# United States Patent

[11] 3,583,124


[72] Inventor **Wilbur J. Morrison**
**Nazareth, Pa.**



[21] Appl. No. **865,379**
[22] Filed **Oct. 10, 1969**
[45] Patented **June 8, 1971**
[73] Assignee **Bell & Howell Company**
**Chicago, Ill.**


[54] **ENVELOPE FLAP OPENING APPARATUS AND METHOD**
**7 Claims, 8 Drawing Figs.**


[52] **U.S. Cl.** ..... **53/3,** 53/67, 53/381
[51] **Int. Cl.** ..... **B65b 43/26**
[50] **Field of Search** ..... 53/3, 29, 38, 63, 67, 187, 381, 382, 386



[56] **References Cited**
UNITED STATES PATENTS

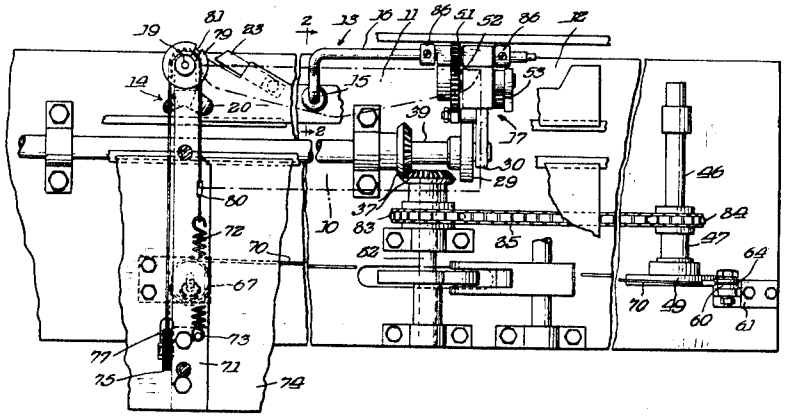
2,949,714 8/1960 Davis ..... 53/187X
3,368,321 2/1968 Sather et al. ..... 53/386X



*Primary Examiner*—Theron E. Condon
*Assistant Examiner*—E. F. Desmond
*Attorney*—Jack H. Hall



**ABSTRACT:** An envelope flap opening apparatus for opening the closed flap of an envelope prior to insertion of a media is provided for use in an automatic mailing machine. The apparatus provides a suction member having a suction cup mounted on a hollow horizontal rotatable shaft for engaging and lifting the envelope flap into a partially open position, and a blade member secured to the end of a vertical rotatable shaft which is positioned adjacent to the suction member and serves to further open the envelope flap as it is released by the suction member. In addition, a detection assembly is provided to detect either the absence of an envelope or the failure of the suction cup to open the envelope flap and to automatically shut down the mailing machine when either condition exists.

