Dec. 25, 1962 R. C. ADAMS 3,070,368

DOCUMENT FEEDING APPARATUS

Filed May 5, 1961

FIG. 1

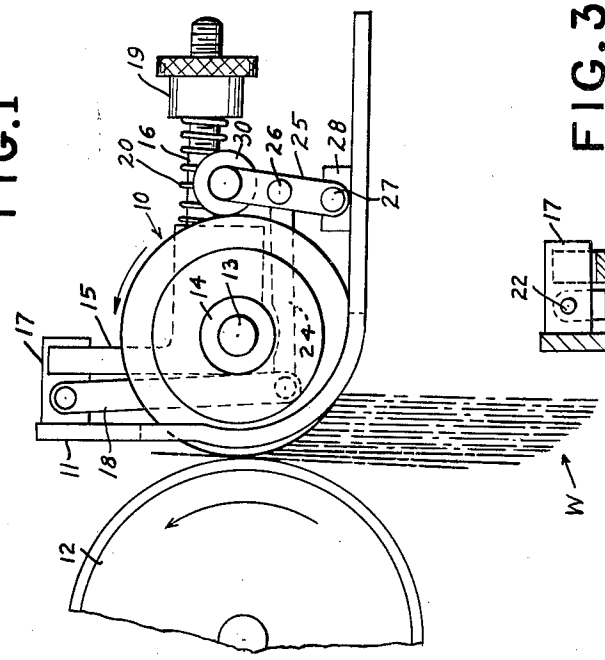


FIG. 3

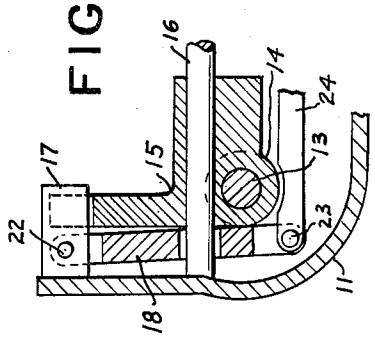


FIG. 2

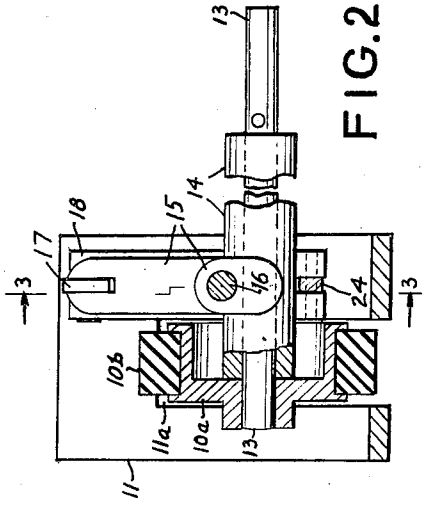
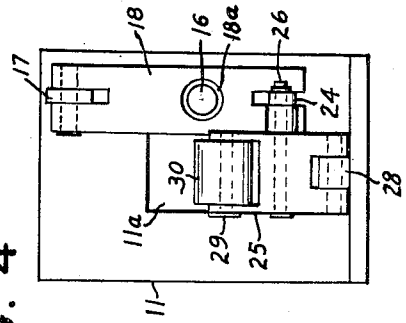


FIG. 4



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DOCUMENT FEEDING APPARATUS

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8 Claims. (Cl. 271—36)

This invention relates to feeding apparatus for flat mail or like documents including cards, slips and other thin flat work pieces, and more particularly to such feeding apparatus as may be used in a postage canceling machine and involving a separator roller peripherally opposing a feed roller to limit it to one-by-one feed of mail pieces.

A problem with document separating means is to preserve a predetermined correct document separating positional and spacing relation of the separator roller to the feed roller despite peripheral wear of the separator roller. Prior means shown in Patent 2,104,630 attempts a solution to the problem. One fault inherent in said prior means is that it over-compensates for wear of the separator roller. Another marked fault of the prior means, inherent in this swingable carrier for the separator roller, is that adjustment of the separator roller axis is along an arcuate locus, so that the angle of confrontation of the separator roller relative to the feed roller and the direction of input of the documents is deviated from the initial predetermined correct angle.

