

April 9, 1963

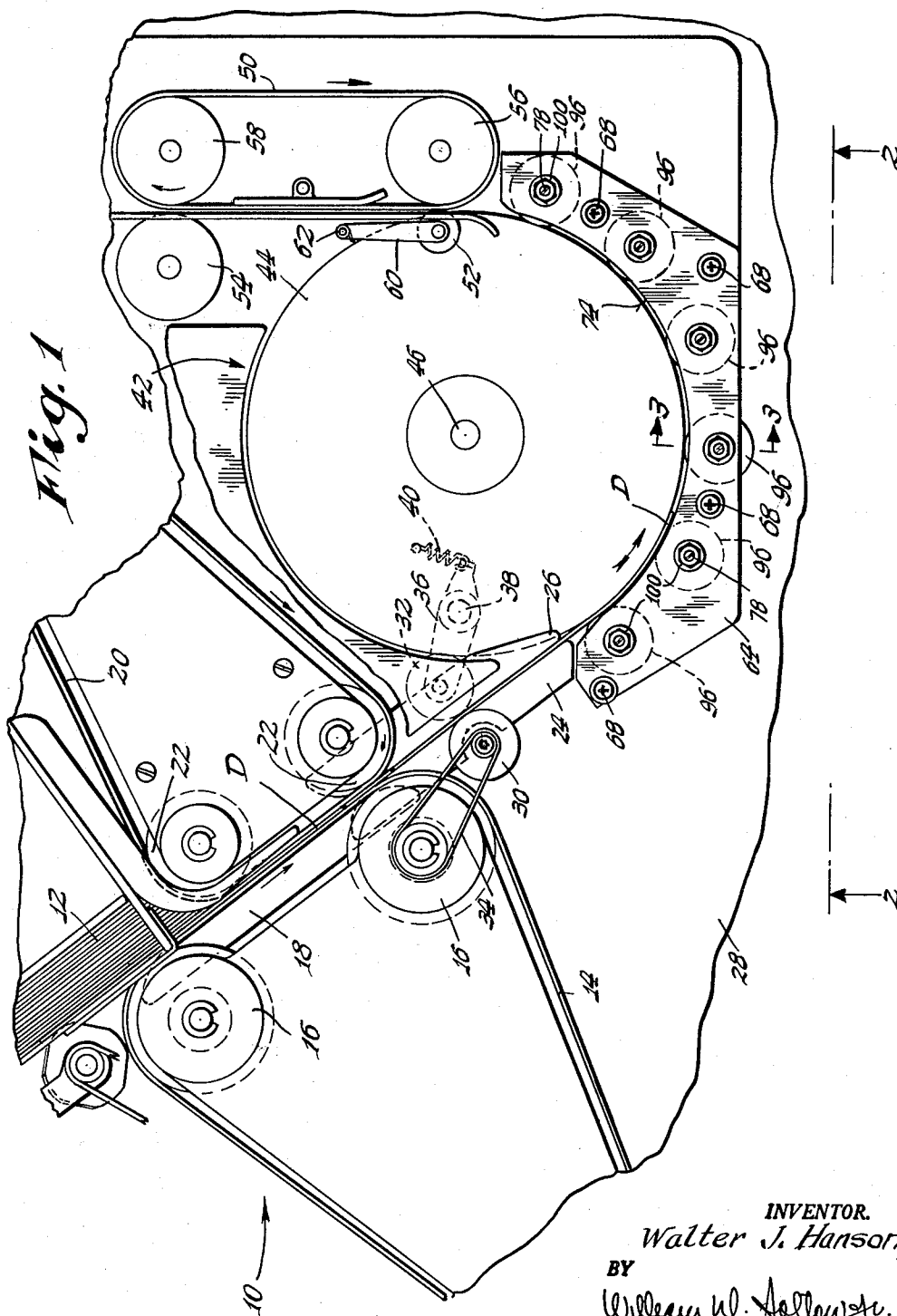
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3,084,931

