May 24, 1955 O. P. WELSH 2,709,081

ENVELOPE BLANK FEEDING MECHANISM

Filed Dec. 29, 1950

5 Sheets-Sheet 1

Fig. 1.

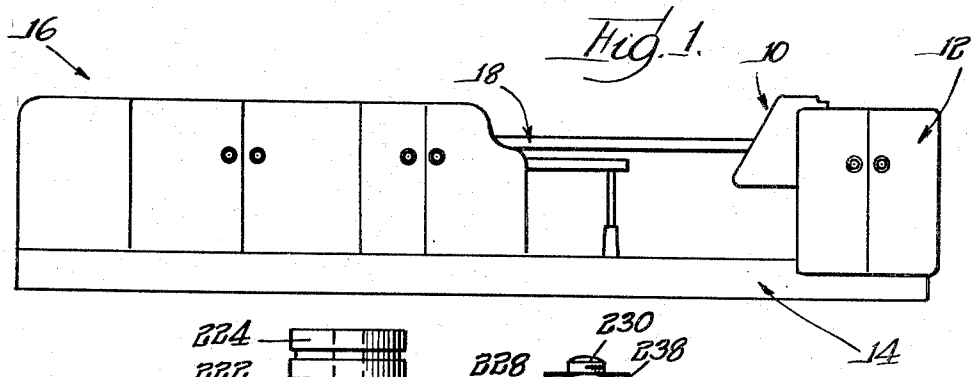


Fig. 2.

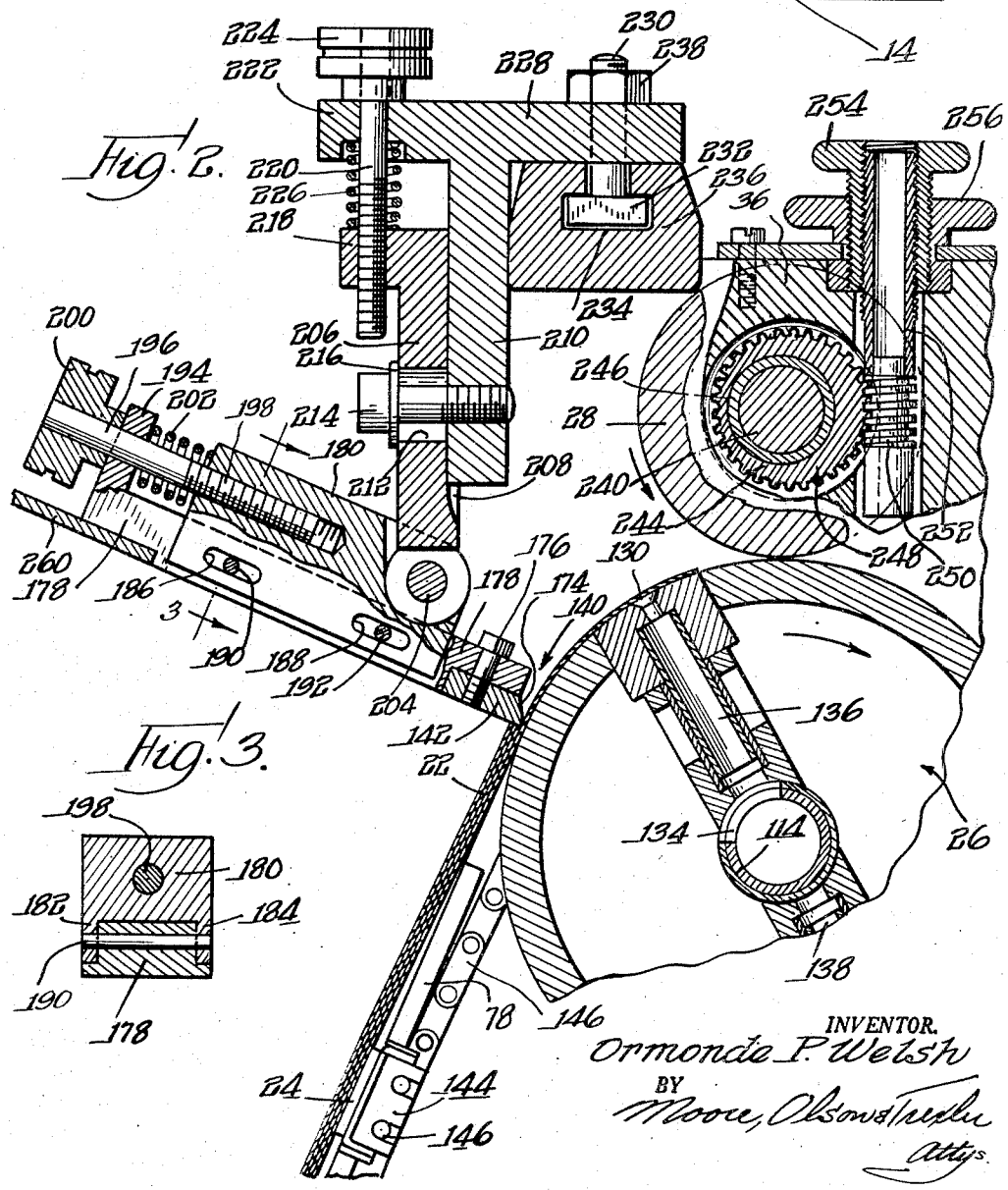


Fig. 3.

