United States Patent

[11] **3,549,067**

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[54] **ENVELOPE OPENING MACHINE**
7 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **225/106,** 83/912, 271/2, 271/29
[51] **Int. Cl.** **B26f 3/02**
[50] **Field of Search** 225/106, 100; 271/2, 29; 83/912, 402

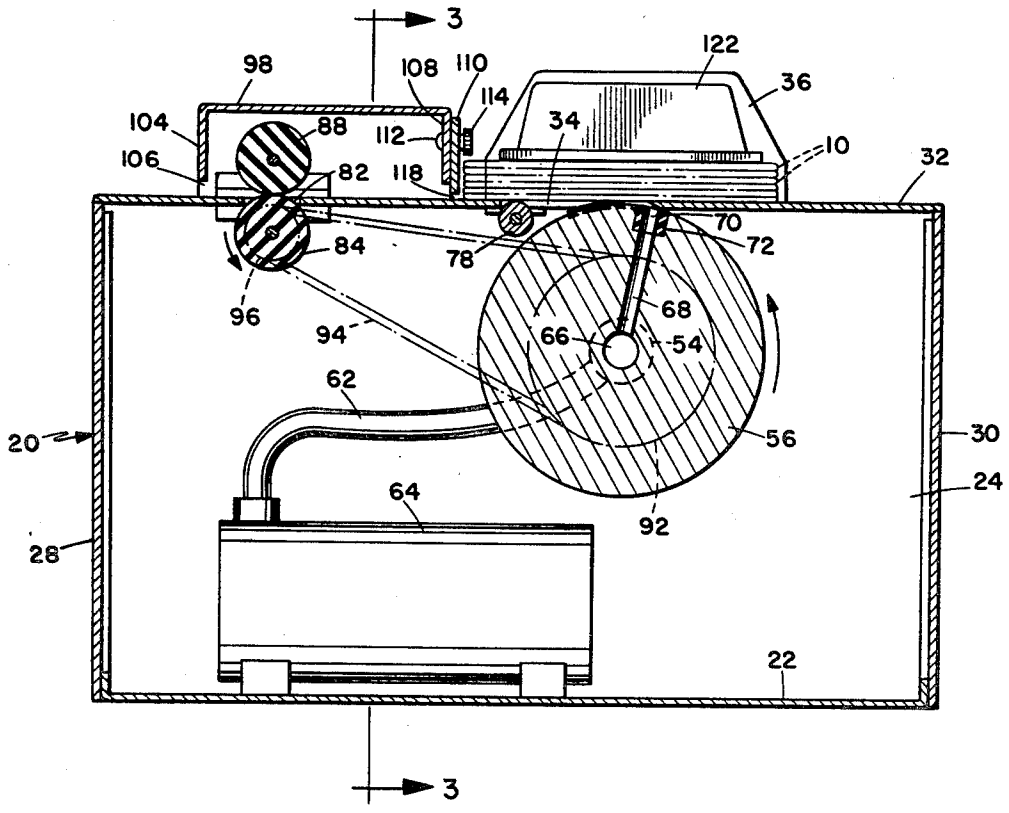
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ABSTRACT: The machine automatically opens and ejects envelopes of the type having a perforated tear flap, the envelopes being stacked between guides on top of the machine and remaining flat during the opening and ejection process. A driven wheel picks up one envelope at a time by vacuum, without using timing valves or complex synchronizing means, and completely strips open and peels back the flap as the envelope is extracted by driven ejection rollers.