DOCUMENT MISREGISTRATION-CORRECTING MEANS

Filed June 22, 1961

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 2

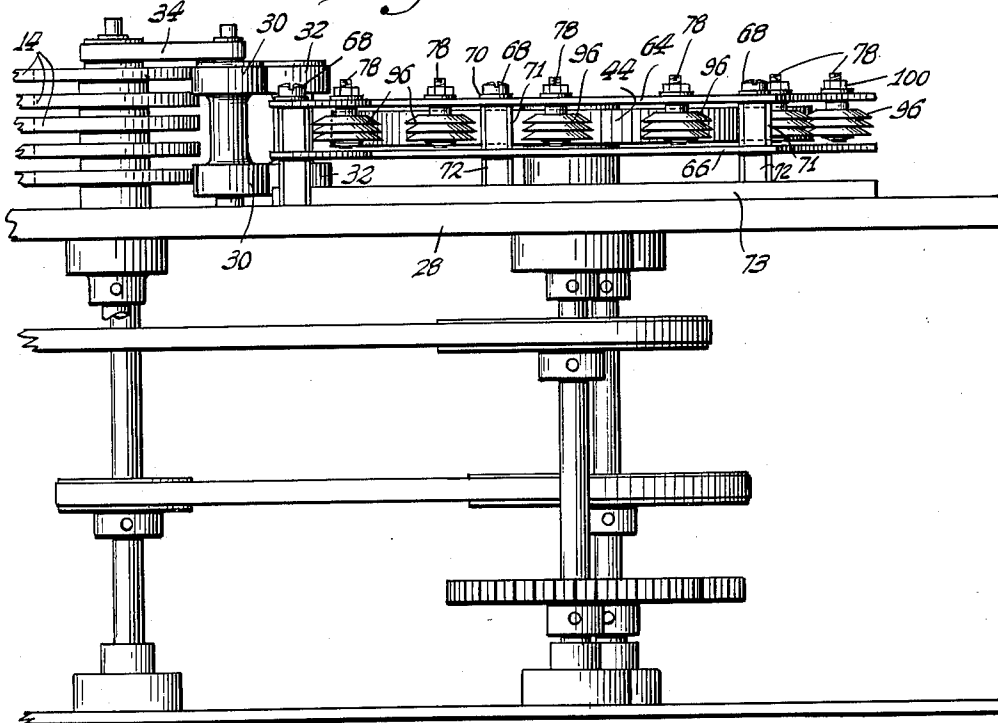


Fig. 3

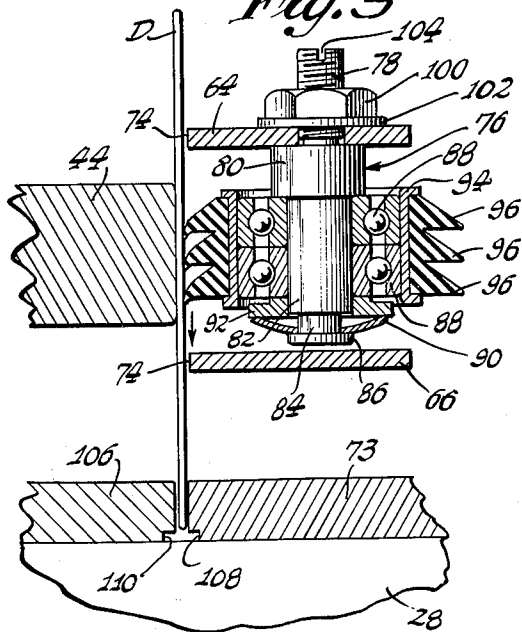
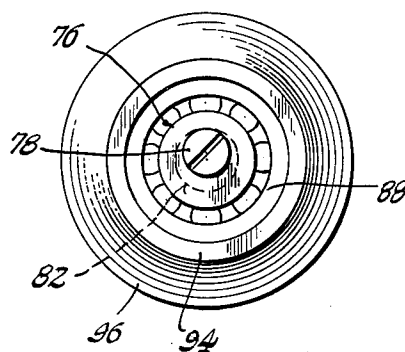


Fig. 4



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DOCUMENT MISREGISTRATION-CORRECTING MEANS

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Filed June 22, 1961, Ser. No. 118,963

6 Claims. (Cl. 271—52)

This invention relates to an apparatus for correcting the misregistration of documents fed in succession along a document feed path.

