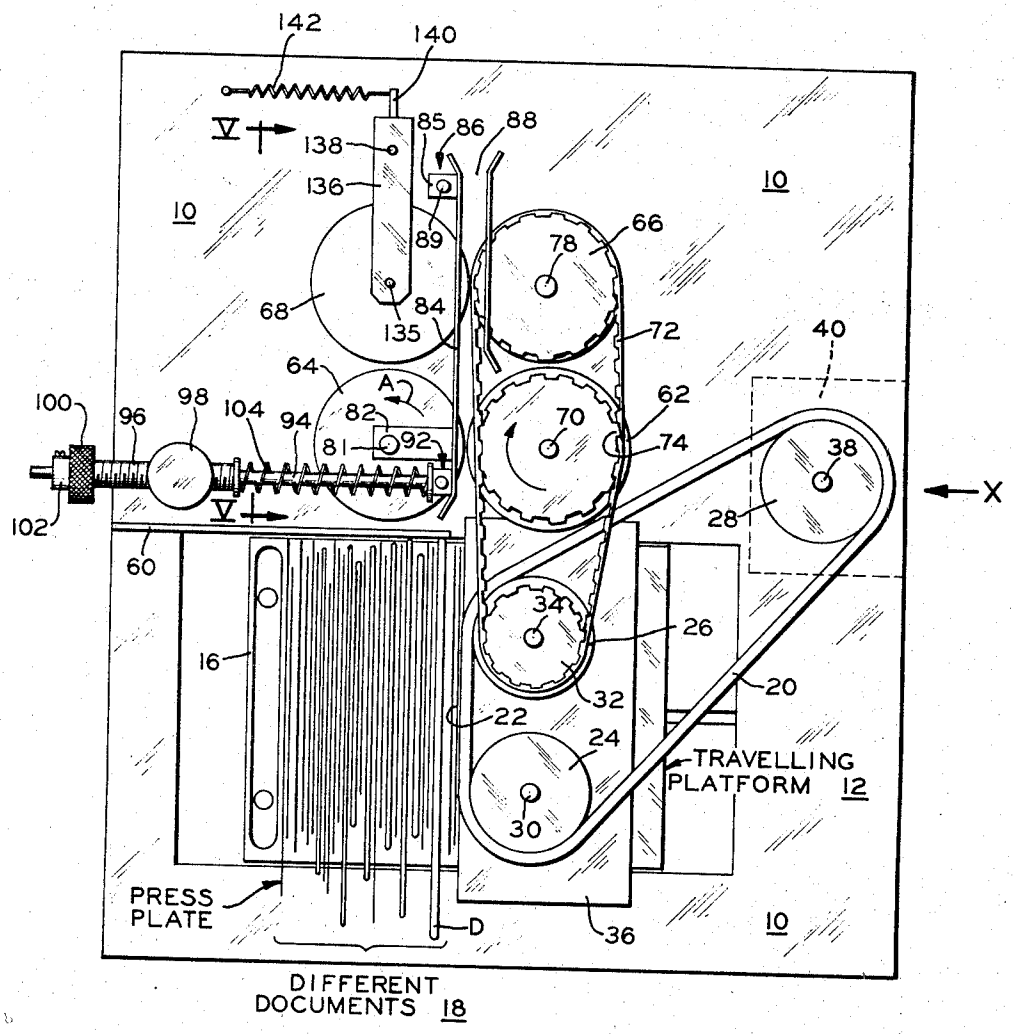

FIG. 2

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3 Sheets-Sheet 3

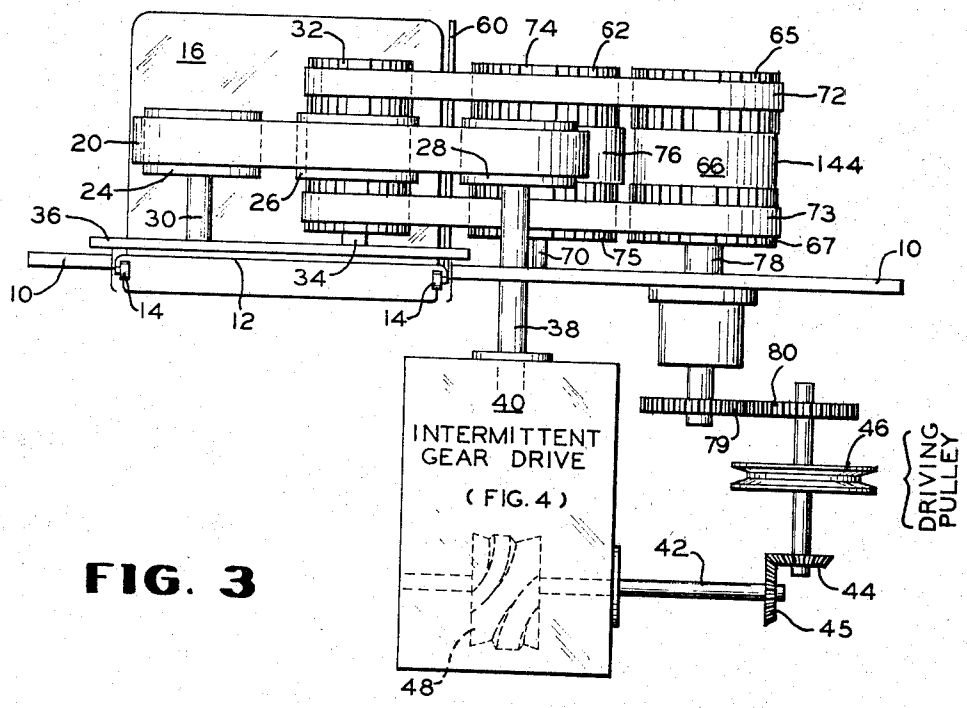

FIG. 3

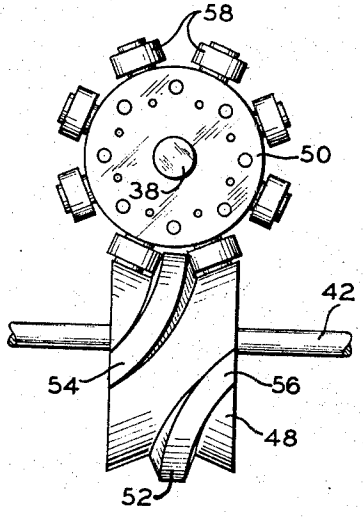

FIG. 4

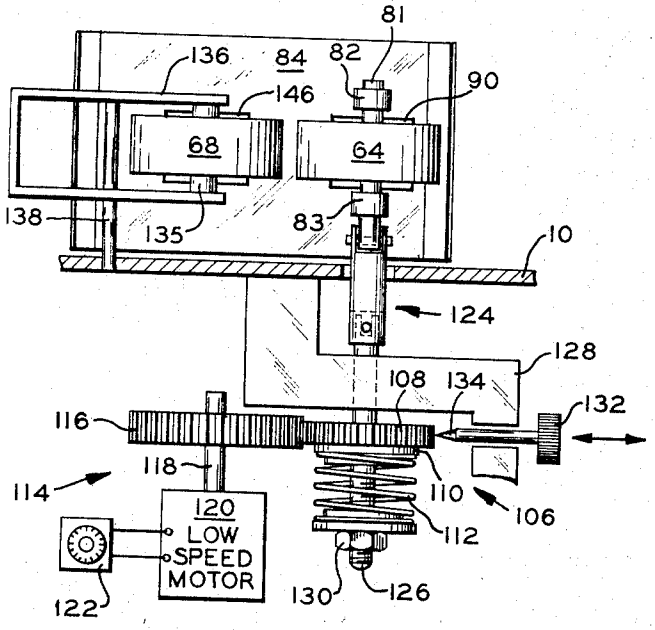

FIG. 5

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United States Patent Office 3,372,925
Patented Mar. 12, 1968

3,372,925

APPARATUS FOR SEPARATING AND GUIDING A VARIETY OF DIFFERENT DOCUMENTS

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Continuation-in-part of application Ser. No. 429,062, Jan. 29, 1965. This application Apr. 12, 1967, Ser. No. 630,395