An object of the present invention is to provide an improved document separator arrangement. According to the invention, one-to-one compensation for wear of the separator roller can be effected. Further, according to the invention, adjustment of the separator roller is in a straight line so that in any adjusted position of the separator roller, its angle of confrontation to the feed device and the documents is unchanged.

Other objects of the invention, including broader aspects, appear from the detailed description, the claims, and the drawing, wherein:

FIG. 1 is a plan view showing the new separator arrangement together with a portion of the associated feed roller;

FIG. 2 is a broken vertical sectional view through the axis of the separator roller and detoured behind the carrier for this roller;

FIG. 3 is a broken section substantially along lines 3—3 of FIG. 2; and

FIG. 4 is a rear view showing certain elements of the separator arrangement and omitting the separator roller, its carrier and tensioning means.

The separator arrangement includes a separator roller **10** comprising a cup-shaped wheel **10***a* tightly ringed by a replaceable friction rubber ring **10***b*. A stationary angular guard frame **11**, suitably mounted to the machine frame, has an opening **11***a* through which the separator roller **10** extends into spaced facing relation to the feed roller **12**. The feed and separator rollers are driven in peripheral opposition, the separator roller in a direction to reject presented documents W and the feed roller in a direction to advance a document. The documents are ordinarily presented for feed at a greater rate than they can be fed one at a time by the feed roller, so that a stack of the documents is usually awaiting feed. The front ends of the documents are echeloned by contact with the projecting arc of the separator roller and by the curved knee of the guard frame **11**, so that the leading document intrudes between the feed and separator rollers. The feed roller exerts greater tangential force than the separator roller on the document between them and succeeds in feeding it through, while the separator roller rejects the adjacent documents.

The separator roller **10** thus has the function of restricting the documents to one-by-one feed by the feed roller **12**. In order to function properly, the separator roller must be maintained at predetermined correct gating spacing from the feed roller. Initially, before wear of the separator roller occurs, it is at the correct spacing from the feed roller. During continued service of the separator roller, its friction rim wears and its radius decreases. The present invention provides automatic forward adjustment of the separator roller in a manner enabling one-to-one compensation for peripheral wear. Further, the invention provides for this adjustment along a straight line, so that the angle of confrontation and radial pressure vector of the separator roller with respect to the feed roller and the documents will not vary as a result of the adjustment.

In the arrangement provided here for carrying out the stated objectives, the separator roller **10** is part of an adjustable separator unit slidably mounted on the guard frame **11**. The separator wheel **10***a* is fixed to the left end of a shaft **13** (as viewed in FIG. 2) which is journaled in a sleeve **14** integral with a carrier or carriage **15**. The carriage and its sleeve **14** form another part of the adjustable separator unit. In the working position of the separator roller **10**, the base of its wheel **10***a* abuts the left end of the sleeve **14** and the shaft **13** extends at its right end past the right end of the sleeve, suitable thrust means and drive-receiving means (not shown) being carried by the projecting right hand portion of the shaft. The carriage **15** is angular; its horizontal leg (as viewed in FIG. 3) is smoothly bored for reception of a round guide rod **16** fixed at the front to frame **11**. The relatively vertical leg of the carriage **15** is slotted at its free end to straddle a rectangular guide bar **17** projecting from the frame **11**. Thus, the carriage **15**, along with the integral sleeve **14** and the elements of the separator roller **10**, is slidably mounted on the frame for rectilinear movement, the disposition of the guide rod **16** and the guide bar **17** being such that the direction of such movement is toward or away from the feed roller **12**. Adjustment of the separator unit will thus take place along its original radial line of direction relative to the feed roller, and the radial pressure vector of the separator roller will be unchanged as a result of adjustment.