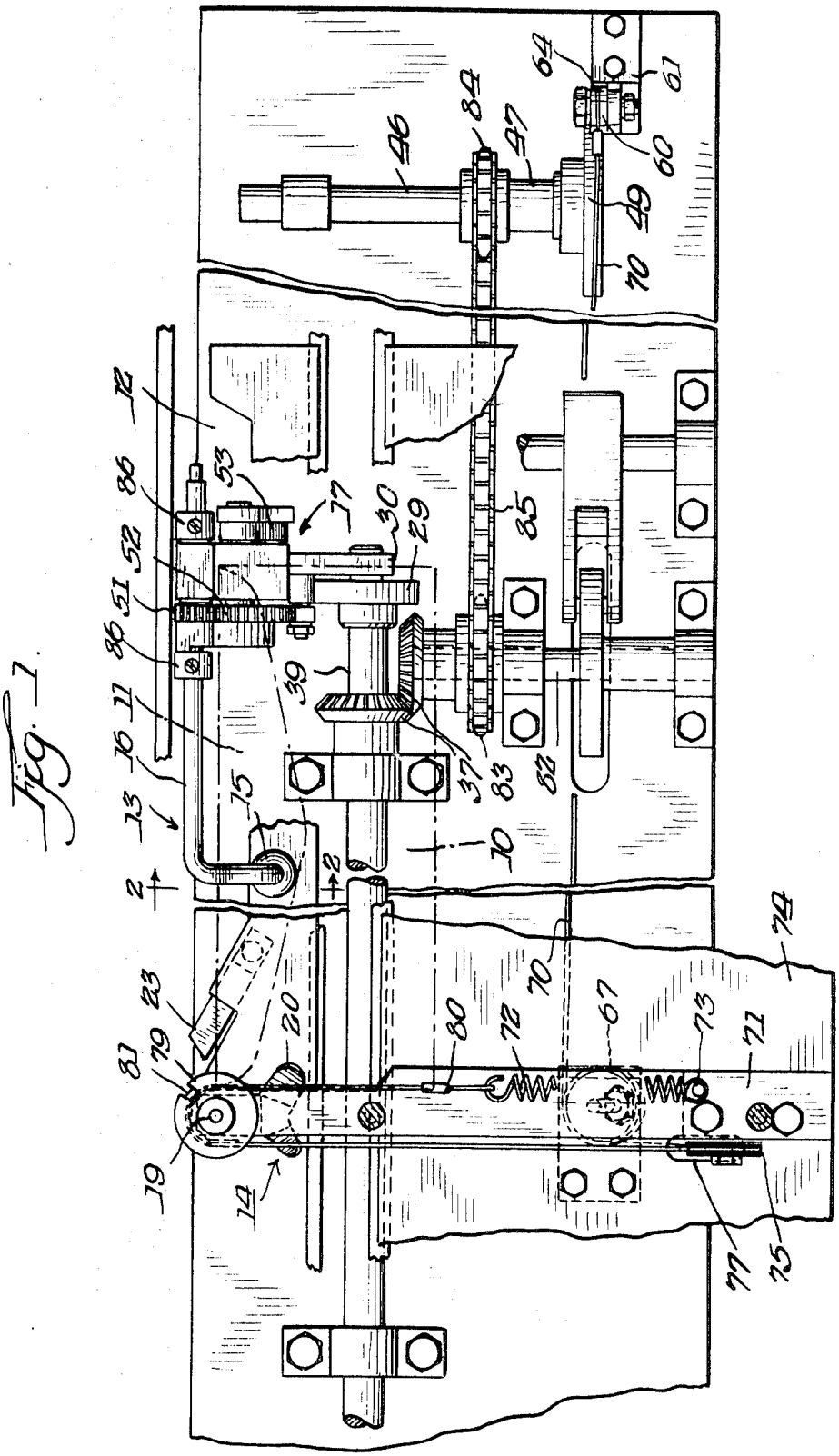

64
61
84
96
47
60
49
70
12
53
86
77
30
29
85
52
51
86
39
11
16
37
83
82
13
75
10
2
2
74
70
23
20
80
72
67
73
71
81
79
19
14
77
25

Fig. 1.

