Nov. 9, 1954 O. P. WELSH 2,693,957

ENVELOPE MACHINE

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Fig. 1

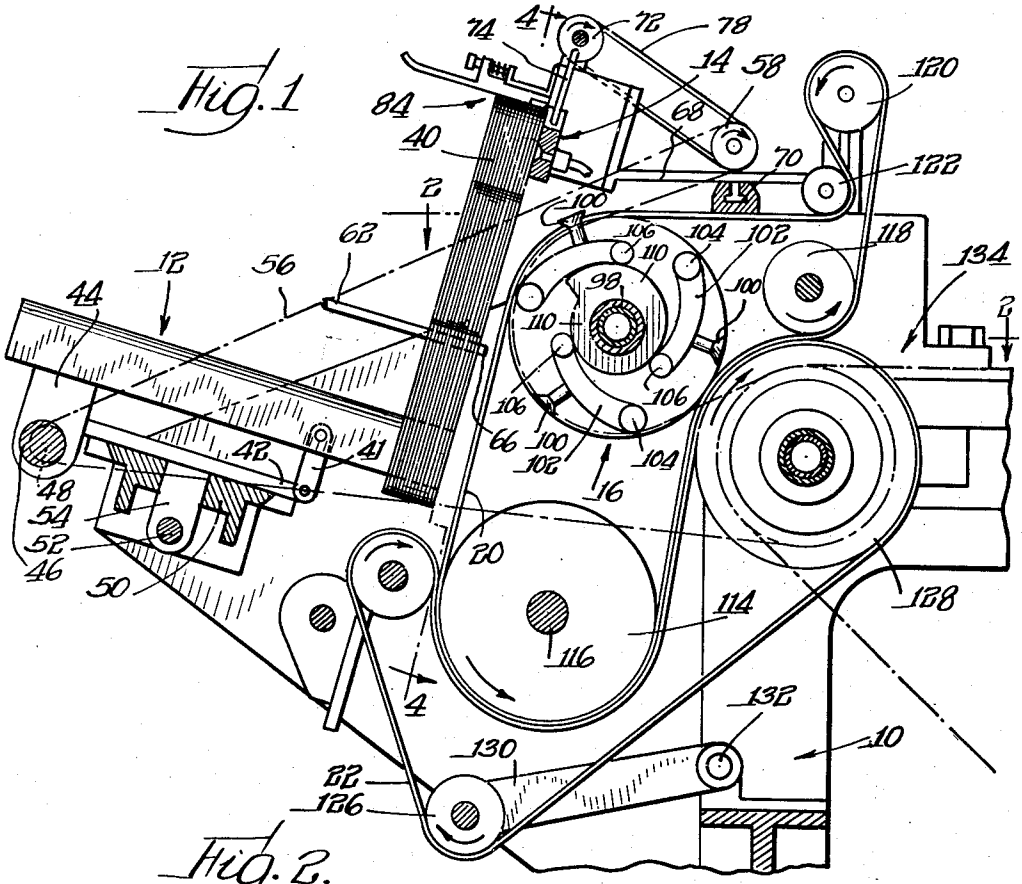
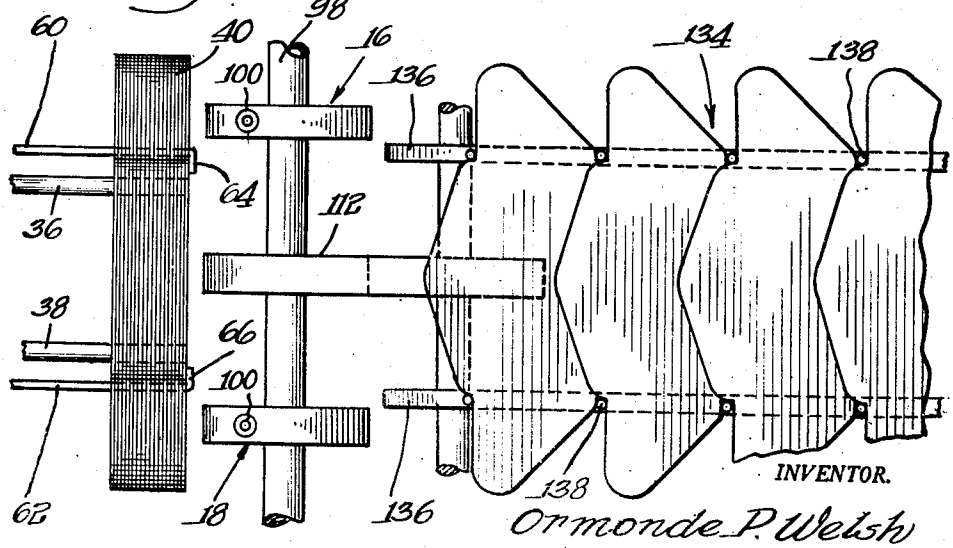


Fig. 2.



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Fig. 4.