20 Claims. (Cl. 271—37)

ABSTRACT OF THE DISCLOSURE

An apparatus for separating and guiding documents such as forms, cards, letters and the like of different size, stiffness and quality having an intermittently driven continuous belt for conveying documents from a stack to and between two successive pairs of opposed conveying rollers along an adjustable slot formed by a pivoted plate. The first pair of rollers insure that only one document at a time is fed to the second pair of rollers. Both of the rollers of the first pair may be driven, however, one is adjustably spaced and resiliently mounted with respect to the other, is driven through a friction clutch, and its speed is variable and considerably slower than that of the other roller of that pair. One of the second pair of rollers is frictionally driven by contact with the other driven roller of that pair.

RELATED APPLICATIONS

The present application is a continuation-in-part of copending application Ser. No 429,062, now abandoned, filed Jan. 29, 1965, entitled "Apparatus for Separating and Guiding a Variety of Different Documents," which copending application is based on an earlier filed Netherlands application Ser. No. 6400734, filed Jan. 30, 1964, for which priority was claimed.

BACKGROUND OF INVENTION

It is generally known that the difficulties encountered in removing individual documents from a stack increase as the variety of differences between documents in the stack increases. These differences are not only with respect to size, thickness, stiffness, and smoothness of surface, but also the document's general condition. Not infrequently, a document that has gone astray proves to be a serious cause of trouble.

As regards removing and separating postal articles, reasonable results can be obtained by using air pressure or suction. Considering the required regulating equipment and the rather expensive pneumatic plant, this solution is anything but simple and quiet.

One well known device leads the documents between two rollers, in which their adjacent surfaces move opposite one to the other. These rollers are pushed one towards the other by means of a spring, but a stop prevents the rollers from touching one another, which would result in an undue wear and tear of the rollers. If in this embodiment the pressure between the rollers is so adjusted that some documents when fed two at a time between the rollers are correctly separated, one other thicker document may not be conveyed between the oppositely driven rollers at this adjusted pressure. This difficulty increases as the differences and irregularities of the documents increase.

In German patent specification 1,130,452 these difficulties have only been partly removed. In this patent, the

counter rotation roller is driven through a friction coupling, so that when only one document is between this counter rotation roller and its forward rotation roller, or these two rollers touch each other, the counter rotation roller will turn along with the single document on the forward rotation roller against the drive through the friction coupling. Then when two or more doccments attempt to pass between these rollers, the slower counter rotation removal speed wipes one document back.

Generally, documents can be removed from a stack very well in these manners, however, in some cases the front edge of a document is damaged, which is very apt to occur with letters, such as having their front edge curled up, even before the letter has entirely arrived at the opening between the rollers. This is easily accounted for because an envelope and its contents consist of several layers of paper which the counter rotating rollers tend to separate. Also it may happen that the counter rotation roller is wiping back when there is only one document between the rollers, so that the letter does not pass through the opening between the rollers, thus jamming up the system.

SUMMARY OF THE INVENTION

According to the present invention, means are provided for effectively feeding and separating, even documents with damaged leading edges, comprising: first intermittently removing documents preferably one at a time, from a stack of documents and then feeding the thus removed document between two pairs of conveying rollers along a width adjustable slot or passage way gauged by a pivoted plate. The first pair of such rollers are automatically adjustably spaced for separating two or more intermittently removed documents, one of which rollers is positively forwardly driven and the other of which is independently forwardly driven through a friction clutch at a reduced and variable speed with respect to the positively driven roller of that pair.

Accordingly an obejct of this invention is to provide a document feeding, separating, and guiding apparatus which insures the feeding of one document at a time from a stack of documents having a wide range of stiffness and varying thicknesses.

Another object is to provide such a separating apparatus which insures feeding of such varying documents one at a time regardless of their surface and/or edge conditions.

Still another object is to provide such a document feeding and separating apparatus in which one of a pair of adjustably spaced separating rollers may be driven through a friction clutch in a forward direction at various reduced speeds with respect to the other forwardly driven roller of that pair of rollers.

A further object is to provide such a document feeding and separating apparatus which is simple in construction, efficient in operation, inexpensive to manufacture, and easily adjusted and maintained.