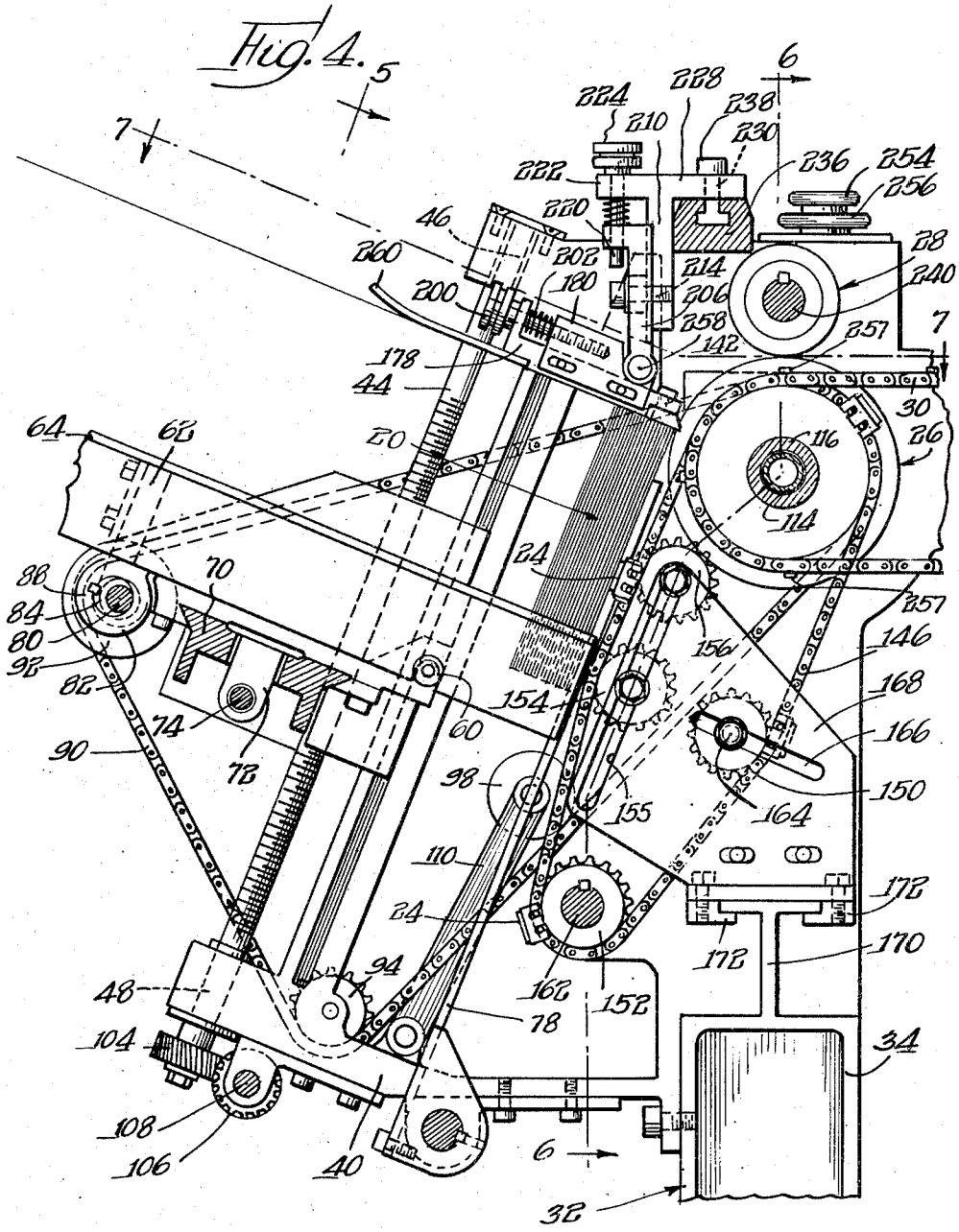
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ENVELOPE BLANK FEEDING MECHANISM

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Fig. 4.



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ENVELOPE BLANK FEEDING MECHANISM