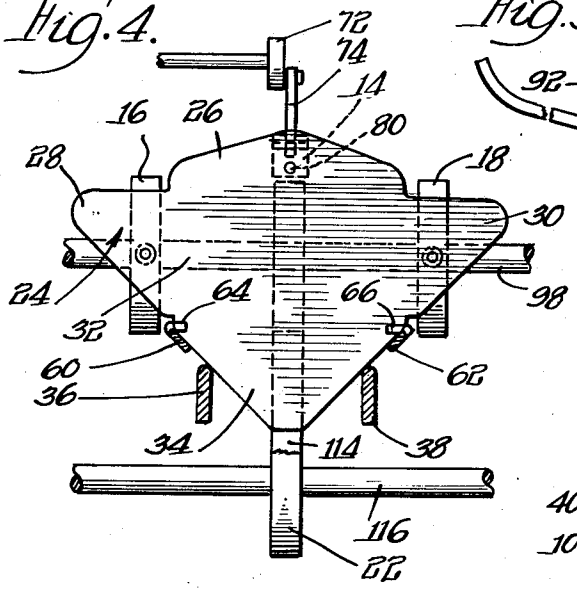


Fig. 3.

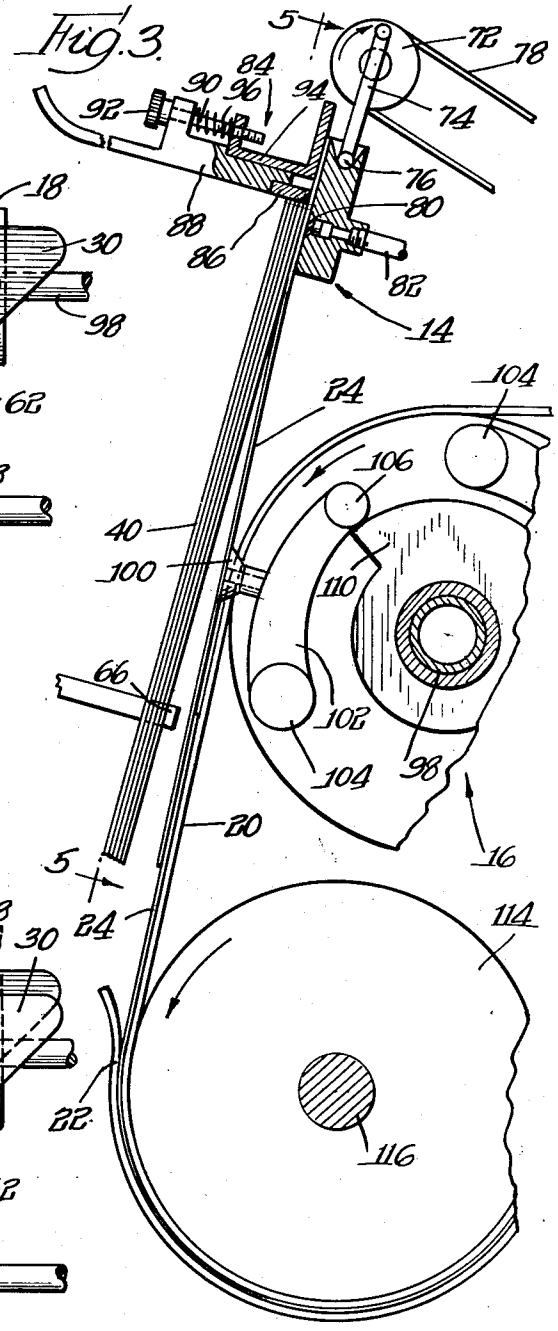
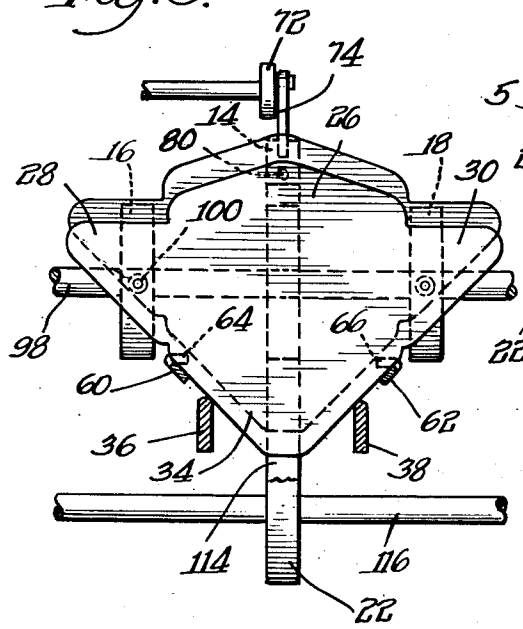


Fig. 5.



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Fig. 6.