In the feeding of documents for sorting and other purposes, it is frequently desirable and at times necessary that each document be fed in registry past operating means such, for example, as the reading head of an apparatus for automatically reading printed characters as they appear on the successively fed documents. Correction of the misregistration of documents being fed is accomplished according to the present invention by providing a resilient roller whose peripheral surface is disposed adjacent an endless document feeding surface to effect an interference relation for each document fed between said surfaces. The radially outer marginal portion of the resilient roller deflects in a direction toward a document registration surface each time a document is fed between the resilient roller and the endless document feeding surface. With this deflection the document, while being fed, is yieldably urged in the direction toward the registration surface to bring the edge of that document which is adjacent the registration surface into engagement and into registry with the latter. By locating any operating means in registry with the document registration surface, each document registered with the registration surface will, of course, be in registry with that operating means.

Accordingly, an object of the present invention is the provision of new and improved means for correcting the misregistration of documents as they are fed in succession along a document feed path.

Another object is to provide such means which is effective in operation on paper documents as well as on card stock; and this without mutilation of the documents.

Further objects are to provide such means which are adjustable, reliable in operation and economical.

Additional objects and advantages will become apparent as the description proceeds.

An embodiment of the invention is shown in the accompanying drawing wherein:

FIG. 1 is a fragmentary plan view of a document separating and feeding apparatus including means for correcting the misregistration of documents according to said embodiment;

FIG. 2 is a fragmentary elevational view thereof taken along the sight line 2—2 in FIG. 1;

FIG. 3 is an elevational view taken in section along line 3—3 in FIG. 1; and

FIG. 4 is a top plan view of the roller shown in FIG. 3, certain of the parts for supporting the same being omitted in FIG. 4 so as clearly to show an eccentric adjustment feature thereof.

Referring to FIGS. 1 and 2 of the drawing, a separating and feeding unit is generally indicated at 10. With this unit documents D are separated from a stack 12 and forwardly fed in one-by-one succession to the right and downwardly as viewed in FIG. 1. In this regard, a plurality of endless advancing feed belts 14 are trained about pulley wheels sets 16, 16 and driven in the clockwise direction. Between the two sets of pulley wheels as shown in FIG. 1, a vacuum shoe 18 is disposed, and as each one of several spaced groups of holes in the advancing feed belts 14 moves past the vacuum shoe 18,

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the endmost document of the stack becomes attached to the advancing feed belts and moves forwardly therewith. A plurality of reverse feed belts 20 are trained about pulley wheels 22 and are driven in the clockwise direction to prevent more than a single document from being separated and forwardly fed from the stack 12 at one time. For additional details of the structure and operation of the separating and feeding unit 10, reference may be had to U.S. Patent No. 2,977,114 granted on March 28, 1961, to W. J. Hanson et al.

A pair of side guides 24, 26 are mounted on the upper surface of a platform 28 and aid in guiding the lead end of each document into the bite between a pair of driven rollers 30 and a pair of idler rollers 32. The rollers 30 are secured on a shaft which is driven from the shaft of one of the sets of pulley wheels 16 by means of a drive belt 34 trained about respective pulley wheels secured to these two shafts. The idler rollers 32 are mounted for rotation on a shaft carried at one end of a lever 36. The lever 36 is pivotally mounted on a shaft 38 and is biased in the counterclockwise direction by a tension spring 40.