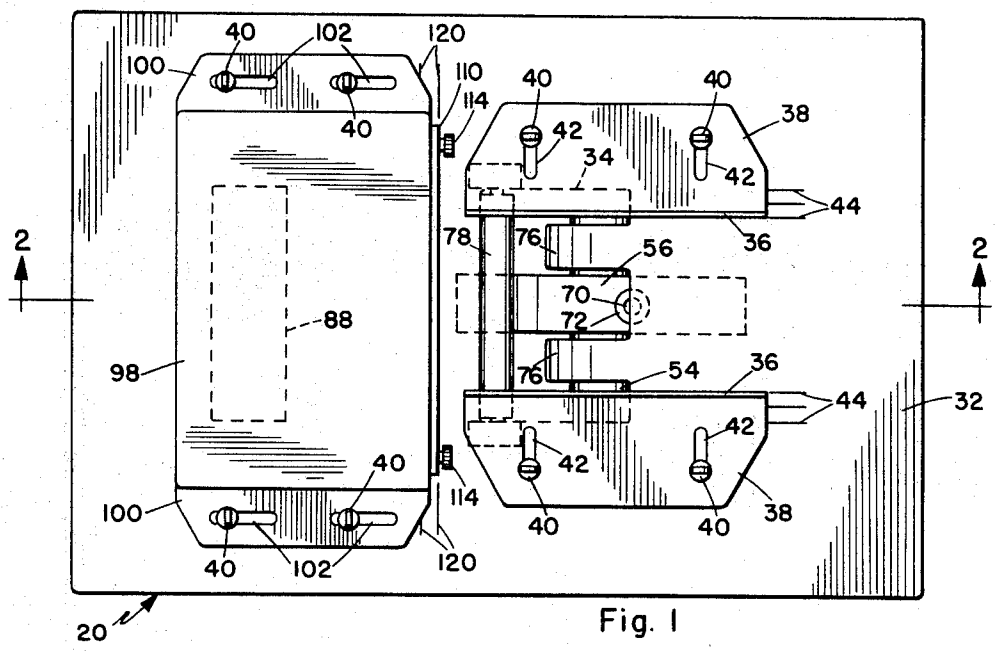


Fig. 1

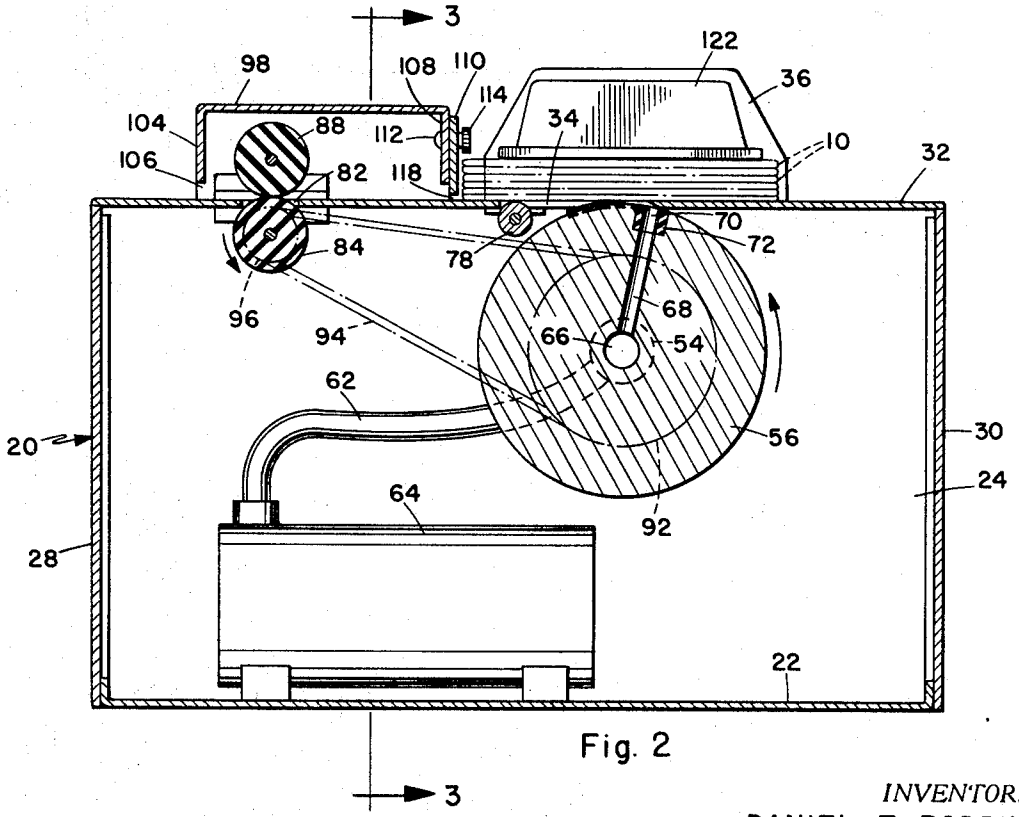


Fig. 2