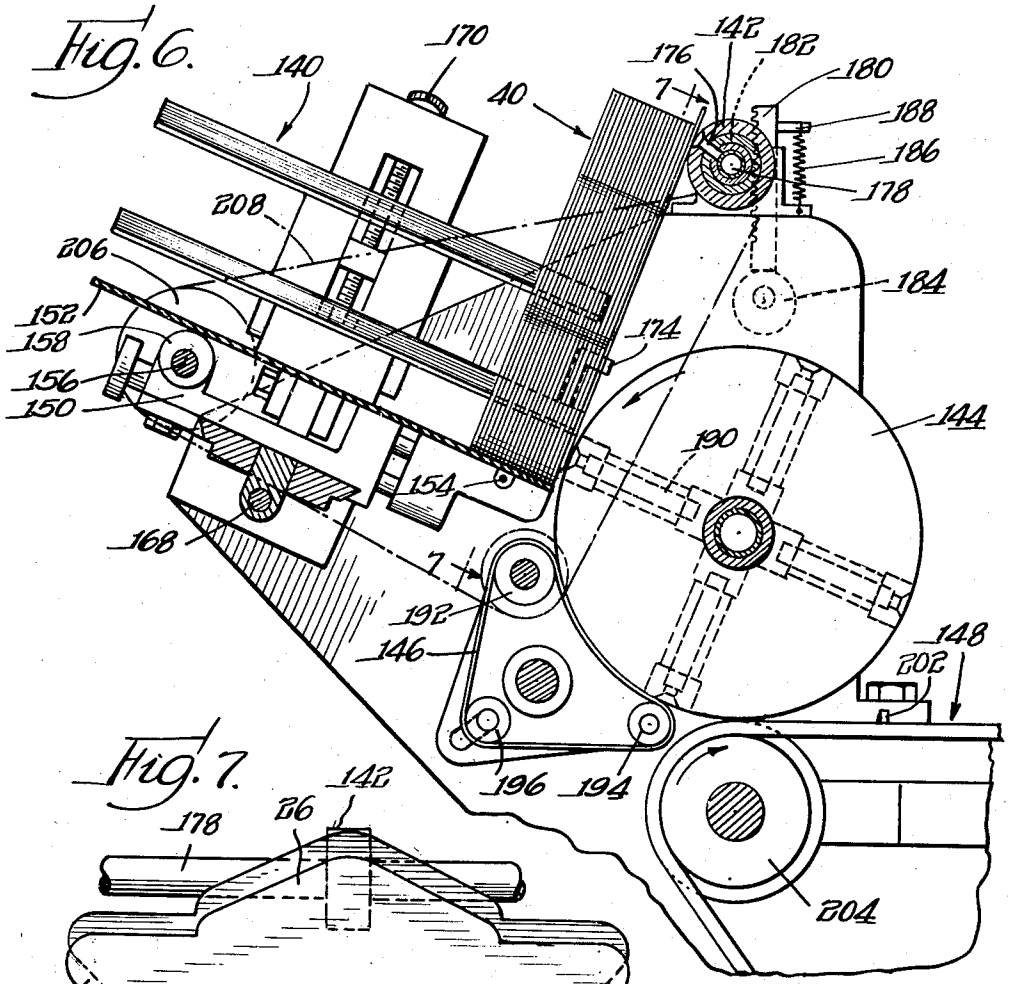
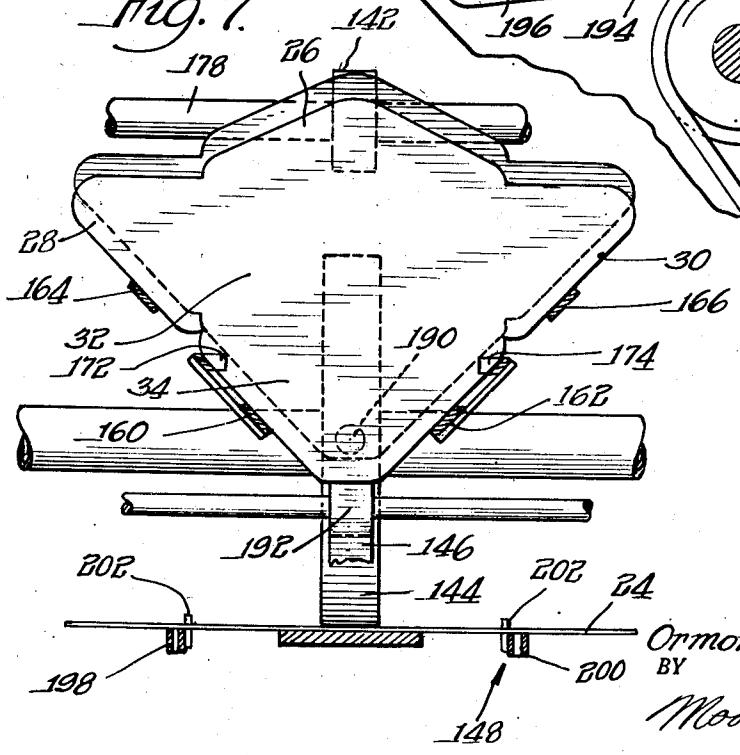


Fig. 7.