BRIEF DESCRIPTION OF THE FIGURES

The above mentioned and other features, objects and advantages and a manner of attaining them are described more specifically below by reference to an embodiment of this invention shown in the accompanying drawings, wherein:

FIG. 1 is a perspective diagram of one embodiment of a document feeding, separating, and guiding apparatus of this invention;

FIG. 2 is a diagrammatic plan view of the embodiment shown in FIG. 1;

FIG. 3 is a diagrammatic side view of the apparatus shown in FIG. 1 taken in direction of arrow X of FIG. 2;

FIG. 4 is a diagrammatic view of a worm mechanism for producing the intermittent drive shown in the intermittent gear drive box in FIGS. 2 and 3; and

FIG. 5 is a diagrammatic sectional view taken along line V—V of FIG. 2 in the direction of the arrows, showing the friction and separate variable drive for one of the first pair of rollers.

DETAILED DESCRIPTION

Feeding mechanism

Referring now to the drawings, particularly FIGS. 1, 2 and 3, there is shown a relatively stationary table 10 for supporting the various elements of the document feeding, separating and guiding apparatus. A travelling platform 12 is movably mounted on the table 10 by means of rollers 14. This platform 12 has a vertically extending end plate 16 which urges a stack of documents 18 supported on their edges against a vertical feed belt 20 having a reach 22 parallel to the plate 16. A constant force provided by a weight connected over a pulley (not shown) moves the platform 12 and plate 16 to urge the document D at the end of the stack 18 into frictional engagement, with the reach 22 of the feed belt 20.

This feed belt 20 extends around and is guided by an idler roller 24 and a ring roller 26 and is driven by a driving roller 28. The idler roller 24 is rotatably mounted on a vertically extending shaft 30 while the ring roller 26 is centrally disposed and rotatably mounted on a toothed idler roller 32 which in turn is rotatably mounted on a shaft 34. The shafts 30 and 34 are fixedly mounted on a platform bridging plate 36 supported by the stationary table 10. The driving roller 28 (see also FIG. 3) is mounted on a shaft 38 for rotation therewith, which shaft 38 is driven by a suitable intermittent gear drive mechanism 40 positioned under the stationary table 10. This gear mechanism 40 may be driven via a shaft 42, bevelled gear-wheels 44, 45, and a driving belt pulley 46 by a driving motor (not shown).

One suitable intermittent drive mechanism 40 is shown in FIG. 4 and includes a worm gear 48 and a worm follower 50. The worm gear 48 is fixedly mounted on the drive shaft 42 to rotate therewith while the worm follower 50 is fixedly mounted on the driven shaft 38 to rotate therewith. The half of this worm gear 48 which is not shown has a straight and continuous central rib 52, while the half which is shown, shows the rib 52 to be discontinuous with oppositely branched ends 54 and 56. Straddling this rib 52 may be adjacent pairs of stud rollers 58 radially mounted on the periphery of the worm follower wheel 50, which has eight equally spaced points. Thus during 180° of rotation of the worm 48, the wheel 50 and shaft 38 remain stationary, and for the next 180° of rotation, one adjacent pair of rollers 58 are moved off one end 54 of the rib 52 on the worm 48 and the next adjacent pair of rollers 58 engage the other end 56 of the rib 52. Thus each rotation of the worm 48 intermittently or steppingly rotates the wheel 50 and its shaft 38 about 45°. This intermittently or discontinuously driven shaft 38 then drives the roller 28 to intermittently drive the feed belt 20.

Since static friction between two objects is greater than the moving friction between the same objects, the intermittent driving of the belt 20 causes the documents D to be more positively engaged for successive removal from the stack 18, than if the belt 20 were driven continuously. However, more than one document still may be removed from the stack 18 by the belt 20.

Separating mechanism

In order to limit the number of letters or documents D which may be removed from the stack 18 by the intermittent belt 20, there is first provided a vertically extending plate 60 (see FIGS. 1 and 2) attached to the table 10 along the side of the movable platform 12. The end of this plate 60 is spaced from the belt 20 a distance

slightly greater than the thickest document to be removed from the stack 18. This plate 60 also retains the documents D on the platform 12 by engaging the leading edges, except for the leading edge of document or thin documents adjacent the belt 20.