After leaving the bite between rollers 30, 32, the lead end of each successively fed document enters a document feeding and misregistration-correcting unit generally indicated at 42. This unit 42 includes a wheel or disc 44 which is mounted on a shaft 46 for rotation about an axis. The disc 44 has an endless circular peripheral surface that is driven in a closed path when the disc is rotated.

The platform 28 is disposed beneath the units 10 and 42, and this platform acts as a feed deck in that the documents when fed from the stack 12 ordinarily move with their lower edge at least approximately in engagement with the upper surface of this platform. The upper surface of the platform 28 directly beneath the document feed path therefore acts as a document registration surface. The document feed path and this document registration surface extend from the separating and feeding unit 10 along a portion of the endless peripheral surface of the disc 44 and then past the bite between a feed belt 50 and each one of idler rollers 52 and 54. The feed belt 50 is trained about pulley wheels 56 and 58. The idler roller 52 is carried at one end of a lever 60 which is resiliently biased in the counterclockwise direction (as viewed in FIG. 1) about a shaft 62. In this manner, the roller 52 is resiliently biased toward the feed belt 50. The idler roller 54 is resiliently biased toward the feed belt 50 by similar means not shown.

The drive to the lowermost one of pulley wheels 16 (as viewed in FIG. 1), to the uppermost one of pulley wheels 22, to the disc 44 and to the pulley wheel 58 may be the same as that to the respective counterparts of these members in the apparatus disclosed in the above-noted U.S. patent.

Disposed about said portion of the endless peripheral surface of the disc 44 is a pair of generally U-shaped plate frame members 64 and 66; the latter member lying directly beneath the former. A plurality of mounting pins 68 are provided, each of which is headed and slotted at its upper end for the reception of a screw driver. Each one of the pins 68 extends in succession through a washer 70, an aperture in frame member 64, a spacer tube 71, an aperture in frame member 66, a spacer tube 72, an aperture in a guide member 73 and then into tightened threaded engagement with a tapped hole in the platform 28. Each of the frame members 64 and 66 presents an arcuate edge 74 which, as can be seen in FIGS. 1 and 3, acts as a guide for documents being fed.

Mounted on the frame member 64 are a plurality of mutually spaced bearing-supporting members generally designated by the reference numeral 76. Referring to

FIG. 3, each of the bearing-supporting members includes a threaded shank 78, a shoulder 80, a cylindrical shank 82, a reduced-diameter section 84 and a headed end 86. Fitted on the shank 82 are the inner races of a pair of conventional ball bearings 88. A split spring washer 90 is disposed about the reduced-diameter portion 84 and urges a retainer washer 92 upwardly as viewed in FIG. 3, thereby to retain the inner races of the ball bearings 88 between the retainer 92 and the shoulder 80. A sleeve 94 is flanged at each end and fitted about the outer races of the bearings 88. A set of three annular rollers 96 is cemented to the sleeve 94 between the end flanges thereof. Each of the rollers 96 is formed of a resilient frictional material such as soft rubber. The radial dimension of the outer peripheral surface of each of the rollers 96 varies from a maximum to a minimum in the direction away from the document registration surface provided by the platform 28. As shown in FIG. 3, the cross-sectional shape of the outer marginal portion of each of the rollers is conical and terminates in a blunt, rather than a sharp, radially outer edge. The frictional material of which the rollers 96 are formed is such that the coefficient of friction between this material and a document is greater than that between the endless peripheral surface of the disc 44 and a document.

Each of the rollers 96 may be preformed as a separate piece, then coated with cement about its inner periphery, radially expanded, positioned about the sleeve 94 and finally permitted to contract about the sleeve. Alternatively, and in the form shown in FIG. 3, an integral, hollow, cylindrical piece of rubber is coated with cement about its inner periphery and applied about the sleeve 94 between the end flanges thereof. After the cement has set, the integral cylindrical piece is turned down with a rasp or other suitable tool to form the set of three integral rollers 96.