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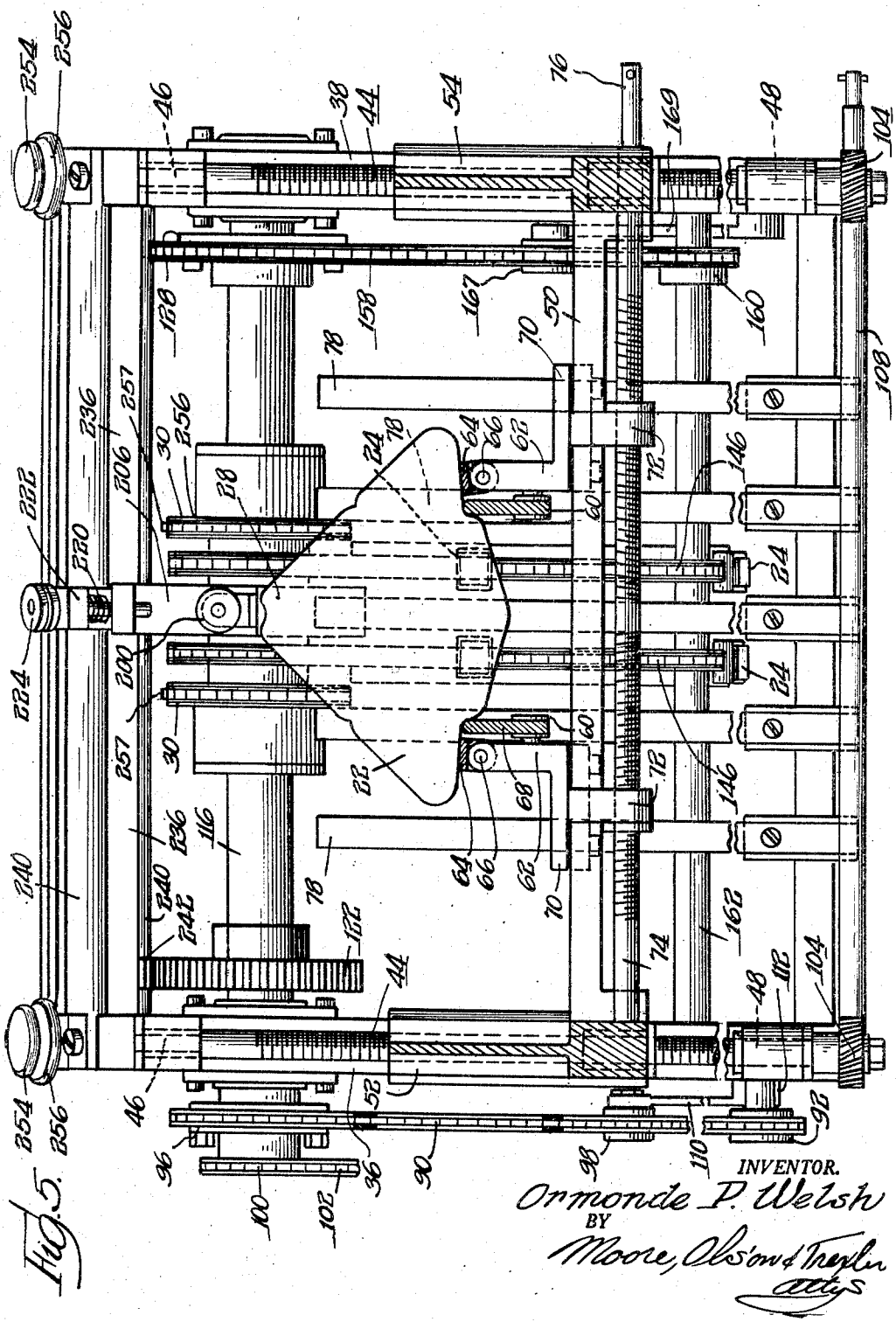


Fig. 5.

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ENVELOPE BLANK FEEDING MECHANISM

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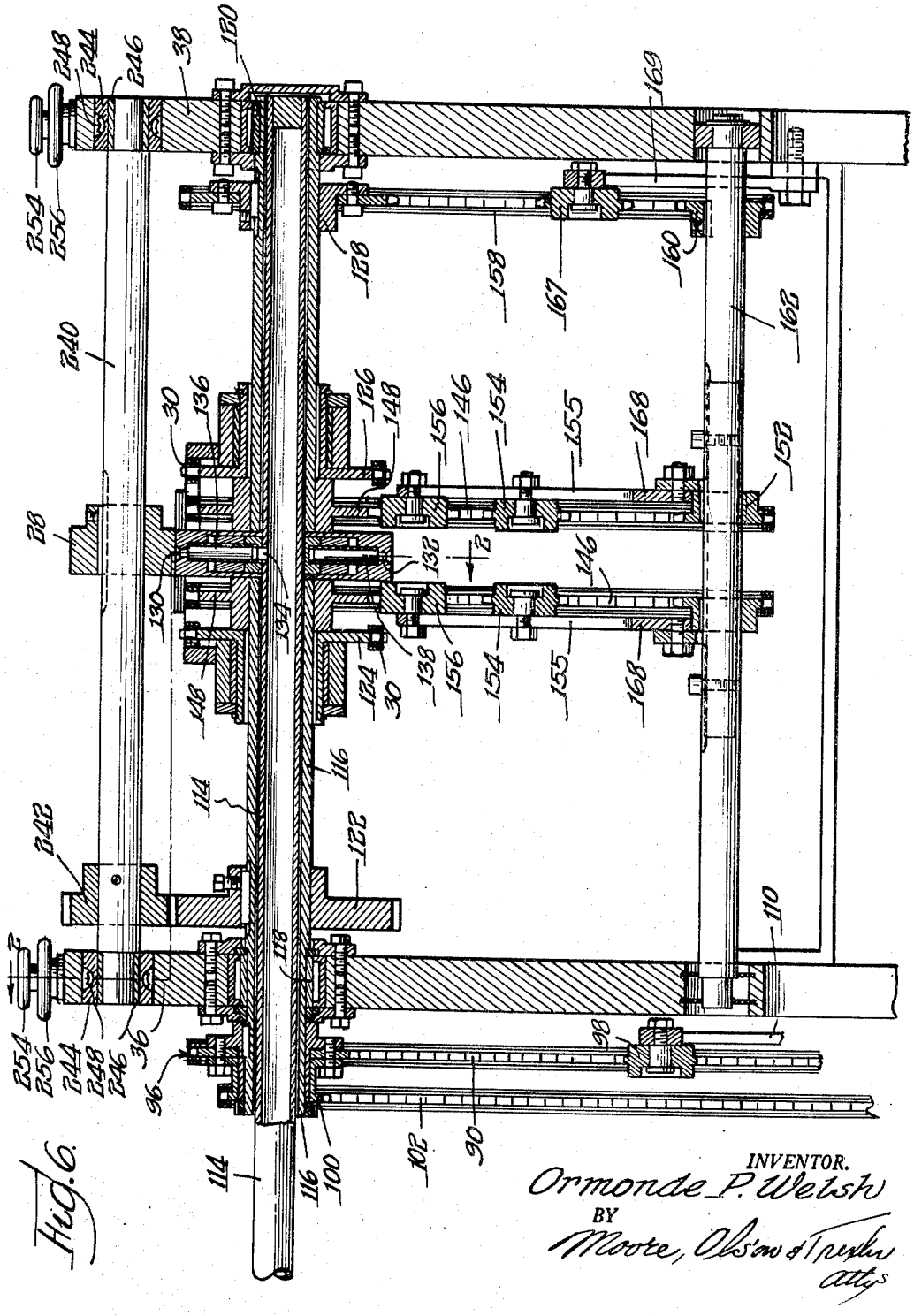