However, since more than one document D may be removed from the stack 18 at a time by the belt 20 because of the differences between the documents, a first pair of separating rollers 62 and 64 is provided to insure that only one document D at a time is passed on to a second pair of guiding rollers 66 and 68. This first pair of separating rollers 62 and 64 are independently driven and one of them 64 is adjustable toward and away from the other 62, as well as being driven at a predeterminable slower speed.

The roller 62 is mounted on shaft 70 fixedly attached to the stationary table 10. This roller 62 is positively driven by a pair of vertically spaced parallel toothed belts 72 and 73 which guide the documents D from the intermittent belt 20 to between the pairs of rollers 62, 64 and 66, 68 and which belts 72, 73 drivingly engage spaced tooth portions 74–75 formed on each side of a centrally disposed smooth document engaging portion 76 on this roller 62. These toothed belts 72 and 73 extend around and are guided by the toothed idler roller 32, and are driven by spaced tooth portions 65, 67 on the driving roller 66. This toothed driving roller 66 (see FIGS. 1, 2 and 3) is fixedly mounted on a shaft 78 for rotation therewith which shaft 78 also is rotatably mounted on the stationary table 10. The shaft 78 is continuously driven via spur gear wheels 79, 80, and the previously described driving belt pulley 46.

The other and adjustable roller 64 of the first pair of rollers 62 and 64 is mounted on a drive shaft 81 which is rotatably mounted in brackets 82, 83 that are secured to the outside of a double apertured plate 84. This plate 84 is pivotally mounted 85 on the stationary table 10 (see FIGS. 1, 2 and 5) by means of brackets 85, 87 and a pin 89 and forms one side of a narrow passageway or slot 88 through which the documents D are to pass successively. A first aperture 90 (see FIGS. 1 and 5) disposed in this plate 84 is for receiving a projecting peripheral edge of the roller 64, so the roller 64 can contact the documents D in the slot 88. The document entrance end of the plate 85, that is opposite from the pivot means 85, is connected at 92, to a rod 94 which freely and slidably extends through an outside threaded sleeve 96 adjustable in a stationary post 98 affixed to the stationary table 10. The outer end of this threaded sleeve 96 may have a knurled knob 100 for turning adjustment relative to the fixed post 98. Abutting against the knob 100 is an adjustable collar or stop 102 mounted on the rod 94. Between the inner end of the sleeve 96 and the plate 84 there may be provided a compression spring 104, the compression of which may be adjusted by the threaded sleeve 96 and stop 102. This stop 102 and this threaded sleeve 96 are usually adjusted so that the rollers 62 and 64 do not contact each other, and the passageway, gap, or slot 88 between them is less than the thinnest document D to be separated or passed through the apparatus. The spring 104 is thus compressed by the thickness of the documents D passing between the rollers 62 and 64, which moves the roller 64 away from the roller 62. Accordingly, both the width of the gap 88 and the amount of pressure required to open this gap are adjustable by the just described parts.

FIGS. 1 and 5 illustrate a drive for the roller 64 via a friction coupling, indicated generally at 106, comprising a gear wheel 108 driven in a direction indicated by the arrow A (see FIG. 2) i.e. in the direction of movement of the documents, a friction plate 110, and a compression spring 112. The gear wheel 108 is driven via a gear and drive mechanism 114, which may be driven by pulley 46, but preferably by an independently speed controlled mechanism as shown in FIGS. 1 and 5. This preferred gear

and drive **114** includes a gear **116** mounted on a shaft **118** of a motor **120**, whose speed may be varied by means of a rheostat **122**. The gears **108** and **116** of the mechanism **114** are of a lower ratio than that of the gears **79**, **80** so that the roller **64** is driven at a lower speed than is the roller **62**, namely in a ratio of about one to ten. This reduced speed is transmitted to the roller **64** as shown in FIGS. 1 and 5 via a universal joint **124**, which allows for the transverse axial movement of the roller **64** mounted on the pivoted plate **84**. A shaft **126**, upon which the gear wheel **108**, friction plate **110**, and spring **112** are mounted, may be journalled in a fixed bracket **128** anchored to the lower side of the table **10**. Also the engaging pressure of the clutch or friction drive **106** may be adjusted by a nut **130** on a threaded end of the shaft **126** which varies the compression of the spring **112** to control the degree of over-ride of the clutch **106** when only one document D is passing between the rollers **62** and **64**.