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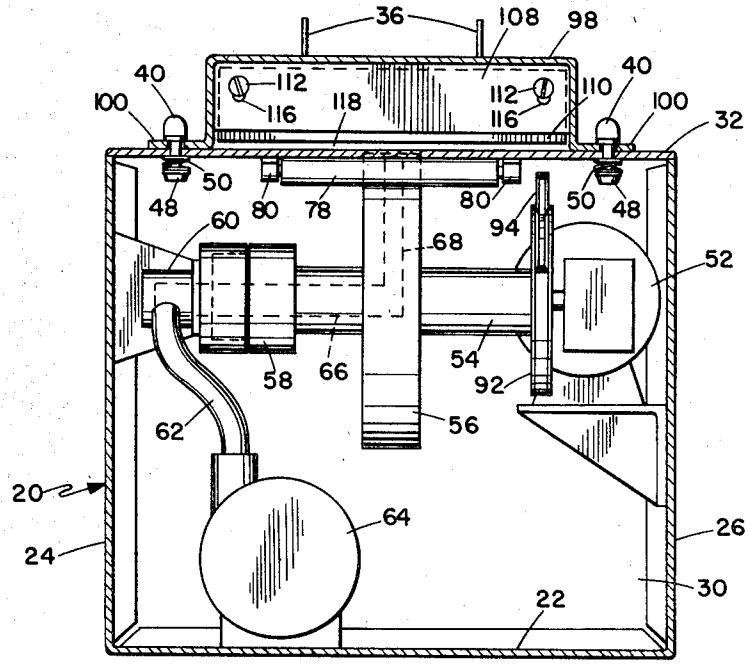