Fig. 6.

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ENVELOPE BLANK FEEDING MECHANISM

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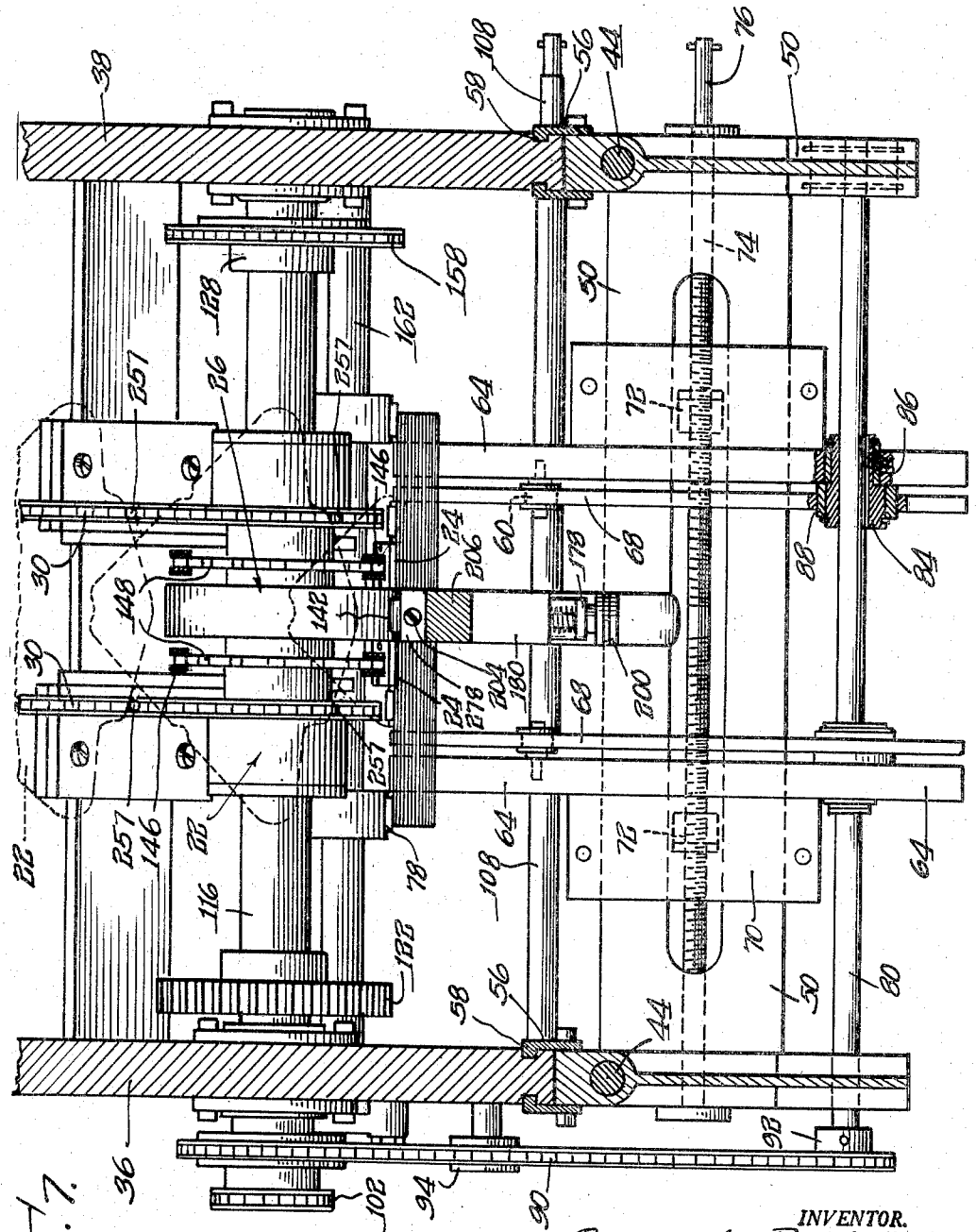


Fig. 7.