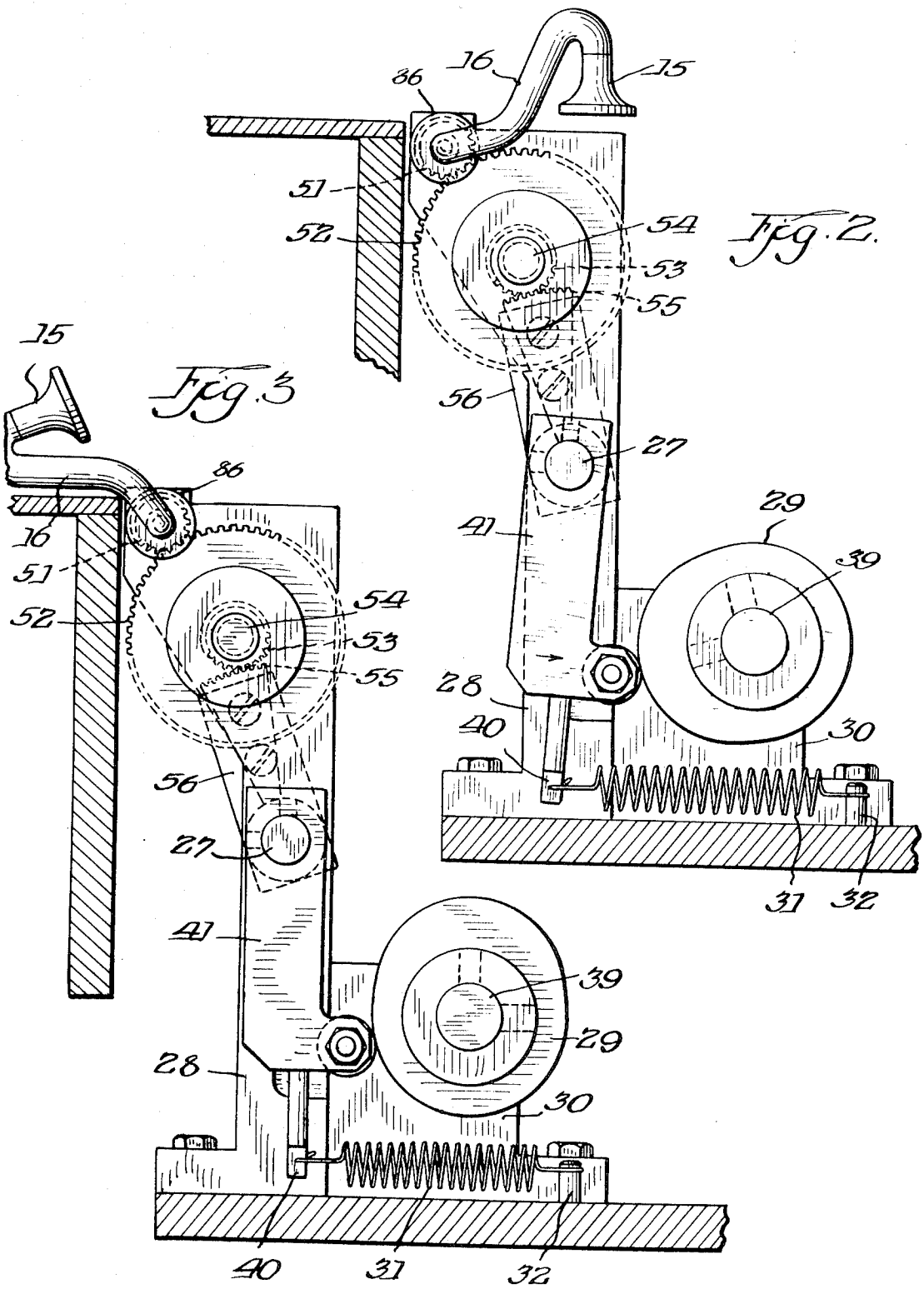



Fig. 2.

Fig. 3

Fig. 4

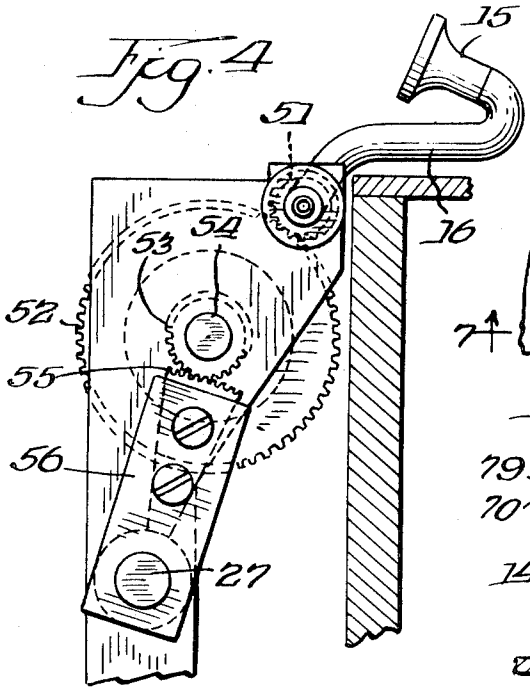
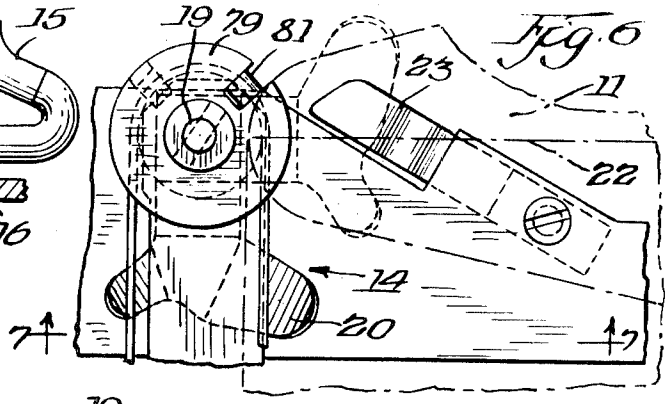