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ENVELOPE MACHINE

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Application June 19, 1951, Serial No. 232,340

11 Claims. (Cl. 271—12)

This invention relates to envelope making machines, and more particularly to apparatus for feeding envelope blanks to a high speed automatic machine.

Cost considerations make high speed operation desirable in the manufacture of envelopes. This high speed operation, in general, presents problems in the handling of envelope blanks, and particular problems in feeding the envelope blanks from a stack to the first envelope forming stage of the machine.

The envelope blanks in high speed machines must be moved to successive forming operations at the rate of several hundred blanks per minute and must be moved one at a time at predetermined intervals in a continuous manner. If the blanks are not properly separated or spaced at accurate intervals, succeeding steps in the formation of the envelope may be interfered with and as a result, an envelope may be imperfect.

Accordingly, it is an object of the present invention to provide improved apparatus for feeding envelope blanks; more particularly, it is an object of the invention to provide an improved feed apparatus for feeding an envelope to high speed envelope forming machines.

Another object of the invention is to provide an apparatus for feeding envelopes to high speed envelope machines which will feed the blanks from a stack one at a time.

Yet another object of the invention is to provide a feed apparatus which will feed envelope blanks from a stack at uniform predetermined intervals in a continuous manner at a high rate.

In conjunction with the preceding object, it is a further object to provide an apparatus for feeding envelope blanks of the type set forth in which additional blanks can be added to the stack without interrupting operation of the feed apparatus.

These and other objects and advantages of the invention will be better understood from the following description when taken in conjunction with the accompanying drawings. In the drawings, wherein like reference numerals have been used to indicate like parts throughout:

Figure 1 is a side elevational view with certain parts broken away of an envelope blank feeding apparatus made in accordance with and embodying the principles of the present invention;

Figure 2 is a view in horizontal section substantially as seen in the direction of the arrows along the line 2—2 of Figure 1;

Figure 3 is an enlarged partial view in vertical section showing the manner in which an envelope is grasped and removed from the stack;

Figure 4 is a partial view in vertical section substantially as seen in the direction of the arrows along the line 4—4 of Figure 1;

Figure 5 is a view similar to Figure 4 and showing the envelope blank adjacent the suction block in the uplifted position;

Figure 6 is a view in vertical section and showing another embodiment of the present invention; and

Figure 7 is a view similar to Figure 5 and illustrating the manner in which this form of the invention withdraws an envelope blank from the stack.

Referring now to the drawings and particularly to Figures 1 through 5 thereof, it will be seen that the feed mechanism comprises generally a frame **10**, an envelope blank stack support **12**, a suction block **14**, a pair of suction wheels **16** and **18**, and a pair of feed belts **20** and **22**.

The form of envelope **24** illustrated in the drawings includes a seal flap **26**, a pair of side flaps **28** and **30**, a front **32** and a bottom flap **34**. The envelope blanks **24** are supported in a substantially vertical position with the seal flap **26** disposed upwardly. The stack support **12** includes a pair of support bars **36** and **38** which extend the length of the stack **40** of blanks and engage the blanks substantially midway along the edges of the bottom flap **34**. The forward or right hand end of the bars **36–38** are pivotally mounted as by levers **41** on a movable base **42**. The rear end of the bar **36–38** is provided with depending legs **44** which have an eccentric **46** journaled therein. The eccentric **46** is mounted upon a shaft **48** supported in the movable base **42**. The base **42** is mounted upon and slides along a member **50** which is attached to the frame **10**. Movement of base **42** along member **50** is obtained by rotating a threaded rod **52** which engages a leg **54** integrally attached to base **42**. By this construction the support bars **36** and **38** can be moved inwardly and outwardly, toward and away from each other whereby to accommodate various sizes and shapes of blanks **24**.

As is best seen in Figure 1, the support bars **36** and **38** are inclined downwardly to the right whereby to support the blanks **24** at an angle of from 10° to 15° with respect to the vertical. This position of the blanks at an angle with respect to the vertical facilitates moving the blanks along the bars **36–38** toward the suction block **14** and the suction wheels **16–18**. Movement of the blanks **24** to the right is also facilitated by the action of eccentric **46**. The shaft **48**, upon which eccentric **46** is mounted, is driven by means of a belt **56** from a drive pulley **58**. When shaft **48** is rotated, the eccentric **46** moves the rear ends of the support bars **36–38** upwardly and downwardly.

A pair of holding and guide bars **60** and **62** engage the envelope blanks at a point adjacent the junction of the bottom flap **34** with the front **32**. The forward ends of the bars **60–62** are turned inwardly to form holding fingers **64** and **66**, respectively, which engage the forwardly facing surface of the envelope blank which is adjacent the suction wheels **16–18**. The fingers **64–66** retain the envelope blanks in operative position.