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2,709,081

ENVELOPE BLANK FEEDING MECHANISM

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Application December 29, 1950, Serial No. 203,266

13 Claims. (Cl. 271—2)

This invention relates to envelope forming machines, and more particularly to apparatus and methods for feeding envelope blanks to an envelope machine.

In forming envelopes, an envelope blank is formed from a flat sheet of paper by cutting the sheet to the proper shape. The envelope blank is then glued and folded to form a finished envelope. The present invention is directed to feed apparatus and methods for high speed automatic envelope forming machines. In these high speed machines the feed apparatus and methods must move the envelope blanks to successive forming operations at the rate of several hundred blanks per minute and move them one at a time in a continuous manner. More specifically, the blanks must be separated from each other so that no two blanks remain completely superimposed and there must be a substantially uniform time interval between adjacent blanks. If two or more blanks remain completely superimposed an envelope having double thickness walls will develop. If the feed mechanism fails to feed an envelope in proper timed sequence with the immediately preceding or succeeding envelope, certain succeeding operations of the forming machine, for example the gluing of the seal flap, will damage the next succeeding or next preceding envelope blank.

Accordingly it is an important object of the present invention to provide apparatus and methods for feeding envelope blanks to high speed envelope forming machnies; more particularly, it is an object of the invention to provide an improved feed apparatus and method for high speed envelope machines which will feed the envelope blanks from a stack one at a time and at uniform predetermined intervals in a continuous manner.

Another object of the invention is to provide envelope feed apparatus and method which has means for engaging the envelope blank simultaneously at spaced apart points.

Yet another object of the invention is to provide an apparatus for feeding envelopes to high speed envelope machines which has positive means to insure that only one envelope blank is fed from a stack of envelope blanks at a time.

In conjunction with the preceding object, it is a further object to provide positive gate means which can be universally adjusted to accommodate various sizes and thicknesses of envelope blanks.

Still another object of the invention is to provide an envelope blank feed apparatus having means for continually urging the envelope blanks toward the feed members.

Yet another object of the invention is to provide an envelope feed apparatus which can be easily and quickly adjusted to accommodate various sizes and shapes of envelope blanks.

A further object of the invention is to provide an envelope blank feed apparatus which is particularly adapted to feed blanks formed of heavier paper and to feed larger sizes of envelope blanks.

A still further object of the invention is to provide

in combination an envelope blank feed mechanism of the type described and a timing section for positively positioning the separated envelope blanks in fixed spaced relationship.

These and other object 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:

Fig. 1 is a side elevational view of an envelope forming machine having incorporated therein a feed mechanism embodying the principles of the present invention;

Fig. 2 is an enlarged view in vertical section of the suction wheel and gate substantially as seen in the direction of the arrows along the line 2—2 of Fig. 6;

Fig. 3 is a view in vertical section as seen in the direction of the arrows along the line 3—3 of Fig. 2;

Fig. 4 is a vertical view of the envelope blank feeding apparatus forming the subject matter of the present invention, certain parts being shown in section and certain parts being broken away for illustrative purposes;

Fig. 5 is a view in vertical section along the line 5—5 of Fig. 4;

Fig. 6 is a view in vertical section substantially as seen in the direction of the arrows along the line 6—6 of Fig. 4; and

Fig. 7 is a view in horizontal section substantially as seen in the direction of the arrows along the line 7—7 of Fig. 4.

Referring now to Fig. 1 of the drawings, there is shown an envelope forming machine including a blank feed mechanism generally designated by the numeral 10 embodying the principles of the present invention. The feed mechanism 10 takes the envelopes one at a time from a stack at predetermined time intervals and delivers them to a section 12 of the machine which applies glue to the seal flap. The envelope blanks with the glue in the undried condition are then fed to a drying mechanism 14 where the glue is dried, and then to a side flap gluing and folding mechanism generally designated by the numeral 16. The completed enevlopes are then stacked at 18 where they can be picked up by the operator and sent to other processing stations.

The blank feed mechanism 10 is best illustrated in Fig. 4. The feed mechanism 10 includes means for supporting a stack 20 of envelopes 22, a plurality of rubber pads 24 which engage the lower edge of an envelope blank when a blank is to be removed from the stack, a suction wheel 26 which engages the upper edge of a blank to be removed from the stack 20, a pressure roll 28 and a pair of timing conveyor chains 30. All of the above parts are supported upon a main frame 32 having a base portion 34 extending transversely with respect to the envelope forming machine and a pair of upstanding side frame portions 36 and 38 disposed at the ends of the base portion 34.

The support for the envelope stack 20 is mounted upon a side frame 40 which is bolted to the main frame as at 42 and extends to the left as viewed in Figure 4. Frame 40 extends substantially to the top of the envelope machine whereby to form a support for a pair of threaded rods 44 having the ends thereof journaled in frame 40 at 46 and 48. Threadedly mounted upon rod 44 is a stack frame 50, the sides of the stack frame 50 having elongated members 52 and 54 which engage the rods 44 along a substantial portion thereof. The forward ends of members 52 and 54 have attached thereto a pair of L-shaped brackets 56 (see Fig. 7), having a free leg 58 of the bracket turned inwardly to provide a guide member. A pair of upwardly extending grooves are formed in the side frame 40 to receive legs 58. Mounted on the stack frame 50 is a pair of support frames 62 which ex-

tend rearwardly and beyond the rear edge of the stack frame 40. Each of the support frames on the upper edge thereof carries a side flap supporting bar 64 which engages the envelopes on the under side of side flaps as viewed in Figure 5. The support bars are adjustable about the pivot 66 to accommodate different shaped side flaps on different styles of envelope blanks. Also mounted on the stack frame and disposed inwardly of the support frame are support rails 68 which engage the envelope blanks at the junction between the side flaps and the front flaps. The forward ends of the support rails 68 are pivoted on frame 62 as at 60 and the rear ends of the rails 68 are provided with means to reciprocate the rails in a vertical direction, as will be described hereinafter.