With the outer peripheral surface of each of the rollers 96 varying from a maximum to a minimum in the direction away from the document registration surface of the platform 28 along with the factors that this outer marginal portion is formed of resilient material which provides a friction coefficient between itself and a document greater than that provided by the disc 44, all as described above, a radially inward force applied to each of the rollers tends to deflect the radially outer marginal portion thereof in the direction opposite to said last-mentioned direction and toward the document registration surface. In order to increase this tendency to deflect toward the registration surface, the flat undersurface of each of the rollers 96 can be undercut or relieved, if desired.

The set of three rollers 96 rotatably mounted on each one of the bearing supporting members 76 is spaced from the next adjoining set or sets of rollers 96 a distance shorter than the length (in the direction of feeding) of the shortest document to be fed. This ensures that at least one of the sets of rollers 96 is in engagement with each document at any given instant throughout the feeding of that document about the outer periphery of the disc 44.

Each of the sets of rollers 96 is adjustable in the general directions toward and away from the outer periphery of the disc 44 to provide, for each document to be fed, a slight interference fit between the outer peripheral surface of each roller 96 and the outer peripheral surface of the disc 44. The generally radially inward force developed against each of the rollers 96 due to this interference relation causes downward deflection of the radially outer marginal portions of these rollers as depicted in FIG. 3. This adjustment is achieved by virtue of eccentric disposition of the axis of the threaded shank 78 relative to the axis of the cylindrical shank 82; this latter axis defining the axis of rotation of the respective set of rollers 96. This eccentric relation can be seen in FIG. 3, but is best shown by the plan view of FIG. 4 wherein the frame member 64, a nut 100 and a washer

102 have been omitted for clarity of illustration. In effecting the adjustment of each set of rollers 96, the respective nut 100 is loosened, a screw-driver is utilized in cooperation with a slot 104 at the free end of the shank 78 to adjust the latter rotatably, and the nut 100 is tightened down while holding the shank in adjusted position with the screw driver.

In operation, the outer peripheral surfaces of the rollers 96 of each set thereof are deflected toward the document registration surface at the respective areas of contact of the rollers with each document as the latter is being fed therepast. The effect of the rollers 96 is to urge each document toward the document registration surface to bring the edge of the document next adjacent the registration surface into engagement therewith while forward feeding of the document continues. It has been observed that while being fed between the disc 44 and a set of rollers 96, a document appears to have a rotational component of motion about an axis located more remote from the registration surface than is the location of the rollers. Also, the area of contact of each roller with the document is generally arcuate or crescent-shaped, with the two ends of the arc or crescent being more remote from the registration surface than is the point of greatest deflection of this area of contact. Of course, any point on the peripheral surface of a roller 96 that contacts a document deflects away from the registration surface while moving from the location of maximum deflection the same amount this point deflects toward the registration surface while moving to the location of maximum deflection. However, while this point is moving to the location of maximum deflection, the document is working to deform or deflect the roller periphery whereas the roller periphery is merely relaxing or recovering while moving from the location of maximum deflection with the result, it is believed, that the downward deflection (as viewed in FIGS. 2 and 3) of the radially outer marginal portion of each roller is more effective in urging the document toward the registration surface than upward deflection is in urging the document away from the registration surface.

Whatever may be taken as the explanation for the effect of the rollers 96, the correcting action of these rollers is effective to correct a wide range of misregistrations including those whereby only the lead end of the document engages the registration surface (clockwise skew), only the trail end of the document engages the registration surface (counterclockwise skew), and both the lead and trail ends of the document are out of engagement with the registration surface. Also, this correcting action has been observed when the disc 44 was driven manually at a peripheral speed as slow as approximately one-half inch per second as well as when the disc 44 was power driven at a peripheral speed of one hundred fifty inches per second.

