July 16, 1963 R. WINKLER ETAL 3,097,578

APPARATUS FOR FOLDING THE CLOSURE FLAPS OF ENVELOPES AND SIMILAR ARTICLES

Filed Nov. 10, 1960

3 Sheets-Sheet 1

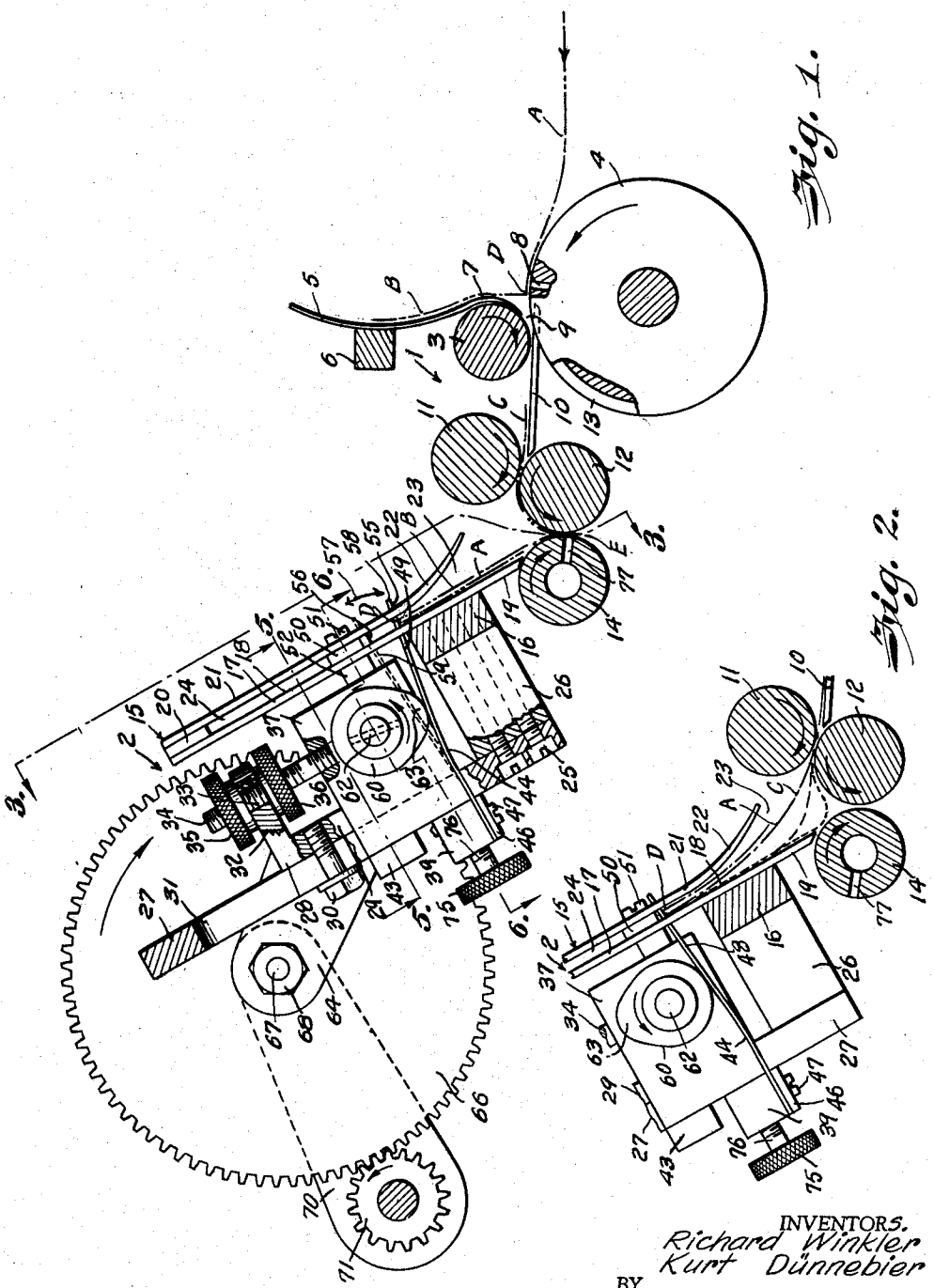


Fig. 1.