The seal flap **26** of the forward envelope lies against the face of suction block **14** and is supported thereby. Block **14** is, in turn, slidably mounted in a frame **68** adjustably mounted on frame **10** by means of a T-shaped section **70**. Means is provided for reciprocating suction block **14** in a direction parallel to the surface of the adjacent blank **24** in the form of a wheel **72** rotatably mounted upon the frame **68** and an arm **74** which has one end thereof pivotally connected to block **14** as at **76**. Wheel **72** is driven in a clockwise direction by means of a belt **78** which is driven by pulley **58**. Upon rotation of wheel **72**, the suction block **14** will be reciprocated within its mounting on frame **68**. The face of the suction block adjacent the envelope blank stack **40** is provided with a suction port **80** which is connected to a suitable vacuum apparatus through hose **82**. Suitable valve mechanism is provided so that suction is applied to port **80** when suction block **14** is in the lowermost position (see Figure 4), the suction being applied while the suction block **14** moves upwardly to the position shown in Figure 5, at which time the suction is turned off.

To insure that only one envelope blank is lifted by suction block **14**, a suitable gate **84** is provided. Gate **84** includes a gate member **86** mounted upon a support **88** which is, in turn, received on a threaded rod **90**. One end of rod **90** passes through a portion of support **88** and has a nob **92** affixed thereto. The other end of rod **90** passes through a frame member **94** which is attached to frame **68**. By turning nob **92**, the gate member **88** can be moved toward or away from the surface of suction block **14** whereby to adjust the distance therebetween. The distance between the gate member **86** and the forward face of block **14** is adjusted so that only a single blank can be moved therethrough at one time. This distance can be adjusted for various thick-

nesses of envelope blanks. A spring **96** is disposed between frame **94** and support **88** to hold these members in adjusted position.

A single blank **24** is removed from the stack **40** in the following manner. When the suction block **14** is in the position shown in Figure 4, i. e., in the lower position, suction is applied to port **80** through hose **82**. This suction grabs the blank disposed against the suction block **14** and holds the blank against the block. Block **14** then begins to move upwardly and carries the adjacent envelope blank with it. The upper edge of the blank being moved passes in front of gate member **86**, and if another envelope blank is adhering to the blank being lifted, it will be stopped by gate member **86**. At the uppermost point of movement of block **14**, the lower edges of the bottom flap **34** will have cleared the ends of fingers **64—66** as is shown in Figure 5. The envelope blank so raised can now be grasped by the ports in suction wheels **16** and **18** and drawn outwardly away from the retaining finger **64—66** whereby to remove this blank from the stack.

The suction wheels **16** and **18** are mounted upon a shaft **98** which in turn is journaled in frame **10**. The suction wheels **16** and **18** are substantially identical in construction and, accordingly, only the structure of wheel **16** will be described in detail. A plurality of movable suction ports **100** are provided around the periphery of the wheel **16**, each port being provided with suitable valves and connections to the suction mechanism. Normally, the ports **100** are withdrawn to the periphery of wheel **16** and are held there by suitable tension means. Means is provided for moving the suction ports outwardly beyond the periphery of wheel **16** in the form of arms **102**. Each arm **102** is pivoted on the suction wheel as at **104** and carries to the other end thereof a cam engaging member **106**. Member **106** is in contact with a substantially helically shaped cam **110** which serves to pivot each arm **102** outwardly once during the revolution of wheel **16**. Cam **110** is so positioned that the ports **100** are moved outwardly when the ports approach the foremost blank **24** in stack **40** and rapidly retracted as they move past the point of tangency between the foremost blank and wheel **16**. Suction is applied to the ports **100** simultaneously with their movement outwardly, whereby the active or outwardly positioned port grasps the foremost blank **24**. As is best shown in Figure 3, the motion of suction block **14** and suction wheels **16** and **18** is so synchronized that the active ports of the suction wheels **16** and **18** engage the envelope blank when the suction block **14** is in its uppermost position.

Referring to Figures 2 and 4, it will be seen that the suction wheels **16** and **18** are spaced apart and contact the side flaps **28** and **30**. Suction wheels **16** and **18** rotate in a counter-clockwise direction as seen in Figures 1 and 3 and, therefore, carry the foremost envelope blank downwardly away from the stack **40** and the suction block **14**.

As the active ports **100** carry the associated blank downwardly, the ports are retracted and draw the blank against the feed belt **20**. After the suction to port **100** is removed, the feed belt **20** carries the blank downwardly into contact with the feed belt **22**. Feed belt **20** lies against one face of the envelope blank and feed belt **22** lies against the other face of the blank whereby to grasp the blank between the belts. Referring to Figures 1 and 2, it will be seen that the feed belt **20** is in the form of a closed loop and is carried by a roller **112** mounted on shaft **98**, a large roller **114** mounted upon a shaft **116**, a guide roller **118** and rollers **120** and **122**. Motive power to drive the belt **20** is derived from roller **112** which is driven by shaft **98**.