Another advantage that flows from the arrangement described herein whereby a plurality of sets of rollers 96 are disposed along a portion of the circular outer periphery of the disc 44 is that the longitudinal bowing of each document as it conforms to this circular periphery reinforces the document against buckling due to the yieldable urging of the document against the registration surface by the rollers 96. Of course, the greater the degree of the above-described interference for each document between the peripheral surfaces of the disc 44 and those of the rollers 96, the greater will be the misregistration correcting effect but the greater will be the tendency to buckle the document. A substantial range of document thicknesses from paper to card stock have been operated upon successfully by adjusting the rollers 96 toward and away from the disc 44 to strike a proper balance between these two factors. To aid in preventing buckling of the documents without decreasing the misregistration correcting effect, a pair of guides 73 and 106 are provided as shown in FIGS. 1-3. The guide 73 is secured to the platform 28 by the mounting pins 68 as described above, and the guide 106 is secured to the platform by screws (not

shown). The space between the opposing side walls presented by the guide members 73 and 106 follows the document feed path about the respective portion of the peripheral surface of the disc 44. These opposing side walls are relieved or recessed at 108 and 110, respectively, whereby the possibility of the edge of a document working its way into a minute space between the platform and either of the guides 73 and 106, is avoided.

The unit 42 as particularly described herein can be identical to the timing unit 23 of the above-mentioned patent to W. J. Hanson et al. with the exceptions that the sets of rollers 96 and their mounting means of the present disclosure take the place of the idler rollers and their mounting means about the periphery of the disc as disclosed in said patent, the guide members 73 and 106 may be provided as disclosed herein, and the timing fingers (77) and their supporting means as disclosed in said patent can be provided or not as desired. In this latter regard, it is to be noted that the present invention provides the further advantage that the misregistration function of the sets of rollers 96 does not interfere with the timing function of the timing fingers when the latter are provided. The timing fingers and their supporting structure were omitted from this description to avoid unnecessarily complicating the same.

Since many changes can be made in the embodiment of the invention as particularly described and shown herein without departing from the scope of the invention, it is intended that this embodiment be considered as exemplary and that the invention not be limited except as warranted by the following claims.

What is claimed is:

1. An apparatus for correcting the misregistration of documents fed thereto, said apparatus comprising a wheel having an endless peripheral surface adapted to be driven about a closed path, means providing a document registration surface, a roller, at least the radially outer marginal portion of said roller being formed of a resilient material providing a coefficient of friction between said material and a document greater than the coefficient of friction between a document and said peripheral surface of said wheel, bearing means supporting said roller for rotation about an axis intersecting said registration surface, said roller being disposed with its peripheral surface adjacent the peripheral surface of said wheel to provide an interference relation for each document when fed between said two peripheral surfaces, the radial dimension of said peripheral surface of the roller varying from a maximum at one side edge of said peripheral surface to a minimum in the direction away from said registration surface whereby the radially outer marginal portion of said roller is deflected toward said registration surface while engaging each document being fed and the latter is yieldably urged toward said registration surface.

2. An apparatus for correcting the misregistration of documents fed thereto, said apparatus comprising a member having an endless peripheral surface adapted to be driven about a closed path, means providing a document registration surface, a plurality of rollers, at least the radially outer marginal portion of each of said rollers being formed of a resilient material providing a coefficient of friction between said material and a document greater than the coefficient of friction between a document and said peripheral surface of said member, bearing means supporting said rollers for rotation about a common axis substantially perpendicular to said registration surface, each of said rollers being disposed with its peripheral surface adjacent the peripheral surface of said member to provide an interference relation for each document when fed between the peripheral surface of said member and the peripheral surfaces of said rollers, the radial dimension of the peripheral surface of each of said rollers varying from a maximum at one side edge of said peripheral surface to a minimum in the direction away from said registration surface whereby the radially outer marginal

portion of each of said rollers is deflected toward said registration surface while engaging each document being fed and the latter is yieldably urged toward said registration surface.