Fig. 2.

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3 Sheets-Sheet 2

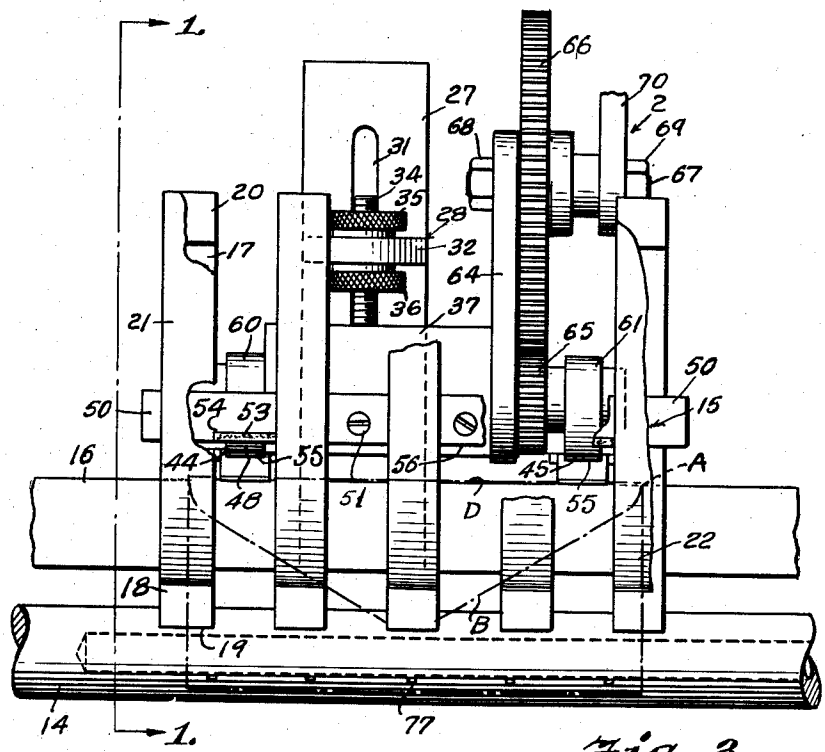



Fig. 3.

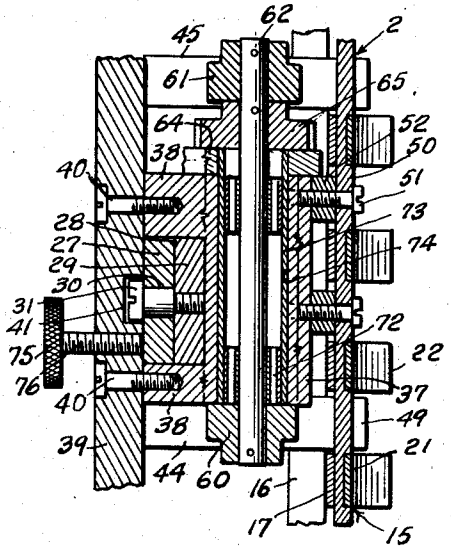



Fig. 6.

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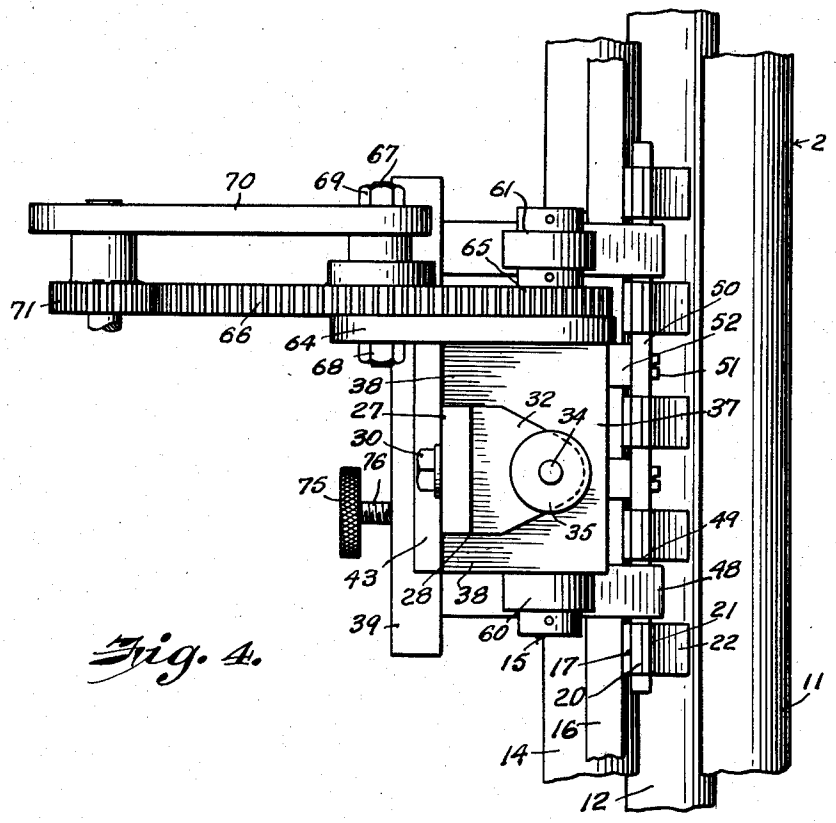