The other feed belt **22** is supported upon a pulley **124**, a tensioning roller **126**, a wheel **128** and the roller **114**. Tensioning roller **126** is rotatably mounted upon one end of an arm **130**, the other end of arm **130** being pivotally mounted on frame **10** as at **132**.

The feed belts **20** and **22** are adjacently positioned for the portion of the path about roller **114**, from roller **114** to roller **128**, their paths parting on the upper portion of roller **128**. It will be seen that the blanks will be fed between the two feed belts **20** and **22** downwardly about roller **114**, then upwardly into contact with roller **128** and from roller **128** they are discharged to a timing section generally designated by the numeral **134**.

Timing section **134** includes a pair of timing belts **136** having a plurality of timing pins **138** mounted thereon and extending upwardly therefrom. The timing pins **138** contact the trailing edge of the side flaps **28** and **30** of the envelope blanks and serve to space the envelope blanks at predetermined intervals along the timing chains **136**. The timing chains **136** carry the properly spaced envelope blanks to the succeeding forming operations.

The overall operation of the envelope blank feeding mechanism is as follows. The nob **92** is turned to space the gate member **86** away from the forward face of the suction block **14** a distance which will permit movement of but a single envelope blank across the end of gate member **86**. The various drives are then set into operation, and the suction is applied to the ports in block **14** and the suction wheels **16** and **18**. A quantity of envelope blanks are then placed in the stack **40**, the endmost blank being supported on its forward face by the finger **64—66** and along its upper edge by the suction block **14**. As suction block **14** begins to move upwardly from the position shown in Figure 4, the suction is applied to port **80** whereby to grasp the endmost envelope blank. Continued movement of suction block **14** upwardly carries the adjacent envelope blank upwardly past the forward edge of gate member **86**. When suction block **14** reaches the uppermost portion of its stroke as seen in Figure 5, the lower edges of the bottom flap **34** have cleared the finger **64—66**, and it is at this time that a pair of ports **100** in the suction wheels **16** and **18** are moved outwardly into engaging position with the suction applied thereto. Immediately upon engaging the envelope blank, the suction ports **100** are withdrawn to the right as viewed in Figures 1 and 3 and thereby bring the envelope blank out of engagement with the fingers **64—66**. Upon continued rotation of the suction wheels **16** and **18** in a counterclockwise direction, the blank is drawn into contact with feed belt **20** and then into contact with feed belt **22**. The suction in the active ports **100** will have been removed, and the feed belts **20** and **22** will carry the envelope blank to the timing section **134**.

The movement of the suction block **14** and the rotation of the suction wheels **16** and **18** are synchronized so that another blank is removed from stack **40** as soon as the upper edge of the preceding envelope blank loses contact with the suction wheels **16** and **18**. This arrangement provides for continuous overlapping of the envelope blanks as they are removed from the stack **40**.

There is shown in Figures 6 and 7 a second modification of a feed mechanism embodying the principles of the present invention. This form of the invention includes a stack support **140**, a reciprocating suction wheel **142**, a rotating suction wheel **144**, a feed belt **146** and a timing section **148**. The support for stack **40** includes a stationary base **150** upon which is pivotally mounted floor **152**, the point of pivot being at **154**. The shaft **156** is journaled in base **150** and has mounted thereon an eccentric cam **158**. The upper surface of cam **158** contacts the lower side of floor **152** thereby to oscillate floor **152** in a vertical direction at the rear end thereof. A pair of lower side support arms **160** and **162** are provided to contact the edges of the bottom flap **34**, and a pair of upper support arms **164** and **166** support the edges of the side flaps **28** and **30** respectively. Means is provided for adjusting the support arms inwardly and outwardly, i. e., toward and away from each other, in the form of a screw rod **168** journaled in the base **150**. Rotation of screw rod **168** moves the support arms **160** through **166** either toward each other or away from each other. Vertical adjustment of the arms **164** and **166** is obtained by means of a nob **170** (only one having been shown).

The forwardly disposed ends of the support arms **160—162** have formed thereon inturned fingers **172** and **174** which lie against and support the forward surface of the endmost envelope blank. The structure and function of fingers **172—174** are substantially identical with the structure and function of fingers **64—66** described above.

The upper end of the endmost envelope blank in stack **40** lies against the surface of the reciprocating suction wheel **142**. Formed on the periphery of wheel **142** is a suction port **176** having suitable connections to a suction line **178** upon which the wheel **142** is mounted. The

wheel **142** is reciprocated or oscillated by means of a toothed rack **180** which contacts a toothed gear **182**. Movement of rack **180** upwardly and downwardly oscillates the wheel **142**. Vertical movement of rack **180** is obtained by means of an eccentric cam **184**, which is driven at a suitable rate. Contact between rack **180** and the surface of cam **184** is maintained by means of a spring **186**, which is connected between an arm **188** on rack **180** and the frame of the feed mechanism.