Fig. 3

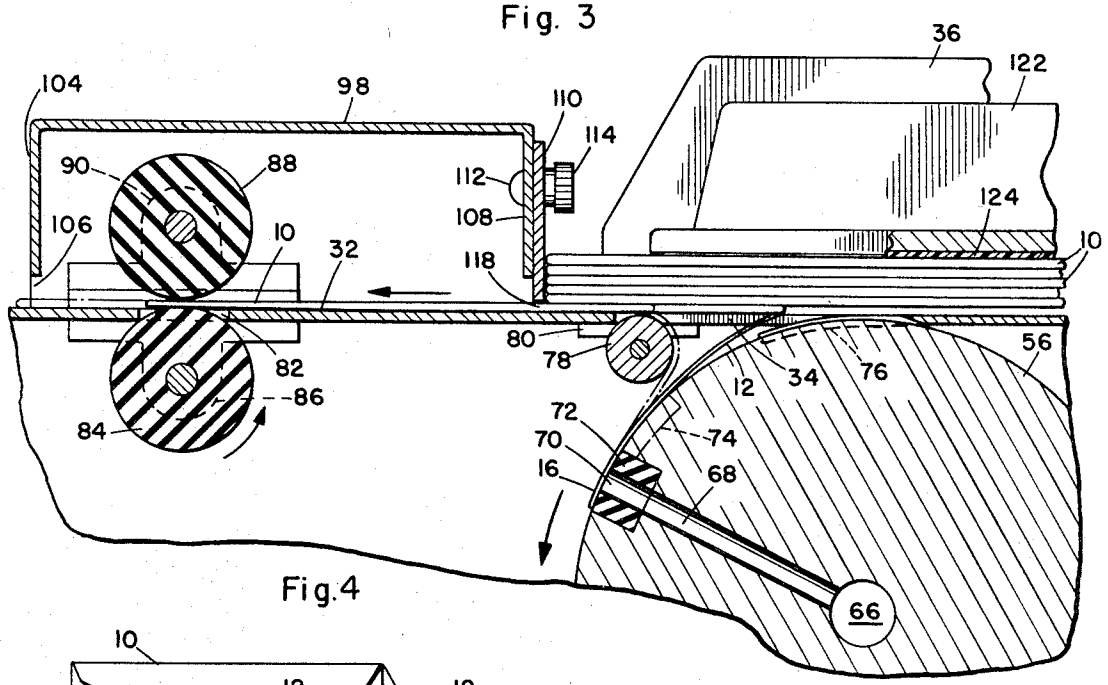


Fig. 4

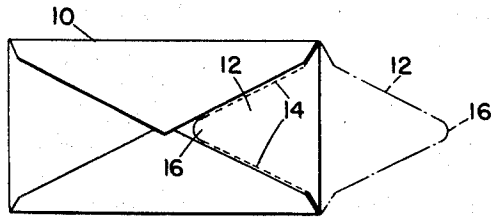


Fig. 5

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ENVELOPE OPENING MACHINE

BACKGROUND OF THE INVENTION

The present invention relates to article handling apparatus and specifically to and envelope opening machine.

Automatic envelope opening machines have been developed to handle a variety of common or special envelopes. Common types are usually slit along an edge by a knife, which can damage the contents. Some special envelopes have nonadhered flap portions into which fingers are inserted to lift the flap, which does not always separate cleanly. In many instances the envelopes pass around rollers, which can impart a curl to the contents. This is especially undesirable when the envelopes contain punched cards, or the like, which must be kept flat. Most machines have elaborate synchronizing means between stages and, if air pressure or vacuum are used, timing valves are usually required to direct the flow sequentially to multiple positions, or in some specific sequence.

SUMMARY OF THE INVENTION

The machine described herein is particularly adapted to opening envelopes of the type shown in U.S. Pat. No. 3,297,235, entitled Easy-Open Envelope, but will handle other types having a suitable tear flap configuration. Envelopes are stacked between guides on top of the machine with the flap side down. In the machine is a driven wheel rotating below the envelope stack and having a peripheral port coupled to a source of vacuum. Each time the port passes an envelope the vacuum picks up the flap and pulls the envelope from the stack, the flap being stripped open and peeled back as the envelope is caught by driven ejection rollers and pulled from the machine. No valves are needed to control the vacuum and there is no elaborate timing or synchronizing mechanism. The envelopes remain completely flat and their contents undistorted. Adjustments are provided for various envelope sizes and thicknesses, to ensure consistent processing of each single envelope, at any operating speed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of the complete machine;

FIG. 2 is a sectional view taken on line 2–2 of FIG. 1;

FIG. 3 is a sectional view taken on line 3–3 of FIG. 2;

FIG. 4 is an enlarged portion of FIG. 2, showing the envelope opening action; and

FIG. 5 is a view of the back of the type of envelope for which the machine is adapted.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIG. 5, the envelope **10** as shown is of the type described in U.S. Pat. No. 3,297,235 and has a generally triangular flap **12** with its base across one end of the envelope. The converging sides are perforated, as at **14**, to tear readily and the apex comprises a completely cut tab **16** by which the flap is gripped and pulled out to the extended position indicated in broken line. While the machine as shown is for use with this particular envelope, it will be evident that simple changes in proportions will adapt the machine to other, generally similar flap configurations.

The machine is contained in a casing **20**, shown as a simple rectangular box with a bottom panel **22**, sides **24** and **26**, ends **28** and **30** and a top panel which serves as a flat table **32**. Any suitable configuration and construction may be used for the casing, only the flat top being significant. Near the center of the table **32** is a generally rectangular opening **34** at least as wide as the widest envelope to be handled by the machine. On opposite sides of opening **34** are longitudinally extending upright guide plates **36**, each having a base flange **38** which rests on table **32**. The guide plates **36** are secured by retaining pins **40** passing through slotted openings **42** in base flanges **38**, so that the guide plates are adjustable to the width of the envelopes to be handled. Position markings **44** are provided on table **32** at the appropriate locations for standard sized envelopes, to facilitate setting and centering alignment of the guide plates. Alternatively, some type of linkage could be used to interconnect the guide plates for equal and opposite motion. As illustrated, the retaining pins **40** each have a head **46** on the top of base flange **38**, the lower end having a collar **48**, which may be a locknut threaded thereon. A spring **50** is fitted between collar **48** and the underside of table **32**, to hold the guide plates by frictional grip while allowing easy adjustment. This has been found satisfactory, but screws and wingnuts, or similar securing means may be used if necessary.