Fig. 6



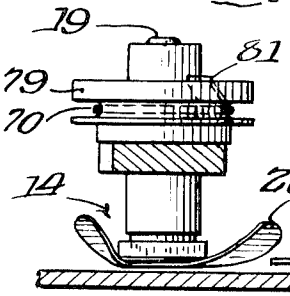




Fig. 7.

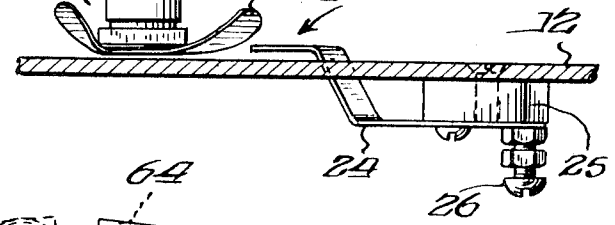
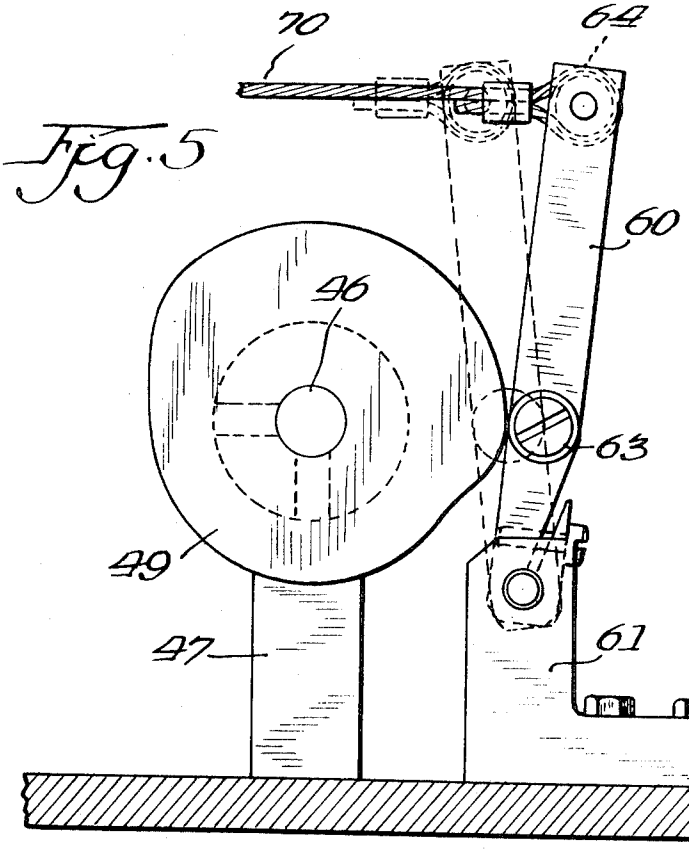



Fig. 5



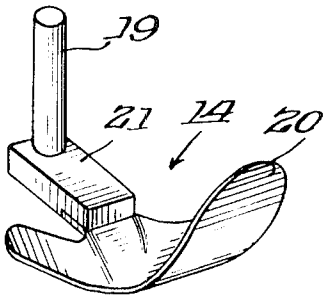




Fig. 8.