Suction is applied to port **176** when wheel **142** is rotated to its lifted position in the counterclockwise direction. Drive mechanism including the cam **184** and the rack **180** then moves the wheel **142** in a clockwise direction with the suction applied to port **176** whereby to lift the endmost blank upwardly as shown in the drawings. Referring to Figure 7, it will be seen that the lower edges of the bottom flap **34** clear the ends of the fingers **172—174** when the blank is in the upward or lifted position. At this point of the operation, a suction port **190** in wheel **144** engages the blank adjacent the lower edge thereof. Wheel **144** is rotated in a counterclockwise direction, and therefore reverses the direction of the movement of the blank and moves it downwardly and around its periphery. Four suction ports **190** are provided to insure that a suction port is available for all sizes of envelopes and to provide for overlapping of adjacent envelopes. Suitable valve connections are provided to apply and remove suction from the ports **190**.

Wheel **144** carries the blank downwardly into contact with the drive belt **146**. A pair of rollers **192** and **194** in cooperation with a tensioning roller **196** support and drive the feed belt **146**. Roller **192** is positioned adjacent the lower edge of the stack **40** and near the periphery of wheel **144** whereby to urge belt **146** against the periphery of wheel **144** at this point. Each blank as it is withdrawn from stack **40** is pressed between the drive belt **146** and the periphery of wheel **144** and is carried by the movement of these members past roller **194** and onto the timing section **148**.

Timing section **148** includes a pair of spaced apart timing chains **198** and **200** on which are mounted a plurality of timing pins **202**. The chains **198—200** are supported upon a plurality of sprocket wheels such as wheel **204**. The edges of pins **202** engage the trailing edge of the side flaps **28—30** whereby accurately to position the blanks with respect to each other upon the timing section.

The reciprocating wheel **142** and the rotating wheel **144** are synchronized so that the blanks are fed from stack **40** in overlapping position. The shaft **156** is rotated by means of a pulley **206** driven by belt **208** whereby to jog the stack **40** and urge it downwardly toward the wheel **144** in the manner explained above.

It will be noted that in both forms of the invention additional envelope blanks can be added to stack **40** without interrupting the feeding of blanks from the stack to the envelope forming machine. The blanks are fed, one at a time, from stack **40** at a high rate of speed, the blanks being positively controlled at all times. In addition, the blanks are fed at uniform predetermined intervals in a continuous manner at an overlapping relationship. Suitable adjustments have been provided for accommodating various sizes and shapes of envelope blanks.

Although certain preferred embodiments of the invention have been shown for purposes of illustration, it is apparent that various changes may be made without departing from the spirit of the invention. The invention is, accordingly, not to be limited to the particular structures shown and described, but only as indicated in the following claims.

I claim:

1. An apparatus for feeding envelope blanks from a stack of the blanks comprising generally horizontal and inclined means for supporting the stack with the plane of the blanks disposed at an angle with respect to the horizontal, means for supporting a lower endmost blank in said stack, said support means including means for gripping and moving the lower endmost blank in a direction substantially perpendicular to the longitudinal axis of the stack, and suction means for gripping said blank and moving the blank in a direction opposite to the direction of movement imparted by said first gripping means whereby to remove said blank from the stack, said first mentioned gripping means being constantly disposed in position to support succeeding blanks in the stack while the endmost blank is being removed from the stack.

2. An apparatus for feeding envelope blanks from a stack of blanks comprising generally horizontal and inclined means for supporting the stack with the plane of the blanks disposed at an angle with respect to the horizontal, means for supporting a lower endmost blank in said stack, said support means including suction means for gripping the lower endmost blank, means for moving said suction means in a direction substantially perpendicular to the axis of the stack, a rotatably mounted second suction means for gripping said blank after movement of said first suction means, and means for rotating said second suction means in a direction opposite to the initial direction of movement of said blank whereby to remove said blank from the stack, said first mentioned gripping means being constantly disposed in position to support succeeding blanks in the stack while the endmost blank is being removed from the stack.

3. An apparatus for feeding envelope blanks from a stack of the blanks comprising means for supporting the stack with the plane of the blanks disposed at an angle with respect to the horizontal, arms engaging the blanks at one end of the stack to retain the blanks on the stack, a first gripping means for disengaging the endmost blank from said arms, and a suction gripping means for moving the disengaged blank away from said arms and said first gripping means whereby to remove said blank from the stack.

4. An apparatus for feeding envelope blanks from a stack of the blanks comprising means for supporting the stack with the plane of the blanks disposed at an angle with respect to the horizontal, arms engaging the lowermost and endmost blank to retain the blanks in stacked relationship upon the supporting means, suction means for gripping said endmost blank adjacent the upper edge thereof, means for moving said suction means to lift said endmost blank out of engagement with said arms, a second rotatably mounted suction means for gripping the disengaged blank and drawing the blank outwardly away from the stack, and means for rotating said second suction means to move said blank downwardly away from said first suction means and said arms whereby to remove said disengaged blank from the stack.