Inside casing **20** is a motor **52** driving a shaft **54** on which is mounted a large diameter pickoff wheel **56**, rotatable about an axis extending perpendicularly between sides **24** and **26**. Wheel **56** is positioned below opening **34**, substantially on the longitudinal center line of the opening, with the top surface of the table substantially tangential to the periphery of the wheel but with the periphery of the wheel slightly below the top surface of table **32**, to avoid continuous contact with the envelopes. The end of shaft **54** remote from motor **52** is supported by a hollow shaft rotary bearing **58**, having a coupling **60** from which a hose **62** leads to a vacuum pump **64**. For clarity the electrical wiring to the motor and vacuum pump has been omitted, a simple switch and an optional speed control being the only requirements. From bearing **58** an axial channel **66** extends through shaft **54** to a radial channel **68**, leading to a port **70** in the periphery of wheel **56**. Inset in the port **70** is a friction pad **72**, shown as a short rubber sleeve, to provide friction and ensure a good vacuum seal with an envelope. For heavy envelopes it may be desirable to extend the friction pad on the trailing side of the port relative to rotation, as indicated in broken line at **74** in FIG. **4**.

At the entry side of opening **34**, relative to the direction of envelope motion, are two guide fingers **76** extending on opposite sides of wheel **56** and curving concentrically therewith, to support an envelope flap in the initial stage of opening. At the other, or exit side of opening **34** is a small diameter stripping roller **78**, freely rotatably mounted in bearings **80** on an axis parallel to the axis of wheel **56**. Stripping roller **78** is closely adjacent to the periphery of wheel **56** and substantially tangential to the upper surface of table **32**.

Spaced from the exit of opening **34**, the table **32** has a transverse slop **82** parallel to roller **78**. Below the slot **82** is an extraction roller **84** rotatably mounted in bearings **86** on an axis parallel to the slot, said extraction roller being tangential to or very slightly above the upper surface of table **32**. Vertically above roller **84** and in rolling contact therewith is a second extraction roller **88** mounted in bearings **90**. Both of the extraction rollers are preferably of resilient material, such as rubber, to grip an envelope firmly without damaging its contents. The lower extraction roller **84** is driven at a peripheral speed equal to, or preferably slightly in excess of, the peripheral speed of wheel **56** to ensure proper envelope opening action. As shown, the drive means comprises a large pulley **92** attached to shaft **54**, with a drive belt **94** coupled to a small pulley **96** on roller **84** to obtain the desired speed ratio. Other drive means, such as chain and sprocket, may be used if a more positive coupling is required.

The upper extraction roll **88** is enclosed by a generally rectangular boxlike cover **98**, having laterally extending flanges **100** which are secured to the table **32** by retaining pins **40** through longitudinally slotted openings **102** in the flanges. The transverse exit wall **104** of cover **98** ends above the table **32** to leave and exit slot **106** of ample height to pass an envelope. The opposing entry wall **108** also ends well clear of the table and attached to the entry wall is a platelike gate **110**, held by screws **112** and nuts **114**. Vertically slotted opening **116** in wall **108** permit vertical adjustment of gate **110** to leave an entry slot **118** just sufficient to clear an envelope, so preventing passage of more than one envelope at a time. Cover **98** is adjusted so that gate **110** acts as a stop for envelopes, to hold the envelopes so that the flap **16** of the bottom envelope is substantially vertically above the axis of shaft

54. Position markings 120 are applied to table 32 to facilitate setting for various standard lengths of envelopes.

Since the machine is automatic in operation and capable of operating at high speed, its primary use will be for opening large numbers of identical envelopes, such as those containing standardized statements and accompanying payments for a utility or other business. The guide plates 36 and gate 110 are thus adjusted initially and need not be changed until a different size of envelope is to be processed. With the envelopes all oriented in a like manner and in a neat stack between guide plates 36 and against gate 110, each tab 16 will be correctly positioned. It will be obvious that the guide plates and gate can be extended vertically to align a large stack of envelopes. To ensure proper feeding, a weighted follower 122 is used on top of the stack of envelopes, the lower surface of the follower having a low friction coating 124, such as Teflon, to allow easy removal of the last envelope in the stack.