# ENVELOPE FLAP OPENING APPARATUS AND METHOD

## BACKGROUND OF THE INVENTION

This invention relates to the automatic and rapid insertion of letters and other media into their accompanying envelopes prior to closure and mailing. More particularly, the invention concerns an apparatus and method for opening envelope flaps by the sequential use of a rotatable suction cup and blade which first open an envelope flap and then cause it to maintain its open position prior to insertion of the media.

High throughput mailing machines of the type exemplified in U.S. Pat. No. 2,325,455 to A. H. Williams, marketed as "-Phillipsburg Inserters," are in widespread use. Such machines often utilize the direct application of mechanical forces to various points on envelopes being processed in order to effect their rapid opening prior to insertion of a letter or the like. For example, a mechanical cam is often used to apply a force to the top portion of an envelope flap in order to automatically crack open the flap as it is passed along a moving track. Frequently, moisture which accumulates under the glued portion of the envelope flap causes the envelope flaps to seal, and mechanical pressure applied by such cams is normally insufficient to break the seal and thus open the flap. Other flap opening devices are likewise incapable of high reliability opening. Thus, for example, flap openers using stationary knife blades to open envelope flaps, by first passing the closed envelope under the blades and then reversing the stroke of the envelope-carrying conveyor to cause the blades to contact and force open the envelope flap, often fail to open the flap when it has become partially sealed by moisture. Accordingly, the use of such mechanical pressure opening devices and stationary knife blades present significant drawbacks when high speed, large volume mailing is desired.

The present invention overcomes many of the difficulties of such prior art flap opening devices by utilizing the combined effect of a rotatable suction cup which engages the envelope flap and pulls it into a partially open position, and a positive opening rotatable blade which fully opens the envelope flap and maintains the flap in its open position. Although prior art opening devices have employed pneumatic suckers and the like to open envelope flaps, the operational features of such devices vastly limit the speed at which envelopes can be processed. Thus, for example, the combination of a pneumatic flap opening sucker assembly which fully opens an envelope flap and a flap holddown bar which holds the flap in its open position normally function at extremely slow processing speeds relative to the apparatus of the invention. Therefore, the present invention combines both the high speed operation and positive blade opening characteristics desired in large volume mailing operations.

## SUMMARY OF THE INVENTION

According to this invention there is provided a positive envelope flap opening apparatus which is made up of at least the following components:

a. an indexing-type conveying assembly which intermittently moves a series of envelopes having closed flaps through the apparatus;

b. a suction member which has a suction cup mounted on a hollow, horizontal, rotatable shaft and is adapted for rotation about the axis of the shaft;

c. a blade member which is secured to the end of a vertical rotatable shaft and which is in a position adjacent to the suction member;

d. an assembly for rotating the hollow, horizontal shaft so that the suction cup mounted on the shaft can engage the envelope flap and lift it into a partially open position;

e. an assembly for applying a vacuum through the hollow shaft and the suction cup as the cup engages the flap; and

f. an assembly for rotating the vertical shaft carrying the blade member into a position in which the blade member extends over the crease in the envelope flap and thus fully opens the flap and maintains the flap in an open position as it is released by the suction member. The intermittently operating, indexing-type conveying assembly referred to above is well known in the art. Since a further explanation will not be necessary for persons skilled in the art to practice the invention, it will suffice to point out that one such conventional mechanism is shown in the previously mentioned Williams patent, the disclosure of which is hereby incorporated by reference.



The sequential steps involved in opening the envelope flaps by the method of this invention include: the transmission of an envelope through the flap opening apparatus, the contacting of a suction cup and the envelope flap, followed by the application of a vacuum to the suction cup to effect its engagement with the flap, the rotation of the horizontal shaft carrying the suction cup to partially open the flap, the rotation of a blade member which contacts the partially opened flap, completes the opening operation, and maintains the flap in an open position. Finally, the vacuum on the suction cup is released as the blade member contacts the flap and begins to move the flap into a fully opened position.

In addition, a detection assembly, actuated by the rotary blade member, is provided for the flap opening apparatus of this invention to detect both the absence of an envelope in proper position for opening and the presence of an envelope, which has not been opened by the rotating suction member. In either instance, the detection assembly causes an automatic shut down of the entire mailing machine operation.