The means for effecting the slidable, translational adjustment of the separator roller **10** to compensate for its peripheral wear includes a cramping linkage for the separator unit. This linkage includes a lever **18** in front of the carriage **15**. Lever **18** is formed intermediately with a hole **18***a* to permit free passage of the guide rod **16** in any angular position of the lever. The rear portion of the guide rod **16** is threaded to receive a nut **19** with a knurled head. Between the nut and the carriage **15**, rod **16** carries a coil spring **20** biasing the carriage into abutment with the lever **18**. The upper end of the lever **18** is slotted to straddle the guide bar **17**, and a pivot pin **22** passing through the bar **17** and the flanking portions of the lever pivotally mounts or bases the lever on the frame **11**. The lower end of lever **18** is pivotally connected by a pin **23** to the left end of a generally horizontal link **24**. The right end of the link **24** is pivotally connected by a pin **26** to the mid-point of a lever **25**. This lever is behind the separator roller and is fulcrumed at the lower end, by a pivot **27**, to a lug **28** of frame **11**. The upper end of lever **25** is bifurcated and carries a pin **29** journaling a follower roller **30** between the furcations. The follower roller is engaged with the periphery of the separator roller at the rear and is biased into maintained engagement by the effect of the spring **20** applied via the carriage **15**, lever **18** and link **24**. The length of the lever **25** and its position are such that inward movement of the follower roller **30**, upon a reduction of radius of the separator roller, is substantially radially directed toward the axis of the separator roller. The point of follower

engagement of the lever 25 with the separator roller has substantially twice as great a moment arm, about the fulcrum of the lever, as the point of connection of link 24 to the lever. Thus, the ratio of displacement between the follower point and the link, as well as the front lever 18, is two-to-one. The relation of parts is such that the component of displacement of the follower point of the rear lever 25 in a direction paralleling the slidable locus of the separator unit is two times that, in the same direction, of the abutting portions of the front lever and the carriage 15. The pertinent distance between the follower point of the lever 25 and the abutted portion of the front lever 18 is the sum of the fixed distance between the abutted point of the lever 18 and the axis of the separator roller plus the radius of the separator roller.

While the spring 20 constantly tends to advance the carriage 15 toward the feed roller 12, such movement, beyond a limit determined by the radius of the separator roller, cannot take place while this radius remains unchanged. As long as the separator roller radius remains constant, the effective distance between the follower lever 25 and the front lever 18 is constant and inhibits any forward movement of the linkage and the separator unit beyond their current forward limit positions. That is, as long as the effective distance between the follower roller 30 and the abutted point of the front lever remains unchanged, the follower roller cannot move forward beyond its current limit position since such movement would be double that of the pertinent point of the front lever and would attempt to narrow the effective distance of their separation, which is impossible as long as the radius of the separator roller remains the same. It is evident, then, that the linkage 18—24—25 and the separator unit form a mutually interlocked kinematic chain at a forward limit determined by the horizontal spacing between the frame-based pivots of the front and rear links 18 and 25 of this chain and by the effective distance between these links which, in turn, depends on the radius of the separator roller 10. On the other hand, it is evident that the rear link 25 can move rearwardly under the pressure of a document since such rearward movement increases its distance from the front link 18, affording room for the separator unit to move rearwardly.

If the separator roller 10 decreases in radius due to peripheral wear, or if a replacement ring 10*b* is thinner than the replaced ring, the effective distance between the links 18 and 25 is reduced by amount of reduction in radius. In order to take up this decrease, the spring 20 forces the two links forwardly. Because of the motion reducing ratio between link 25 and link 18, the link 18 moves forward half the distance of the link 25. Thus, in order to narrow the distance between these two links by the amount of radius reduction of the separator roller, the link 18 must move forward that amount while the link 25 moves forward twice that amount, the net difference in their relative movements thus being the distance of radius reduction. As the link 18 has moved forward the distance of radius reduction, the carriage follows under the influence of spring 20 and, hence, the axis of the separator roller is advanced the distance of radius reduction and one-to-one compensation for such reduction has taken place. Further, this has been accomplished by rectilinear translation of the separator roller, so that the original angle of pressure and confrontation of the separator roller with respect to the feed roller and the documents has not been changed.