If the roller **64** is not to be driven, the gear mechanism **114** may be stopped and the gear **108** may be locked from turning such as by a jam pin **132**. This pin **132** threadedly mounted in bracket **128** for movement relative thereto is provide with an end **134** which engages the teeth of the gear **108** for holding such gear in a fixed position. Thus the roller **64** will only turn against the friction of clutch **106**, which it is frictionally driven by a single document D which is being moved by the co-operating and driven roller **62**.

If two or more documents D are fed between the rollers **62** and **64**, the roller **64** which rotates slower or not at all will retain these additional documents while the one document against the faster rotating roller **62** will be fed on to the guiding pair of rollers **66** and **68** to separate it from these additional documents. Thus when this one document has passed, the next adjacent one of these documents is engaged by the faster rotating roller **62** and fed on to the rollers **66** and **68**, thus separating these additional documents so that only one at a time is passed. In other words, the frictional engagement between the friction plate **110** and the fixed gear wheel **108** is adjusted to be greater than the frictional force between the two documents and thus is greater than the frictional force that the roller **64** can exercise through the two documents on the roller **62** so that the slower or non-rotating roller **64** will prevent the second document from moving on until the first document of the two has passed on.

Accordingly, the adjustable resiliently mounted slower rotating or stopped spaced roller **64** insures that one and only one document will pass on if more than one document is withdrawn from the stack **18** by the intermittently operated belt **20**. Furthermore because of the non-backward and slower forward rotation and the resilient mounting of the roller **64**, damaged documents or documents with curled-up leading edges will not be further damaged or jam the apparatus, and will be fed as other undamaged documents by the separating rollers **62** and **64**.

Guiding mechanism

As previously noted the document separating and guiding apparatus is provided with a second pair of rollers **66** and **68** as shown in FIGS. 1 and 2. One roller **68** is an idler roller and may be mounted on a shaft **135** affixed to a U-shaped bracket **136** pivoted at **138** having an extension **140** on the opposite side of the pivot **138** from the roller **68**. This extension **140** may be connected to a tension spring **142** which urges the idler roller **68** into contact with a smooth central portion **144** of the driving roller **66** through a second aperture **146** in the plate **84**. Thus the idler roller **68** rotates with the roller **66**, whether or not a document D is between them. This smooth central portion **144** may be less than, greater than, or the same diameter as the outside surface of the toothed belt **72** which pass around the roller **66**, so that the documents D may be engaged either between the central portion **144** of the roller **66** and the roller **68**, and/or bridged between the belts **72** and **73** and the roller **68**.

Operation

In summary the operation of the embodiment described above comprises the steps of first intermittently and successively removing documents D from a stack **18** and feeding them to a first pair of separating rollers **62** and **64** which insures that one and only one document D is fed further by the apparatus.

Where only one document D is fed between the separating rollers **62** and **64**, the greater speed of the driving roller **62** moves the document D at that speed on to the guiding rollers **66** and **68**, causing the resiliently urged and slower driven separating roller **64** to rotate at this faster speed and override its clutch **106** through which it is driven.

In the event that two documents are fed between the separating rollers **62** and **64**, their thickness spreads the gap and slot **88** between these rollers, and the lesser friction between the documents themselves and the documents with each roller, causes the document contacting the faster rotating roller **62** to be passed on at its faster speed, while the document in contact with the slower rotating roller **64** is only moved forward at the slower driven speed of the roller **64**, which slower speed is sufficiently slower that that of roller **62** so that the faster moving document will be passed through the following guiding pair of rollers **66** and **68** before the slower moving document can reach this guiding pair of rollers **66** and **68**. Then after this first faster moving document has passed the faster separating roller **62**, the slower moving document will then be engaged by this faster separating roller **62**, and it then will be speeded on to the guiding pair of rollers **66** and **68**, thus separating these two documents. If more than two documents are fed to the separating rollers **62** and **64**, they will be separated in succession as just described for the two documents.