Numerous advantages result from the use of the flap opening apparatus and method of this invention. For example, the combination of a rotatable suction type opening member and blade member for retaining the open position of the envelope flap provide a relatively efficient, low maintenance, highly reliable assembly required in high speed, large volume mailing operations. In addition, the use of a suction cup rather than mechanically applied pressure to open the envelope flap overcomes the inherent opening difficulties which result from partially sealed envelopes. Since a sufficient vacuum is maintained in the suction cup to assure engagement of the flap and suction cup, the instances of failures in opening a flap are sharply reduced. Moreover, the use of the rotating blade member assures that the opened flap will retain its open position prior to transmission of the envelope to an inserting point.

Since the use of a detection assembly actuated by the rotating blade member permits the rapid detection of a closed envelope flap during a dwell time in the overall operating cycle, the mailing machine can be shut down before the closed envelope is passed to the inserting point where a media is placed in the envelope. This early detection feature permits an operator to locate and correct any operational difficulty before a more serious jamming occurs at the insertion point.

## BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be more readily understood by reference to the accompanying drawings:

FIG. 1 is a fragmentary plan elevation of one form of the flap opening apparatus suitable for practicing this invention with parts of the supporting table broken away;

FIG. 2 is a transverse cross section taken along line 2–2 of FIG. 1 and showing a gear and cam assembly used to drive the suction member. In addition, FIG. 2 shows the suction member in position to engage and open an envelope flap;

FIG. 3 is a transverse cross section taken along line 2–2 of FIG. 1 but showing the suction member in a rotated position after an envelope flap has been partially opened;

FIG. 4 is an opposite side elevation of FIG. 3 showing the gear and cam assembly used to rotate the suction member;

FIG. 5 is a side elevation view of the cam assembly used for rotating the blade member;

FIG. 6 is an enlarged plan view of the rotating blade member and envelope detector assembly showing in dashed lines the position of the blade member extending over the crease of the envelope flap as it contacts an open flap and maintains the flap in open position;

FIG. 7 is an elevational view taken on line 7–7 of FIG. 6 showing the rotatable blade member and envelope detector assembly;

FIG. 8 is a detail of the rotatable blade member showing its flat horizontal body and associated head portion which rises vertically above the horizontal plane of the body.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more specifically to the drawings, FIG. 1 illustrates an arrangement of parts in a high-speed, high-volume envelope flap opening apparatus. Envelope 10 shown in dashed lines and having a closed flap 11 is moved along flat deck 12 until it is stopped for a dwell period in a suitable position beneath suction member 13 and blade member 14 to begin the flap opening operation. Suction member 13 is equipped with a suction cup 15 mounted on a hollow, horizontal rotatable shaft 16. Drive assembly 17 for suction member 13 rotates shaft 16 and thus moves suction cup 15 into either position for engagement with the envelope flap as shown in FIG. 2 or into a rotated position shown in FIG. 3 after partial opening of the flap has taken place. Similarly, blade member drive assembly 18 causes blade member 14 to rotate about vertical shaft 19 into position of contact and noncontact with envelope flap 11 as shown in FIG. 6.

In operation, the envelope flap opening apparatus is adapted to pass a plurality of envelopes in succession along deck 12 until the leading edge of a first envelope 10 is adjacent to blade member 14 and envelope flap 11 is in position to make contact with suction cup 15. At this point, the envelope is stopped for a dwell period in the machine cycle to permit the suction cup to engage the envelope flap. As the suction cup is rotated on shaft 16 in the direction for contact with envelope flap 11, a vacuum is applied through hollow shaft 16 and suction cup 15 to assure the firm engagement of the suction cup and flap. Normally, a vacuum pump is connected to hollow shaft 16 to apply the suction effect in suction cup 15 as it makes contact with flap 11. After engagement of the suction cup and flap, shaft 16 is rotated approximately 115° by suction member drive assembly 17 to break any seals formed between flap 11 and envelope 10 and to move flap 11 into a partially open position. As the envelope flap is opening, blade member drive assembly 18 rotates shaft 19 in the direction of flap 11 until the vertical head portion 20 of blade member 14 contacts the leading edge of the partially opened flap. The blade member then forces the flap to a fully opened position. In addition, when blade member 14 is in the fully rotated position shown in FIG. 6, the vertical head portion 20 of the blade member is sufficiently extended over the crease 22 of envelope flap 11 to hold the flap in a fully opened position.