5. An apparatus for feeding envelope blanks from a stack of blanks comprising generally horizontal and inclined means for supporting the stack with the plane of the blanks disposed at an angle with respect to the horizontal, means for supporting a lower endmost blank in said stack, said support means including suction means for gripping the lower endmost blank, means for moving said suction means in a direction substantially perpendicular to the axis of the stack, a gate positioned adjacent the edge of the blank in the direction of movement of said suction means, said gate permitting only one blank to be moved by said suction means, second suction means for gripping said blank after movement of said first suction means, and means for moving said second suction means in a direction opposite to the initial direction of movement of said blank whereby to remove said blank from the stack, said first mentioned gripping means being constantly disposed in position to support succeeding blanks in the stack while the endmost blank is being removed from the stack.

6. An apparatus for feeding envelope blanks from a stack of the blanks comprising means for supporting the stack with the plane of the blanks disposed at an angle with respect to the horizontal, arms engaging the lowermost and endmost blank to retain the blanks in stacked relationship upon the supporting means, suction means for gripping said endmost blank adjacent the upper edge thereof, means for moving said suction means to lift said endmost blank out of engagement with said arms, a gate positioned adjacent the edge of the blank disposed in the direction of movement of said suction means. said gate permitting only one blank to be moved by said suction means at a time, a second suction means for gripping the disengaged blank and drawing the blank outwardly away from the stack, and means for moving said second suction means to move said blank downwardly away from said first suction means and said arms whereby to remove said disengaged blank from the stack.

7. An apparatus for feeding envelope blanks from a stack of the blanks comprising means for supporting the

stack with the plane of the blanks disposed at an angle with respect to the horizontal, arms engaging the lowermost and endmost blank to retain the blanks in stacked relationship upon the supporting means, suction means for gripping said endmost blank adjacent the upper edge thereof, means for moving said suction means to lift said endmost blank out of engagement with said arms, a second suction means for gripping the disengaged blank and drawing the blank outwardly away from the stack, and a feed belt positioned adjacent said second suction means to carry the disengaged blank away from the stack.

8. An apparatus for feeding envelope blanks from a stack of the blanks comprising means for supporting the stack with the plane of the blanks disposed at an angle with respect to the vertical, arms engaging the lowermost and endmost blank to retain the blanks in stacked relationship upon the supporting means, suction means for gripping said endmost blank adjacent the upper edge thereof, means for moving said suction means to lift said endmost blank out of engagement with said arms, a pair of suction wheels mounted to contact said blank at points spaced apart longitudinally thereon and below the point of contact with said suction means, suction ports in said suction wheels for gripping the disengaged blank and drawing the blank outwardly away from the stack, and means for rotating said suction wheels gripping said blank to move said blank downwardly away from said suction means and said arms whereby to remove said disengaged blank from the stack.

9. An apparatus for feeding envelope blanks from a stack of the blanks comprising means for supporting the stack with the plane of the blanks disposed at an angle with respect to the vertical, arms engaging the lowermost and endmost blank to retain the blanks in stacked relationship upon the supporting means, a suction block mounted for reciprocation in a direction substantially parallel to and adjacent said lowermost and endmost blank, means for moving said suction block to lift said endmost blank out of engagement with said arms, a suction wheel for gripping the disengaged blank and drawing the blank outwardly away from the stack, and means for rotating said suction wheel to move said blank downwardly away from said suction block and said arms thereby to remove said disengaged blank from the stack.

10. An apparatus for feeding envelope blanks from a stack of blanks comprising means for supporting the stack with the plane of the blanks disposed at an angle with respect to the horizontal, arms engaging the lowermost and endmost blank to retain the blanks in stacked relationship upon the supporting means, an oscillating suction wheel for gripping the endmost blank adjacent the upper edge thereof, means for oscillating said suction wheel with the suction applied to lift said endmost blank out of engagement with said arms, a second suction wheel for gripping the disengaged blank and drawing the blank outwardly away from the stack; and means for rotating said second suction wheel to move the blank downwardly away from said oscillating suction wheel and said arms whereby to remove said disengaged blanks from the stack.

11. An apparatus for feeding envelope blanks from a stack of the blanks comprising means for supporting the stack with the plane of the blanks disposed at an angle with respect to the vertical, arms engaging in lowermost and endmost blank to retain the blanks in stacked relationship upon the supporting means, suction means for gripping said endmost blank adjacent the upper edge thereof, means for moving said suction means to lift said endmost blank out of engagement with said arms, a suction wheel mounted adjacent said endmost blank and below said suction means, a movable suction port mounted in said suction wheel for reciprocation in a direction substantially radially with respect to the suction wheel, means for moving said suction port outwardly and applying suction thereto to grip the blank disengaged by said suction means, and means for rotating said suction wheel to move said blank downwardly away from said suction means and said arms whereby to remove said disengaged blank from the stack.

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