While there is described above the principles of this invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of this invention.

What is claimed is:

1. An apparatus for removing documents one at a time from a stack, comprising:

(A) means for intermittently feeding documents from said stack,

(B) a pair of adjustably spaced forward rotation rollers located adjacent said feeding means for receiving documents from said feeding means,

(C) means for driving one roller of said first pair of rollers,

(D) over-riding friction clutch means connected to the other roller of said pair of rollers, and

(E) means for driving said other roller of said pair of rollers through said friction clutch means at a considerably reduced speed with respect to said one roller of said pair of rollers, whereby more than one document at a time is prevented from being fed from said pair of rollers.

2. An apparatus according to claim **1** wherein said intermittent feeding means comprises a

belt means for intermittently feeding documents from said stack toward said pair of rollers, and

means for intermittently driving said belt means.

3. An apparatus according to claim **2** wherein said means to intermittently drive said belt comprises a worm and follower wheel having stud rollers mounted radially of said follower wheel.

4. An apparatus according to claim **2** including a stop plate adjacent said stack of documents for limiting the number of documents removed from said stack by said belt means.

5. An apparatus according to claim 1 wherein said reduced speed with respect to said other roller of said pair of rollers is in a ratio of about one to ten.

6. An apparatus according to claim 1 including a pivoted plate means for mounting said one of said pair of rollers to form an adjustable slot between said pair of rollers.

7. An apparatus according to claim 6 wherein said pivoted plate means includes an adjustable resilient mounting means whereby documents of varying sizes may move said plate means and said one roller of said pair of rollers corresponding to their thicknesses.

8. An apparatus according to claim 7 wherein said mounting means includes an adjustable stop for limiting the movement of said one roller of said pair of rollers, so as to prevent direct contact with the other roller of said pair of rollers.

9. An apparatus according to claim 1 including a sec-one pair of rollers for receiving successive documents from said first pair of rollers.

10. An apparatus according to claim 9 including means for driving one of said rollers of said second pair of rollers.

11. An apparatus according to claim 10 including resilient means for urging the other roller of said second pair of rollers into contact with said one driving roller therof.

12. An apparatus according to claim 1 including means to vary the speed of said one roller.

13. An apparatus for removing documents one at a time from a stack, comprising:

(A) means for intermittently removing documents from said stack,

(B) a first pair of adjustably spaced forward rotating rollers located adjacent said feeding means for receiving documents from said feeding means,

(C) means for driving one of said first pair of rollers at a considerably reduced speed with respect to the other roller of said first pair of rollers, whereby more than one document at a time is prevented from being fed between said second pair of rollers,

(D) means for driving said other roller,

(E) a pivoted plate means for mounting said one of said first pair of rollers to form an adjustable slot between said first pair of rollers.

14. An apparatus according to claim 13 wherein said pivoted plate means includes an adjustable resilient mounting means whereby documents of varying sizes may move said plate means and said one roller of said first pair of rollers corresponding to their thicknesses.

15. An apparatus according to claim 14 wherein said mounting means includes an adjustable stop for limiting the movement of said one roller of said first pair of rollers, so as to prevent direct contact with the other roller of said first pair of rollers.

16. An apparatus according to claim 13 wherein said intermittent removing means comprise:

a belt means for intermittently removing documents from said stack toward said one pair of rollers, and

means for intermittently driving said belt means.

17. An apparatus according to claim 16 wherein said means to intermittently drive said belt means comprises a worm and a follower wheel having stud rollers mounted radially of said follower wheel.

18. An apparatus according to claim 16 including a stop plate adjacent said stack of documents for limiting the number of documents removed from said stack by said belt means.

19. An apparatus according to claim 13 wherein said reduced speed with respect to said other roller of said first pair of rollers is in a ratio of about one to ten.

20. An apparatus according to claim 13 including means to vary the speed of said one roller of said first pair of rollers.

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