After the suction cup 15 has been fully rotated 115° to partially open the flap, the vacuum in shaft 16 and suction cup 15 is interrupted long enough to cause a pressure equalization at the contact point between the flap and suction cup and to cause the suction cup to release the opened flap. Then when the opened envelope flap 11 has been released by the suction cup and fully opened by blade member 14, the opened envelope is rapidly passed in the direction of the blade member toward an insertion plate where a letter or other media is automatically inserted. Then the blade member is rotated back into its original position and the next envelope is passed along deck 12 until its leading edge is adjacent to the blade member and its closed flap is in position to make contact with the suction cup.

As shown in FIG. 8 blade member 14 is constructed of a flat horizontal body 21 which is secured at one end to a vertical rotating shaft 19 and attached at its opposite end to a shovellike head 20 which rises vertically above the horizontal plane of the flat body 21. The purpose of the shovellike head on blade member 14 is to make contact with the open flap 11 and to cause the flap to maintain its open position after release by the suction cup. Accordingly, the head portion 20 of the blade member can have any shovellike shape which permits easy contact with the opened flap. Similarly, although suction cup 15 is normally constructed of a soft rubber material to permit the firm gripping of the envelope flap prior to opening, any suitable elastic material can be used in place of a soft rubber.

In order to assure the prompt shut down of the automatic mailing machine when the flap of an envelope is neither opened nor in a proper position for insertion of a letter or other material, an envelope detector assembly 23 is provided to make contact with the blade member 14. If the envelope flap is closed, the blade member will pass over the closed envelope and contact the detector. Likewise, contact between the blade member and detector will take place if no envelope is present between the blade member and the detector. Thus, unless the blade member is actually opening the envelope flap, the detector assembly will be activated.

As shown in FIG. 7, detector assembly 23 is constructed from a contact detector element 24 and block of electrical insulating medium 25 which is placed between deck 12 and the detector element. Normally, the insulating block is fastened between the deck and detector element by means of screw 26. The lead end of detector element 24 is extended above deck 12 but below the head portion 20 of blade member 14. Thus, when an envelope is not in position between the blade member and the detector element, the normal rotation of the blade member causes it to make contact with the detector element and thus cause an automatic shut down of the entire machine to permit the operator of the apparatus to remove the envelope or correct the malfunction.

Suction member drive assembly 17 serves to rotate horizontal shaft 16 about an angle of approximately 115° from the point at which suction cup 15 makes contact with and engages the envelope flap to the point at which the flap is partially opened. Rotation of shaft 16 is accomplished by cam 29 mounted on cam shaft 39 which imparts motion to cam follower arm 41 mounted on shaft 27. The motion of cam follower arm 41 is translated by gear segment arm 56 to segment gear 55 which drives gear 53 mounted on gear shaft 54. As the gear shaft 54 rotates, it likewise drives spur gears 52 and 51 which in turn rotate shaft 16 about an angle of approximately 115°. The gear and cam assembly is held in place by post assembly 28 and bracket assembly 30. A spring 31 for cam follower arm 41 which is attached to bracket assembly 30 by pin 32 and to the cam follower arm by pin 40 serves to return shaft 16 to its prerotated position after full rotation by the cam gear assembly. Camshaft 39 is an extension of the main cam shaft for the apparatus. Right-angle shaft 82 is driven through bevel gears 37 and transmits rotation through sprocket gear 83 mounted on shaft 82 and sprocket gear 84 mounted on camshaft 46. Sprocket chain 85 serves to interconnect sprocket gears 83 and 84.

Likewise, blade member drive assembly 18 serves to rotate vertical shaft 19 carrying blade member 14 so that the blade member can be moved from a noncontact to a contact position with the open envelope flap and then returned to a noncontact position as the envelope is passed to an inserting plate.