Fig. 4.

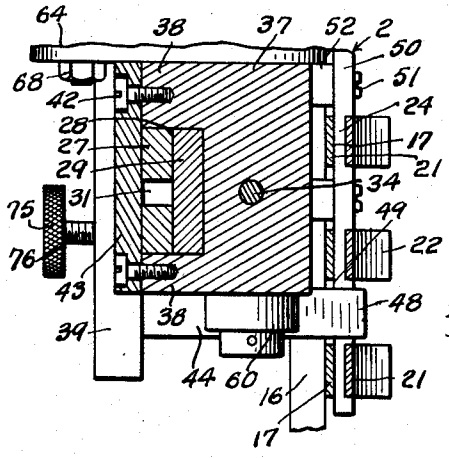



Fig. 5.

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United States Patent Office 3,097,578 Patented July 16, 1963



3,097,578

# APPARATUS FOR FOLDING THE CLOSURE FLAPS OF ENVELOPES AND SIMILAR ARTICLES

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5 Claims. (Cl. 93—62)

This invention relates to machines for making envelopes, flat bags, and like articles having closure flaps, and particularly to a mechanism thereof for folding the closure flaps at higher speeds than are practical with present mechanisms. In envelope making machines of this character, folding of the closure flap is a final operation before the finished envelopes are discharged from the machines. In early envelope making machines, this was accomplished by a reciprocatory blade that engaged the crease line of the closure flaps to produce a flold between a pair of oppositely rotating rollers that seized the fold and passed the envelope therebetween to thereby crease the fold and flatten the closure flap against the body of the envelope. When the speed of such mechanisms was increased to increase the output capacity of the machine, the comparatively heavy reciprocatory folding blade led to irregular running of and heavy wear upon the machine because of the great forces necessary to effect its reciprocatory movement.

More recently the so-called method of "upset folding" has been used, wherein an envelope with the closure flap provided with a line of crease is advanced, with the folded edge of the bottom of the envelope leading and the closure flap trailing. The forward movement of the envelope is interrupted by a stop the instant that the crease line is in position between a pair of oppositely rotating rollers. At this point one of the rollers is intended to grip the closure flap while the other engages the body of the envelope, to bend the closure flap on the line of crease to start the fold and to complete the fold by feeding the envelope between the folding rollers. But here again, when the speed is increased to obtain a greater output of the envelope making machine, trouble arises in that the portion of the envelope to be seized by the folding rollers does not run quickly enough between the folding rollers, and as a result the fold does not coincide with the crease line. In addition, the high speed of the envelope and the sudden engagement with the stop damages the folded edge of the bottom of the envelope.

It is, therefore, the principal object of the present invention to provide a mechanism for folding the closure flaps of envelopes at the high speeds which are so desirable in present day envelope making machinery, without damaging the envelopes and which assures accurate folding of the closure flaps at such higher speeds.

In accomplishing this object of the invention, envelopes are advanced as in the case of the "upset folding" method and the bottom edge of an envelope is run into a slot to the position of a fixed stop, but the speed thereof is slowed down prior to contact with the stop, and a reverse thrust is effected upon the bottom edge of the envelope by means that is separate from the fixed stop to assure positive contact of the envelope with the folding rollers in exact time therewith, so the blank is properly creased to produce the fold coincident with the line of score.