3. An apparatus for correcting the misregistration of documents fed thereto, said apparatus comprising a wheel having an endless peripheral surface, means mounting said wheel for rotation about a first axis, means operatively connected for rotatably driving said wheel about said axis to move said endless peripheral surface about a closed circular path, a document feed deck providing a document registration surface extending perpendicular to a portion of said endless peripheral surface, a roller, at least the radially outer marginal portion of said roller being formed of a resilient material providing a coefficient of friction between said material and a document greater than the coefficient of friction between a document and said endless peripheral surface of said wheel, bearing means supporting said roller for rotation about a second axis intersecting said registration surface, said roller being disposed with its peripheral surface adjacent the endless peripheral surface of said wheel to provide an interference relation for each document when fed between said two peripheral surfaces, the radial dimension of said peripheral surface of the roller varying from a maximum at one side edge of said peripheral surface to a minimum in the direction away from said registration surface whereby the radially outer marginal portion of said roller is deflected toward said registration surface while engaging each document being fed and the latter is yieldably urged toward said registration surface.

4. An apparatus for correcting the misregistration of documents fed thereto, said apparatus comprising a member having an endless peripheral surface adapted to be driven about a closed path, means providing a document registration surface, a roller, at least the radially outer marginal portion of said roller being formed of a resilient material providing a coefficient of friction between said material and a document greater than the coefficient of friction between a document and said peripheral surface of said member, bearing means supporting said roller for rotation about an axis intersecting said registration surface, said roller being disposed with its peripheral surface adjacent the peripheral surface of said member to provide an interference relation for each document when fed between said two peripheral surfaces, said radially outer marginal portion of the roller being conical in cross-section, and said peripheral surface of the roller diverging from the endless peripheral surface of said wheel in the direction away from said registration surface whereby the radially outer marginal portion of said roller is deflected toward said registration surface while engaging each document being fed and the latter is yieldably urged toward said registration surface.

5. An apparatus for correcting the misregistration of documents fed thereto, said apparatus comprising a wheel having an endless peripheral surface adapted to be driven about a closed circular path, means providing a document registration surface extending perpendicular to a portion of said endless peripheral surface, a roller, at least the radially outer marginal portion of said roller being formed of a resilient material providing a coefficient of friction between said material and a document greater than the coefficient of friction between a document and said endless peripheral surface of said wheel, individual bearing means supporting each of said rollers for rotation about respective axes intersecting said registration surface, said axes being spaced from each other about said portion of said endless peripheral surface a respective distance less than the length of the shortest document to be fed, each of said rollers being disposed with its peripheral surface adjacent the endless peripheral surface of said wheel to provide an interference relation for each document when fed between said endless peripheral surface and the peripheral surface of each of said rollers, the radial dimension of

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said peripheral surface of each of said rollers varying from a maximum at one side edge of said peripheral surface to a minimum in the direction away from said registration surface whereby the radially outer marginal portion of each of said rollers is deflected toward said registration surface while engaging each document being fed and the latter is yieldably urged toward said registration surface.

6. An apparatus for correcting the misregistration of documents fed thereto, said apparatus comprising a member having an endless peripheral surface adapted to be driven about a closed path, means providing a document registration surface extending perpendicular to a portion of said endless peripheral surface, a roller, at least the radially outer marginal portion of said roller being formed of a resilient material providing a coefficient of friction between said material and a document greater than the coefficient of friction between a document and said endless peripheral surface of said member, bearing means supporting said roller for rotation about an axis intersecting said registration surface, said roller being disposed with its peripheral surface adjacent the endless

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peripheral surface of said member to provide an interference relation for each document when fed between said endless peripheral surfaces, means mounting said bearing means for adjustment thereof toward and away from said endless peripheral surface of said member to adjust the degree of said interference relation, the radial dimension of said peripheral surface of the roller varying from a maximum at one side edge of said peripheral surface to a minimum in the direction away from said registration surface whereby the radially outer marginal portion of said roller is deflected toward said registration surface while engaging each document being fed and the latter is yieldably urged toward said registration surface.

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