The rotation of vertical shaft 19 is accomplished through the use of a pulley-cam-type arrangement in which cam 49 mounted on camshaft 46 imparts motion to cam follower 63. Movement of cam 49 and cam follower 63 cause cam follower lever 60 to pivot about its pivot block assembly 61. The cam follower lever 60 is attached to cable eye 64 which serves to interconnect cable 70 with horizontal pulleys 67 and 79 and vertical pulley 75. Pulley 75 is mounted on the front end of an arm assembly 71. Pulley 67 is mounted beneath a plate 74, while pulley 79 which rotates shaft 19 is mounted on the rear end of arm assembly 71. Cable 70 passes around pulley 67 through a slot 77 in plate 74, and around pulleys 75 and 79. One end of cable 70 is connected to cam follower lever 60 and the other end to spring 72.

In order to rotate shaft 19 and blade 14, the displacement of cam follower lever 60 causes a tension in cable 70 as shown in FIG. 5. The rearward displacement of cable 70 causes pulleys

67, 75 and 79 to rotate shaft 19. At the same time, spring 72, secured to arm assembly 71 with stud 73 and attached at its opposite end to cable 70 by eye 80, is placed under tension. Thus, when cam 49 returns cam follower lever 60 to its non-displaced position, spring 72 acts to rotate shaft 19 and blade member 14 to a noncontact position with the envelope flap. In addition, clamp 81 is provided for pulley 79 to prevent the cable from slipping in relation to the periphery of the pulley 79.

Additional flexibility in the flap opening apparatus of this invention is provided by collar clamps 86 which hold rotating shaft 16 in a fixed position. These clamps can be loosened to permit shaft 16 to be axially adjusted to facilitate the processing of envelopes of varying sizes and flap orientation. Thus, the flap opening apparatus of this invention can be quickly and simply adjusted for a variety of operating condition.

I claim:

1. An envelope flap opening apparatus in a machine having conveying means for intermittently moving a plurality of envelopes having closed flaps through the apparatus comprising:

a suction member having a suction cup mounted on a hollow horizontally disposed rotatable shaft and adapted to rotate about the axis of said shaft;

a blade member secured to the end of a vertically disposed rotatable shaft and positioned adjacent to said suction member;

means for rotating said horizontally disposed shaft into position for said suction cup mounted on said shaft to engage the envelope flap and lift said flap to a partially open position;

means for applying a vacuum to said suction member as it engages said flap; and,

means for rotating said vertically disposed shaft to permit said blade member to extend over the crease of the envelope flap and to fully open and hold said flap in an open position after said suction member releases said flap.



2. An envelope flap opening apparatus as defined in claim 1 wherein said blade member has a flat horizontal body and a head which rises vertically above the horizontal plane of said body.

3. An envelope flap opening apparatus as defined in claim 2 wherein the head of said blade member fully opens said flap after said suction member releases said flap.

4. An envelope flap opening apparatus as defined in claim 1 wherein said means for applying a vacuum to the suction member applies said vacuum as the suction member engages the envelope flap and releases said vacuum as the blade member contacts said flap.

5. An envelope flap opening apparatus as defined in claim 1 wherein said conveying means intermittently moves said envelopes along a horizontal deck.

6. An envelope flap opening apparatus as defined in claim 1 having means for detecting the absence of an envelope in position for opening.

7. A method for opening envelope flaps comprising:

transmitting a plurality of envelopes having closed flaps along a horizontal deck until a lead envelope is stopped in position for flap opening;

contacting a suction member having a suction cup mounted on a hollow horizontally disposed rotatable shaft with the closed flap of said envelope by rotating said shaft until said suction cup contacts said flap;

applying a vacuum through said hollow shaft and suction cup sufficient to cause the engagement of said flap and said suction cup;

rotating said hollow shaft to partially open said flap;

rotating a blade member mounted on a vertically rotatable shaft until said blade member moves said flap into a fully open position; and

releasing the vacuum on said suction cup as said blade member contacts said flap.