In carrying out the invention, the folded edge of an envelope is brought into contact with moving elements that slow down the speed of the blank before it makes contact with the fixed stop element and which imparts a reverse thrust on the envelope that assures proper contact of the envelope with the closure flap folding rollers. A



preferred embodiment of the moving elements constitutes vibratory members, such as leaf springs set in vibration mechanically by rotary elements, operating in time with the mechanism by which the envelope is advanced through the machine to the closure flap folding rollers, as disclosed in the accompanying drawings, wherein:

FIG. 1 is a longitudinal section of a closure flap folding mechanism embodying the features of the present invention and which is adapted to form a part of a high speed rotary envelope making machine, the section being taken on the line 1—1 of FIG. 3 and showing the vibratory elements in position for retarding movement of an envelope prior to contact with the stop element therefor.

FIG. 2 is a fragmentary section similar to FIG. 1, but showing movement of the vibratory elements to impart a thrust on the folded edge of the blank for urging the body and flap portions thereof into contact with the folding rollers.

FIG. 3 is a fragmentary cross section on the line 3—3 of FIG. 1.

FIG. 4 is a partial plan view of the mechanism.

FIG. 5 is a detailed section on the line 5—5 of FIG. 1.

FIG. 6 is a similar section on the line 6—6 of FIG. 1.

Referring more in detail to the drawings:

1 designates a bottom closure flap mechanism which forms a part of an envelope making machine, and 2 designates a closure flap folding mechanism embodying the present invention.

The mechanism 1 includes upper and lower rollers 3 and 4 and bottom flap guide means 5. The rollers 3 and 4 are suitably journaled in the side frames of the envelope making machine and driven in timed relation therewith. The guide means 5 is carried on a transverse bar 6 that is positioned above the roller 3 and which has its ends supported by the side frames of the machine. The guide means 5 curves upwardly over the roller 3 and the lower portion 7 thereof curves reversely around the periphery of the roller 3 and terminates just above the periphery of the roller 4. Envelope blanks A are delivered to the bottom flap folding mechanism 1 with the bottom flaps B in leading position, with the closure flaps C thereof in trailing position, and with the side flaps gummed and folded over the body portions of the blanks. The bottom flaps are directed upwardly of the guide means 5 until the crease line point of fold D for the bottom flap is in position for the body portion of the blank to be engaged slightly rearwardly of the crease line by suction through suction ports 8 in the periphery of the roll 4, whereupon the seized portion of the blank begins to travel with the roller 4 to fold the blank along the crease line to pass the fold under the lower curved ends of the guide means and into a pass 9 formed between the roller 3 and guides 10. The suction through the ports 8 is controlled intermittently in time with the envelope machine, to suspend the suction at the time the fold is engaged by the upper roller 3. The blank is moved by the roller 3 along the guides 10 and between rollers 11 and 12 of the closure flap mechanism 2. The rollers 11 and 12 crease the bottom fold D and press the bottom flap B into sealing contact with the side flaps to complete the body of the envelope. The rear ends of the guides 10 are positioned in peripheral grooves 13 of the roller 4 to facilitate diversion of the envelopes from the roller 4.

The closure flap folding mechanism 2 includes the upper and lower rollers 11 and 12 at the forward ends of the guides 10, a suction roller 14 cooperating with the roller 12 to effect folding of the closure flaps C as later described, and an apparatus 15 for switching the envelopes to move between the rollers 12 and 14 and to insure positive engagement of the body and closure flap portions C of the envelopes in timed relation with the suction roller 14.

The rollers 11, 12 and 14 are also journaled in the

side frame and are all driven at the same peripheral speed as the rollers 3 and 4.

The apparatus 15 is supported on a cross bar 16 having its ends attached to the side frames of the envelope machine and inclined in a plane substantially parallel with a plane tangent to the suction roller 14.