When the machine is in operation the vacuum pump runs continuously. Each time the port 70 passes below the envelopes, the tab 16 of the bottom envelope, which is positioned over the highest point of the peripheral path of the port, will be caught by the vacuum and adhered to the friction pad 72. Rotation of wheel 56 will pull the flap 12 down, tearing the perforations, and at the same time pull the envelope from the stack and through the entry slot 118, as in FIG. 4. Guide fingers 76 support the sides of the detached flap and prevent any folding or creasing which might cause jamming. Even at the envisioned lowest operating speed of the machine the envelope will be moved with a rapid snap action and thrown toward the extraction rollers 84 and 88, which grip the envelope and continue the pulling action. As shown in the broken line position in FIG. 4, the flap becomes completely opened and wrapped around stripping roller 78. Continued extraction of the envelope causes the tab 16 to slide off the pad 72 and break the vacuum, the stripping roller peeling the flap back into fully opened trailing position behind the envelope as it is ejected from the machine, leaving the next envelope in place over opening 34. The stripping roller minimizes friction of the peeling back action of the flap and, due to the rapidly repeated bursts of rotation applied by the flap stripping, the roller should be light in weight to minimize inertia.

There is no contact between the wheel 56 and the envelopes until the vacuum picks up the flap and, since the vacuum is effective only at one specific point in the rotation of the wheel, no valve or timing means is needed to control the vacuum. The table 32 provides a flat work surface for neat stacking and ease of positioning the envelopes. With the single straight line pass of each envelope across the flat table, the contents of the envelope are kept flat, only the flap being subjected to any bending.

I claim:

1. A machine for opening stacked envelopes of the type having a perforated tear flap with a cut tab by which the flap is grasped and opened, the machine comprising:

a casing having a flat topped table portion;

said table portion having an opening therein with a width at least equal to the flap width of the largest envelope to be handled;

envelope extraction means operatively mounted adjacent one end of said opening;

flap peeling means to peel the tear flap of the lower most of said stacked envelopes into said opening and simultaneously to move said lowermost envelope into engagement with said extraction means, said flap peeling means comprising:

a driven pickoff wheel rotatably mounted in said casing below said opening, the upper surface of the table being substantially tangential to the periphery of said wheel;

said wheel having a port in the periphery thereof and positioned to contact the tear flap of the envelopes;

a source of vacuum connected to said port; and

envelope retaining guide means adjustably mounted on said table to hold a stack of envelopes, with the tab of the lowermost envelope aligned over said opening and wheel to be caught by the vacuum at said port.

2. The structure of claim 1, and including antifriction means (78) extending transversely of said one end of said opening to justify the peeling of the tear flap by said flap peeling means and the extraction of the envelope by said extraction means.

3. The structure of claim 1 and including a resilient friction pad inset on the periphery of said pickoff wheel and adjacent to said port.

4. The structure of claim 2 wherein said antifriction means comprises a flap stripping roller mounted below the exit side of said opening with respect to the direction of rotation of said wheel, said stripping roller being closely adjacent to said wheel and rotatable on an axis parallel to the axis of the wheel.

5. The structure of claim 4 and including a pair of extraction rollers mounted on said table parallel to and spaced from said stripping roller on the exit side thereof, said table having a slot through which said extraction rollers meet in rolling contact, with one roller below the table and with the upper surface of the table substantially tangential to the lower roller, one of said extraction rollers being driven with a peripheral speed at least equal to that of said wheel.

6. The structure of claim 5 and including a cover over said extraction rollers and secured to said table, and a vertically adjustable gate mounted on the side of said cover adjacent said stripping roller to provide a single envelope admitting slot between the gate and said table.

7. The structure of claim 6 wherein said gate is adjustable in the direction of envelope travel and comprises a guide means for aligning the ends of a stack of envelopes.