Various widths of envelopes can be accommodated by moving the support frames 62 toward or away from each other. To this end each support frame is provided with a block 70 having mounted therein a threaded nut 72. Disposed within the threaded portion of nut 72 is a threaded rod 74 which is rotatably mounted in the stack frame 50. One portion of the rod 74 is threaded in a right hand manner and the other end is threaded in a left hand manner so that the support frames move inwardly toward each other or simultaneously away from each other when the rod 74 is rotated. Means is provided for rotating rod 74 in the form of an extension 76 which is adapted to receive a suitable crank.

The forward portion of the envelope stack 20 is supported by a plurality of upstanding arms, see Figs. 2, 5 and 7; the lower ends of support arms 78 are attached to the lower portion of side frame 40. Arms 78 in cooperation with bars 64 and rails 68 serve to properly support the envelopes in stack 20 in position for feeding. As can be best seen from Fig. 4 the entire stack support is inclined forwardly or to the right at an angle of approximately 15° and accordingly no support is necessary on the rear portion of the stack. This arrangement also permits continual addition of envelope blanks to the stack without interrupting the operation of the machine.

As envelope blanks are fed from stack 20 it is necessary to move the stack bodily as viewed in Fig. 4 towards the suction wheel 26 and the pads 24. To this end there is provided means for continuously jogging or reciprocating the support rails 68 with respect to the stack frame 50. A shaft 80 is journaled in the rear end of stack frame 50 for rotation therein. The rear ends of the support rails 68 are provided with downwardly extending portions 82 which rotatably receive a jogging cam 84. Shaft 80 extends through cam 84 in an eccentric manner so that the portions 82 are moved upwardly and downwardly as cam 84 is rotated by shaft 80. To provide positive drive between shaft 80 and cam 84 and yet permit horizontal adjustment of the support frames 62 with respect to each other, an elongated slot is provided longitudinally in shaft 80, this slot receiving a key 86 firmly attached to the cam 84. It is also desirable to insert a bushing 88 between the cam 84 and the portions 82.

Shaft 80 is driven by means of a chain 90 which cooperates with a sprocket wheel 92 affixed to one end of shaft 80; chain 90 also contacts a sprocket wheel 94 mounted on the side portion 36, a driving sprocket 96 and a tension adjusting sprocket 98. The construction and mounting of the sprocket 96 can be best seen in Figure 6 wherein it will be seen that the sprocket wheel 96 is directly connected to another sprocket wheel 100 which is the main drive sprocket for the entire envelope machine. Sprocket 100 is driven by a chain 102 from a prime mover not shown. It will be seen from the above drive mechanism that the shaft 80 is rotated when the main drive sprocket wheel 100 is rotated. The purpose and operation of the tension sprocket 98 will be more fully described hereinafter.

Envelopes having various heights can be accommodated by moving the stack frame 50 upwardly or downwardly with respect to the rods 44. The lower ends of the rods 44 have attached thereto gears 104 which cooperate with gears 106. The gears 106 are mounted upon a shaft 108 positioned in the side frame 40. Upon rotation of shaft 108 the gears 104 are driven and rotate rods 44. Since the stack frame 50 cannot rotate, the frame 50 will be moved upwardly and downwardly along the rods 44 as the rods are rotated, the direction of movement of the frame 50 depending upon the direction of rotation of rods 44. It can be seen from Figure 4 that the chain 90 which drives the jogging cam 84 must be tightened or loosened when the frame 50 moves upwardly or downwardly. This tightening or loosening of the drive chain 90 is accomplished by the tensioning sprocket 98 referred to above. Sprocket 98 is mounted upon the arm 110 at one end thereof and the other end of arm 110 is pivotally mounted on the side frame 40 as at 112. (See Fig. 5.) The weight of sprocket wheel 98 and of arm 110 serves to provide the proper tension in drive chain 90.

The apparatus for removing envelope blanks 22 from the stack one at a time in a continuous manner will now be described. The suction roller or wheel 26 is rotatably mounted about a suction line 114 disposed within a main drive sleeve 116. The main drive sprocket wheel 100 described above is fixedly mounted upon the main drive sleeve 116 and serves to drive sleeve 116. Sleeve 116 is suitably journaled in the side portions 36 and 38 of the main frame as at 118 and 120.

Also mounted on sleeve 116 are a gear 122, a pair of spaced apart sprocket wheels 124 and 126, and another sprocket wheel 128. The gear 122 serves to drive the pressure roller 128, the sprocket wheels 124 and 126 drive the timing chains 30 and the sprocket wheel 128 furnishes means for driving the rubber pads 24.