Carried on the cross bar 16 is a trap including laterally spaced apart guide bars 17 having faces 18 (FIGS. 1 and 2) located in a common plane substantially tangent with the side of the suction roller 14 that faces the roller 12, as shown in FIG. 1. The guide bars 17 are attached rigidly to the cross bar 16 and have their lower ends 19 extending up to the suction roller 14. The upper ends of the bars 17 extend a substantial distance above the cross bar 16 and carry spacers 20 for attaching the upper ends of guide bars 21 that are positioned above each of the guide bars 17 and have rearwardly curved lower ends 22 curving away from the lower ends 19 of the guide bars 17 to provide a throat 23 leading upwardly into a slot-like space 24 to accommodate the envelopes therein as they are fed between the rollers 11 and 12, as when changing the direction of travel of the envelopes A as later described.

Attached to the cross bar 16 on the opposite side to the guide bars 17 by means of screws 25 is a block 26 (FIGS. 1 and 2). Also fastened to the block 26 by the screws 25 is an upwardly inclined plate 27 extending parallel with the guide bars 17 and in forwardly spaced relation thereto, to accommodate therebetween an angle bracket 28 having one leg 29 seated on the plate 27 and adjustably secured thereto by screws 30 that extend through an elongated slot 31 extending longitudinally of the central portion of the plate 27. It is obvious that by loosening the screws 30, the angle bracket may be adjusted up and down the plate 27, for a purpose later to be described.

The other leg 32 of the angle bracket 28 projects toward the guide bars 21 and has an opening 33 therein. Extending loosely through the opening 33 is a threaded stud 34 carrying thereon knurled nuts 35 and 36 engaging the opposite faces of the projecting leg 32 of the bracket, for adjustably supporting the stud 34 in the opening 33. Fixed to the lower end of the stud 34 is a bearing block 37 having side flanges 38 embracing the side edges of the leg 29 of the angle bracket 28 and the side edges of the plate 27.

Extending transversely of the flanges 38 across the side of the plate 27 opposite the bearing block 37 is a lower rail 39 that is secured to the flanges 38 by fastening devices such as screws 40 (FIG. 3). The midportion of the transverse rail 39 has a recess 41 to slide over the heads of the lower screws 30 when the bearing block 37 is adjusted relatively to the angle bracket 28, as later to be described.

Also attached to the side flanges 38 of the bearing block 37 by screws 42 is an upper transverse rail 43 that cooperates with the lower guide rail in maintaining the bearing block in sliding position upon the leg 29 of the angle bracket (see FIGS. 1, 2, 3, 4 and 5). The upper transverse rail 43 needs to be only the width of the bearing block 37, however, the lower transverse rail 39 should be approximately the width of the slot-like opening 24, since it is used for attaching ends of flat leaf springs 44 and 45 thereto by straps 46 and screws 47. The screws 47 extend through the straps 46 at the respective sides of the leaf springs to clamp the leaf springs to the under side of the rail 39. The opposite ends 48 of the leaf springs 44 and 45 extend along the sides of the lower portion of the bearing block 37 and project through the spaces 49 that are provided between the outermost guide bars 17 and 21 and the next adjacent inner guide bars, as shown in FIGS. 3 and 4. The ends 48 thus project across the slot-like space 24.

Extending transversely within the slot-like space 24 above the projecting ends 48 of the leaf springs is a stop rail 50 that is secured rigidly to the bearing block 37 by means of screws 51 and spacers 52, the spacers being located in the spaces between the guide bars 17. Soft rubber pads 53 (FIG. 3) are inserted in notches 54 in the lower edge of the stop rail 50 to serve as dampeners for the leaf springs 44. The leaf springs 44 are so tensioned that in relaxed position they press into the soft rubber pads 53 to at least the thickness of the leaf springs, so that the bottom faces 55 of the leaf springs are in plane with the lower face 56 of the stop rail. This is to allow an envelope, on entering the slot-like space, to engage the lower face 56 of the stop rail along the width of the envelope, and not to merely engage against the leaf springs. The leaf springs swing up and down within the slot 24 as indicated by the double headed arrow 57 (FIG. 1) between a lowest position, designated by the full line 58, and a highest position, designated by the dotted lines 59, at which the leaf springs 44 inset themselves into the rubber pads 53. The leaf springs 44 are caused to move from the highest to lowest position by cams 60 and 61 that are fixed to a shaft 62 which is journalled in the bearing block 37 (see FIGS. 1, 2, 3 and 4), the cams being located directly above the leaf springs so that the high lobe portions 63 act to push the springs downwardly to the lowest position 58, as shown in FIG. 1, and the lowest portion of the cams allow the leaf springs to spring upwardly to their highest position 59, where they are inset into the resilient pads 53 responsive to the spring action, so that the lower faces are in alignment with the lower edge face 56 of the stop rail 50.