As a specific example, assume that the separator roller when in required and predetermined gating proximity to the feed roller projects 1/32 inch beyond the guard frame 11. Suppose now that due to peripheral wear, the radius of the separator roller decreases 1/40 inch. The follower element 30 therefore moves inwardly toward the axis of the separator roller 1/40 inch, resulting in forward displacement of the front member at the point where it abuts the

carriage 15 by 1/80 inch. Thus, the axis of the separator roller advances that distance. In order to maintain its engagement with the separator roller periphery, the follower element 30 moves forward relative to the frame also by an additional distance of 1/80 inch. This causes further forward displacement of the front member and the separator roller axis. An interlocked forward status between the linkage and the separator unit is therefore not reached until the front member 18 and the separator unit have advanced 1/40 inch relative to the frame 11 while the follower element has advanced the same distance relative to the axis of the separator roller and twice that distance, or 1/20 inch, relative to the frame. At this point, the reduction of 1/40 inch in the effective distance between the follower element 30 and the front member 18 has been completely taken up and the separator unit is in a new forward limit position, 1/40 inch beyond its previous forward limit; i.e., by the mount of reduction in radius of the separator roller. Thus, the periphery of the separator roller 10 again projects the required distance of 1/32 inch beyond the front of the guard frame 11 and in the direction of the feed roller 12.

It is obvious that while the follower element 30 is preferably a free-turning roller, a suitable edge of the lever 25 itself may serve as a follower element. It is also understood that other changes from the specifically disclosed form of the invention may be made within the spirit of the invention and that the invention may have more general application than to a separator device. It is intended, therefore, to be limited only as indicated by the claims.

What is claimed is:

1. Apparatus comprising a feed roller for flat mail or like flat documents, a separator roller peripherally opposed to the feed roller to restrict it to one-by-one feed of the documents, a carrier journaling the separator roller, a stationary frame on which the carrier is slidably supported for rectilinear adjustment to and from the feed roller, a follower movably mounted on the frame for engaging the separator roller periphery, the follower moving inwardly toward the separator roller axis upon peripheral wear of the separator roller, and means operatively connected with the follower for adjusting the carrier toward the feed roller proportionately to the inward movement of the follower.

2. Apparatus comprising a feed roller for flat mail or like flat documents, a separator roller peripherally opposed to the feed roller to restrict it to one-by-one feed of the documents, a carriage journaling the separator roller, a stationary frame on which the carriage is slidably mounted for rectilinear adjustment to and from the feed roller, a rocker fulcrumed on the frame and having a follower element engaged with the separator roller periphery for movement inward relative to the separator roller axis upon peripheral wear of the separator roller, and means including a displaceable member supported by the frame and linked to the rocker for adjusting the carriage toward the feed roller in accordance with the inward movement of the follower element relative to the separator roller axis.

3. Apparatus comprising a feed roller for documents such as flat mail or the like, a separator roller peripherally opposed to the feed roller to restrict it to one-by-one feed of the documents, a carriage journaling the separator roller, a stationary frame on which the carriage is slidably mounted for rectilinear adjustment to and from the feed roller, means biasing the carriage toward the feed roller, a rocker fulcrumed on the frame and having a follower element engaged with the separator roller periphery at the rear for forward positioning relative to the separator roller axis in accordance with the radius of the separator roller, a displaceable front member mounted on the frame and operatively engaged with the carriage at a distance in front of the separator roller axis, and means linking the front member to the rocker for forward displacement of the front member and of the carriage in accordance with

the forward position of the follower element relative to the separator roller axis.