The suction wheel 26 is mounted substantially in the center of the sleeve 116 and is positioned near the top of the feeding mechanism, the blank stack support being adjusted so that the suction wheel 26 contacts the upper edges of the envelope blank. A pair of suction ports 130 and 132 are formed in the suction wheel 26 and are diametrically opposed thereabout. The vacuum for the suction ports is supplied through the suction line 114 which has a suitable aperture in the center thereof and which is held stationary with respect to the frame portions 36 and 38. Connection is made between the suction line 114 and the suction ports 130 and 132 through a valve 134 formed in the suction line 114, valve 134 being in the form of an aperture disposed in the position shown best in Fig. 2 of the drawings. As the suction wheel 26 is rotated, the passages 136 and 138 which lead to the suction ports 130—132, respectively, alternately register with the valve 134 whereby to apply suction to the suction ports.

In operation the main drive sleeve 116 rotates in a direction such that suction wheel 26 is rotated in a clockwise direction as viewed in Figs. 2 and 3. When the leading edge of passage 136 first moves across the leading edge of the valve 134, suction is applied to port 130. In this position of the suction wheel 26 the port 130 is positioned adjacent an envelope blank at a point disposed counterclockwise with respect to the point of tangency between the suction wheel 26 and the adjacent envelope blank, that is, near the upper edge of the envelope blank. As suction wheel 26 continues to rotate, the blank will be held by suction and carried with suction wheel 26 up past a gate generally designated by the numeral 140 formed by the periphery of the suction wheel 26 and a gate member 142. Suction will be continuously applied until the forward edge of the envelope blank is carried under the pressure roll 28. A short time after engagement of the blank between pressure roll 28 and suction wheel 26 the suction will be removed from the envelope blank and the forward edge of the blank will be transferred to the timing chains 30.

Referring now to Figs. 2 and 4, the rubber pads 24 are mounted upon pad carriers 144 which in turn are mounted

upon and carried by a chain 146. There are two sets of rubber pads 24, one set being disposed on one side of the suction wheel 26 and the other set being disposed on the other side of suction wheel 26. Only one set of rubber pads and their drive will be described in detail; it is to be understood that the other set of rubber pads and their drive is substantially identical to the set described. The drive chain 146 is mounted upon a plurality of sprocket wheels including the sprocket wheel 148 rotatably mounted upon sleeve 116, adjustable sprocket wheel 150, a sprocket wheel 152 adjustably mounted upon side frame 40, a sprocket wheel 154 adjustably mounted in a slot 155, and a sprocket wheel 156 mounted upon the side frame 40. Means for driving the chain 146 is provided by a chain 158 driven by a sprocket wheel 128. The chain 158 in turn drives a sprocket wheel 160 which is fixedly mounted upon a shaft 162 journalled in the frame portions 36 and 38. The sprocket wheel 152 described above which contacts chain 146 is also fixedly mounted upon shaft 162 and therefore sprocket wheel 152 is driven when sprocket 160 is rotated by moving sprocket wheel 128. It will be seen therefore that rotation of the main drive sleeve 116 will serve to drive the chains 146 upon which the rubber pads 24 are mounted.

The above described drive structure drives the chain 146 in a clockwise direction as viewed in Fig. 4, whereby to move the pad 24 adjacent the envelope blank upwardly along the blank. The pads 24 are arranged on the chains 146 so that a pad 24 contacts the envelope blank near the lower edge thereof when the suction port on wheel 26 contacts the upper edge of the envelope blank. In this manner the rubber pads 24 aid in moving the desired envelope blank upwardly by frictionally engaging the blank and pushing it in an upward direction. It has been found that the provision of two means which simultaneously contact and urge the blank upwardly materially improves feeding of the envelope blanks.

In order to insure that the associated rubber pad 24 contacts the blank near the bottom thereof regardless of the size of the envelope blank being fed, the sprocket wheel 154 is mounted in the slot 155. More particularly, the sprocket wheel 154 is the drive member which urges the rubber pad against the envelope blank. Accordingly, the sprocket wheel 154 is adjustably mounted so that the envelope blanks in the stack will necessarily be contacted by the rubber pads 24 adjacent the lower edge of the blanks. Movement of the sprocket wheel 154 upwardly and downwardly as viewed in Fig. 4, will tend to tighten or loosen the drive chain 146 depending upon the direction of movement of the sprocket wheel 154. In order to insure that proper tension is maintained in chain 146 at all times, the sprocket wheel 150 has its supporting axle 164 mounted in an elongated slot 166, slot 166 being directed downwardly so that sprocket wheel 150 is urged against chain 146 by gravity. The drive chain 158 is adjusted and kept in proper tension by means of a tensioning sprocket wheel 167 which is carried by a pivotally mounted arm 169. Arm 169 is so arranged that the weight of arm 169 and the sprocket wheel 167 is urged against the drive chain 158 by gravity, thereby providing for tensioning of chain 158.

The drive chains 146 are adjustable laterally with respect to the envelope blank stack so that the optimum point of contact between the pads and the blanks can be had for various sizes of envelope blanks. The sprocket wheels 152 can be shifted longitudinally along shaft 162, see Fig. 6, and the wheels 148 can be shifted longitudinally along the sleeve 116. The sprocket wheels 150 and 156 are mounted upon plates 168. The plates 168 are slidably mounted upon a T-shaped member 170 attached to base 134, the plate 168 having a pair of L-shaped guide members 172 attached thereto for cooperation with member 170. By shifting the plates 168, the position of the sprocket wheels 150 and 156 can be adjusted transversely with respect to the face of the envelope blanks.