Pivoted axially of the shaft 62 at one side of the bearing block is a link 64, and fixed to the shaft 62 alongside of the link 64 is a pinion gear 65, meshing with the larger gear 66 that is rotatably carried on a pin 67 held on the outer end of the link 64 by a nut 68. Secured to the outer end of the pin by a similar nut 69, is a link 70, the other end of which is concentrically fixed relatively to a drive pinion 71 and which maintains meshing relation with the teeth of the gear 66. The links 64 and 70 thus provide a scissor-like arrangement to retain the gears in intermeshing relation during adjustment of the bearing block 37. The shaft 62 is preferably mounted for rotation in needle roller bearings 72 that are carried in the ends of a sleeve 73 which is pressed into a transverse opening 74 of the bearing block 37. The link 64 is preferably mounted on a projecting end of the sleeve 73, so that the position thereof is not influenced by the rotating shaft 62.

The knurled nuts 35 and 36 are used for fine adjustment in positioning the stop rail 50 within the slot-like opening between the guide bars, and the bearing block which carries the stop rail is secured to the plate 27 and the leg 29 of the angle bracket 28 by a knurled screw 75, having the shank 76 thereof threaded in the lower rail 39 and bearing against the plate 27, as shown in FIG. 6, to secure the bearing block and the stop rail carried thereby in its finally adjusted position. An initial adjustment of the bearing block 37 may be obtained by loosening the knurled screw 75 and the screws 30 which extend through the slot 31 of the plate 27. After the initial adjustment, the screws 30 are retightened, and after the fine adjustment by the knurled nuts 35 and 36, the knurled screw 75 is retightened to hold the adjustments.

The suction roller 14 is provided with suction ports 77 and the roller is so timed that when an envelope A is in the slot-like opening or pocket 24, and the folded edge D of the bottom flap is contacting the stop rail 50, the suction ports 77 will engage the body portion or face side of the envelope adjacent the line of fold E of the closure flap C to carry the envelope A between the rollers 12 and 14 in effecting fold of the closure flap on the line of fold E as now to be described.

In using the apparatus for holding the closure flap C of a given size envelope A, the bracket 28 is adjusted upon the plate 27. This adjustment is effected by loosening of the screws 30 and knurled screw 75. The bracket can be then moved to an appoximate position along the plate

27, where the bottom fold D just touches the bottom edge 56 of the stop rail 50 when the fold line E is over the rollers 12 and 14. Movement of the bracket 28, of course, carries the bearing block 37 therewith, because of its connection by means of the stud 34. This movement changes the position of the shaft 62 relatively to the drive gear 71, but meshing engagement of the gears 71, 66 and 65 is maintained by the scissors action of the links 64 and 70 because the links fix the axial spacing between the shaft 62 and pin 67 and between the drive shaft of the gear 71 and the pin 67. A finer adjustment of the stop rail 50 is maintained by adjusting the knurled nuts 35 and 36 on the threaded stud 34. After proper adjustment has been ascertained, the knurled screw 75 is tightened to clamp the bearing block 37 on the plate 27.

After proper adjustment and with the machine in operation, the envelope blanks are individually delivered in regular manner with the bottom flaps B leading and the closure flaps C in trailing position, with the side flaps (not shown) folded over the body portion of the blank and the side flaps have been provided with an adhesive preparatory to adhering the bottom flap thereto. These operations are all performed as standard procedure in the envelope making machine, and specifically form no part of the present invention.