4. Apparatus comprising a document feed roller, a complementary separator roller, a carriage journaling the separator roller, a separator roller guard frame provided with means slidably mounting the carriage for rectilinear forward and rearward adjustment relative to the feed roller, spring means biasing the carriage forwardly, a follower lever mounted on the guard frame and engaged with the separator roller periphery at the rear for forward angular positioning relative to the separator roller axis in accordance with the radius of the separator roller, a front lever abutting the carriage forwardly of the separator roller axis, and means linking the levers to each other for interrelated displacement so as to determine the forward position of the front lever and therethrough of the carriage in accordance with the forward angular position of the follower lever relative to the separator roller axis.

5. Apparatus comprising a feed roller for flat mail or the like, a separator unit including as one part a separator roller peripherally opposed to the feed roller and as another part a carrier journaling the separator roller, a stationary frame on which the separator unit is mounted for forward and rearward adjustment relative to the feed roller, and means to establish the forward position of the separator unit and including a linkage having a displaceable front member mounted on said frame for coaction with a part of the separator unit at a fixed, constant distance in front of the separator roller axis, the linkage also having a rocker fulcrumed on the frame and provided with a follower element engaged with the separator roller periphery at the rear for forward limit positioning relative to the separator roller axis in accordance with the radius of the separator roller, and the linkage further having means linking the front member to the rocker for forward limit positioning of the front member and therethrough of the separator unit relative to said frame in accordance with the forward limit position of the follower element relative to the separator roller axis, and means biasing the linkage and the separator unit to their forward limit positions.

6. Apparatus comprising a document feed roller, a separator unit including a separator roller peripherally opposed to the feed roller, a stationary frame on which the separator unit is slidably mounted for rectilinear forward and rearward adjustment relative to the feed roller, and means to establish a forward limit position of the separator unit dependent on the radius of the separator roller, said means including a linkage having a rockable front member based on the frame and abutting the separator unit at a fixed distance in front of the separator roller axis, a rocker based on the frame and having a follower element engaged with the separator roller periphery at the rear for inward movement relative to the axis

of the separator roller in accordance with a reduction in radius of the separator roller due to peripheral wear, the linkage further including means linking the rockable front member to said rocker for forward adjustment of the abutting portions of the front member and the separator unit relative to the frame corresponding to the inward movement of the follower element relative to the separator roller axis so as to compensate for the reduction in radius of the separator roller, and means biasing the separator unit and linkage forwardly.

7. Apparatus comprising a document feed roller, an adjustable unit embodying a roller complementary to the feed roller, a stationary frame on which the adjustable unit is mounted for movement to and from the feed roller, and means for establishing a forward limit position of the foremost peripheral point of the complementary roller relative to the feed roller, said means including a front lever pivoted to the frame and abutting the adjustable unit at a fixed, constant distance in front of the axis of the complementary roller, a rear lever pivoted to the frame and having a follower element engaged with the periphery of the complementary roller rearwardly of its axis and at an effective distance from the abutted portion of the front lever substantially equal to said fixed distance plus the radius of the complementary roller, means linking the front lever to the rear lever substantially half-way between the pivot of the rear lever and the follower element, and means biasing the linkage and adjustable unit forwardly.

8. In a work handling machine, an adjustable assembly including a work engaging roller and a carriage journaling the roller, a frame on which the carriage is slidably mounted for rectilinear adjustment relative to the work, and means for varying the forward position of the carriage in accordance with the radius of the roller, said means comprising a cramping linkage for the adjustable assembly and forward biasing means for the assembly and the linkage, the linkage including a front link pivoted to the frame and abutting the assembly at a fixed distance in front of the roller axis, a rear link also pivoted to the frame and having a follower element engaged with the periphery of the roller at the rear of the roller axis, and means connecting the front link to the rear link in reduced motion ratio relative to the follower element, whereby the linkage and the assembly are mutually interlocked against forward adjustment beyond a limit position determined by the radius of the work engaging roller.

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