Upon passage of the blanks to the suction roller 4, the bottom flap B is directed in a manner to run upwardly of the curved guide 5, and when the fold line D is in position for the ports 8 to engage the body of the envelope on the trailing side of the line of fold, suction is established through the ports 8 to grip the body portion of the blank. This breaks the blank on the line of crease or fold, and continued movement of the blank under seizure of the suction through the ports 8 causes the fold to enter between the rollers 3 and 4 and through the pass 9 in guided relation with the guides 10. On continuing movement of the blank, the bottom flap is folded over the adhesive areas on the side flaps. At this time the suction through the ports 8 is cut off. As the fold enters the bight between the rollers 11 and 12, the fold is creased and the bottom flap is pressed into firm contact with the gum on the side flaps. Continued movement of the blank between the rollers 11 and 12 causes the folded bottom edge of the envelope to be engaged by the lower ends of the guides 17 and be deflected thereby upwardly through the throat 23 and into the slot 24, where the folded edge first comes into contact with the vibratory leaf springs 49. Rotation of the shaft 62 is so timed that the high lobes of the cams have moved the leaf springs to their lowermost position and the leaf springs are starting their upward movement under their own action within the slot-like opening 24 to gradually slow down the envelope before it comes in contact with the lower edge 56 of the stop rail. As previously stated, the leaf springs are so tensioned that they will impress themselves, at least the thickness thereof, into the resilient pads 53, so that the folded edge contacts the stop rail along the entire width of the envelope to assure that the envelope is realigned with the folding rollers.

It is obvious that the envelope is eased toward a stop by the leaf springs before it comes into contact with the stop rail. Ample lag in the operation of the leaf springs is provided to allow realignment of the envelope with the stop rail before the high lobes 63 of the cams again come into contact with the leaf springs. During this interval the rollers 11 and 12 continue feed of the closure flap therebetween, which, with stopping of the envelope by the stop rail 50, causes buckling of the closure flap downwardly because of the crease line in the closure flap. By this time the high lobes of the cams begin to move the leaf springs downwardly to exert a downward thrust on the bottom fold of the envelope, to reverse movement thereof in the pocket. This downward thrust cooperates with the thrust of the rollers 11 and 12 and assures that the buckle in the closure flap makes positive contact with the folding roller 14.



The suction ports of the roller 14 have now moved into contact with the front face side of the envelope adjacent the crease line to seize the envelope thereto and cooperate with the downward thrust of the leaf springs in transporting the buckled portion of the closure flap between the folding rollers 14 and 12 with the fold taking place along the crease line. Continuing movement creases the fold between the rollers 14 and 12 and the entire envelope is passed therebetween for discharge from the closure flap folding mechanism. The suction through the ports 77 is automatically suspended at the time the suction ports 77 are at or just past the tangent point of the rollers 12 and 14.

The timing is such that, after one envelope has cleared the path of the following envelope, the above described operations are carried out on the following envelope. Thus one envelope after another is folded in rapid sequence.

It is to be noted that the leaf springs 44 and 45 retard the envelopes under control of the low lobe portions of the cams, but that the actual stopping and positioning of the envelopes relatively to the folding rollers 12 and 14 is by contact with the fixed rail 50. Also, the reverse thrust on the envelopes is imparted solely by the leaf springs 44 and 45 as they move the envelopes away from the fixed stop rail 50 upon contact of the high lobe portions of the cams with the leaf springs. Since the stop bar is fixed, the alignment and reverse starting point is always the same, to assure accurate fold of the closure flaps by the folding rollers 12 and 14.

The invention is not restricted to the embodiment illustrated diagrammatically by way of example. Above all, the number of the leaf springs and the driving mechanism for their swinging movement may be selected differently without departing from the idea of the invention as a result. In certain circumstances, the kinetic energy contained in the envelopes rapidly approaching the stop rail 50 may be used to set the leaf springs in vibration.

What we claim and desire to secure by Letters Patent is:

1. An apparatus for registering and folding the closure flap of an envelope in which side and bottom flaps of the envelopes have been previously folded and sealed in completing the body of the envelope, said apparatus including a pair of counter-rotating folding rollers having a pass therebetween, an inclined trap above the folding rollers and having a lower guide means terminating substantially tangentially with the periphery of one of the folding rollers and having an upper guide means terminating to provide an entrance to said trap, a feed roller cooperating with the other of said folding rollers to provide a pass into said entrance of the trap through which the envelope is directed under driven contact by the said other folding roller and the feeding roller with the folded edge of the bottom flap leading into said trap and sliding upon the lower guide means and with the closure flap trailing between said rollers, laterally spaced apart leaf springs extending resiliently across the trap to be engaged by the fold of the bottom flap of the envelope, rotatable cam means having low lobe portions for controlling movement of the leaf springs in movement with the envelope into said trap to exert a yieldable retarding pressure upon said bottom fold in opposition to feed by said feed roller and the other of said folding rollers to maintain the body of the envelope in contact with the lower guide means, a stop rail extending transversely of said trap to provide the ultimate stop for the envelope to assure alignment of the envelope with respect to the folding rollers, resilient pads carried by the stop rail for impress therein of the leaf springs for contact of the envelope with the stop rail, said cam means having high lobe portions to reverse movement of the leaf springs to start the envelope from said trap and buckle the closure flap into the bight between the folding rollers, and suction means carried by the said one folding roller for engaging the body of the envelope near the fold to be imparted in the buckled closure flap to carry the body of the envelope between

the folding rollers for folding and creasing the trailing closure flap.

2. An apparatus for registering and folding the closure flaps of envelopes having the bottom and side flaps previously folded and sealed to complete the bodies thereof, said apparatus including a pair of folding rollers, means for conveying the envelopes in spaced apart relation across the folding rollers with the bottom fold leading and the closure flap trailing, a trap over the folding rollers to receive the body of the leading envelope therein, a stop rail extending transversely within the trap, means mounting the stop rail in fixed position relatively to the folding rollers, a cam having rotatable support on said mounting means about an axis extending transversely of the trap, and a leaf spring carried by the mounting means and bearing against the cam on the side facing the folding rollers, said leaf spring having a free end extending into the trap for engaging the bottom fold of the envelope moving into the trap to retard said envelope under control of a low lobe portion of the cam as the leaf spring is stopped by the stop rail to register the envelope with the folding rollers, said cam having a high lobe portion following the low lobe portion to apply a reverse thrust on the envelope through the leaf spring for buckling the closure flap into contact with the folding rollers for engagement thereby to carry the envelope and its closure flap therebetween for folding the closure flap into contact with the body of the envelope.

3. An apparatus for registering and folding the closure flaps of envelopes as described in claim 2, and including a resilient pad carried by the stop rail for contact by the free end of the leaf spring, the action of said leaf spring being sufficient to press the leaf spring into the pad so that the bottom fold of the envelope comes into direct contact with the stop rail when registering the envelope with the folding rollers.

4. An apparatus for registering and folding the closure flap of an envelope having the side and bottom flaps previously folded and sealed in completing the body thereof, said apparatus including a pair of counter-rotating folding rollers providing a bight therebetween, a trap above the folding rollers and having a lower guide means terminating substantially tangentially with the periphery of one of the folding rollers and having an upper guide means terminating to provide an entrance to said trap, a



feed roller cooperating with the other of said folding rollers to direct the envelope into said trap with the bottom fold leading and sliding along the lower guide means, a stop rail fixed between the guide means in parallel relation with said rollers, laterally spaced apart cams having high and low lobe portions, means for rotatably mounting the cams on an axis extending transversely of the trap, leaf springs each having one end fixed with respect to said mounting means and extending in contact with the cams on the side of the cams nearest the folding rollers and with their other ends projecting across the trap to be engaged by the fold of the bottom flap of the envelope and having spring action to carry the free ends into engagement with the stop rail under control of the low lobe portions of the cams to retard the envelope prior to contact with the stop rail, said high lobe portions following the low lobe portions to apply a reverse thrust of the leaf springs on the envelope for reversing movement of the envelope and for buckling the closure flap into positive contact with the folding rollers, and suction means carried by the said one folding roller for engaging the body of the envelope near the fold to be imparted in the closure flap to carry the body of the envelope and the closure flap between the folding rollers for folding the closure flap into contact with the body of the envelope.

5. An apparatus for registering and folding the closure flaps of envelopes as described in claim 4, wherein the stop rail has recesses in the portion thereof to be contacted by the bottom fold of the envelope and located in registry with the leaf springs, and including dampening pads in said recesses, said action of the leaf springs being sufficient to press the leaf springs into the dampening pads so that the bottom fold of the envelope directly contacts the stop rail.

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