The gate member 142 is universally adjustable with respect to the surface of suction wheel 26. It has been found that universal adjustability of the gate is necessary to give optimum operating characteristics with varying thicknesses of blanks, size of blanks, and blanks made of different materials. The primary object of the gate 140 is to insure that only one envelope blank is carried upwardly away from the stack at any one time. This is accomplished by adjusting the distance between the end of gate member 142 and the surface of wheel 26 so that this distance is equal substantially to the thicknesses of the envelope blank being fed. The point on the periphery of wheel 26 at which gate 140 is formed is also important, the optimum operating point depending upon the character of the paper from which the blanks are made and the size of the blank.

The gate member 142 is substantially rectangular in shape and has the forward or gate forming edge thereof cut away or relieved as at 174 so that substantially line contact is provided with adjacent envelope blanks. A bolt 176 attaches member 142 to a plate 178. Plate 178 is in turn carried by a mounting block 180 having a groove formed on the lower side thereof providing depending flanges 182 and 184 between which is received the plate 178. The flanges 182 and 184 are provided with longitudinally extending slots 186 and 188 through which pass pins 190 and 192. Pins 190 and 192 also pass through suitable apertures in plate 178 to thereby form a sliding connection between plate 178 and block 180. The rearward end of plate 178 is provided with an upstanding flange 194 having an aperture therein to receive a rod 196. One end of rod 196 is threaded as at 198 and is received in a complementarily threaded aperture in block 180. The other end of rod 196 is provided with a knob 200 which permits manual adjustment of rod 196 with respect to block 180. A spring 202 under compression is disposed between flange 194 and the adjacent edge of block 180, spring 202 serving to urge flange 194 rearwardly against knob 200. By turning knob 200 the position of plate 178 with respect to block 180 and also the position of member 142 with respect to the periphery of wheel 26 can be adjusted with great accuracy. This adjustment in effect controls the width of the gate 140 and will hereinafter be referred to as the gate size adjustment.

Block 180 is pivotally attached as at 204 to a slide 206. A vertically extending groove 208 is formed in slide 206 and cooperates with a complementarily shaped support member 210. An elongated slot 212 is formed in slide 206, the longitudinal axis of slot 212 extending vertically. A bolt 214 having a washer 216 passes through slot 212 and into a threaded aperture in support member 210. By this arrangement the position of slide 206 with respect to support member 210 can be adjusted and tightened into adjusted position.

The upper edge of slide 206 has a rearwardly extending flange 218 having a threaded aperture therein to receive the threaded end of a rod 220. The other end of rod 220 passes through an aperture in a laterally extending flange 222 formed on support member 210 and has a knob 224 attached thereto. Interposed between flange 218 and flange 222 is a spring 226 under compression which urges slide 206 to the adjusted position. Adjustment of slide 206 with respect to support member 210 is achieved by loosening bolt 214 and then turning knob 224 until the proper position of slide 206 is obtained. Then bolt 214 is tightened to hold the slide 206 in adjusted position.

Also formed on the upper end of support member 210 is a second laterally extending flange 228 having an aperture therein to receive a bolt 230. The head 232 of bolt 230 is received in a complementarily shaped slot 234

formed in a bar **236** mounted between the side frame portions **36** and **38**. Head **232** of bolt **230** can be moved longitudinally in the slot **234** whereby to move support member **210** laterally with respect to wheel **26** and the envelope stack. When the desired position of the gate is obtained, a nut **238** threaded on the shank of bolt **230** is tightened to hold the member **210** in the adjusted position.

Referring now to Fig. 6, the mounting and drive for the pressure roller **28** will be described. Roller **28** is substantially cylindrical in shape and has an aperture therethrough which receives a shaft **240**. Roller **28** is adjustable longitudinally with respect to shaft **240** by means of a key and slot arrangement. The drive for shaft **240** is provided from gear **122** mounted on sleeve **116**, gear **122** meshing with a gear **242** fixedly mounted on shaft **240**. Rotation of the main drive sleeve **116** will therefore rotate shaft **240** and roller **28** in a counterclockwise direction as viewed in Figs. 2 and 4.

The ends of shaft **240** are eccentrically mounted in a support member **244**, a bushing **246** being provided between shaft **240** and the support member **244**. The support members **244** are in turn rotatably mounted within the frame portions **36** and **38** for rotation therein. A circumferentially extending groove is formed in the support members **244** and teeth **248** are formed in the bottom of the grooves. The teeth **248** mesh with a helical worm **250** formed on the lower end of a rod **252**. Rod **252** is mounted in the associated side frame portion **36** or **38** and extends upwardly and beyond the upper edge of the associated frame portion. The upwardly extending end of rod **252** is provided with a knob **254** so that rod **252** can be manually turned. Referring to Fig. 2, it will be seen that when rod **252** is rotated, the support member **244** will be rotated. Since the shaft **240** is eccentrically mounted on the support members **244**, it will be moved upwardly or downwardly away from or toward the suction wheel **26**. Accordingly the distance between pressure roll **28** and suction wheel **26**, and therefore the pressure applied to an envelope blank therebetween, can be adjusted by turning the knob **254**. A lock nut **256** is provided to lock the roll **28** in the adjusted position.

As the envelope blanks leave the suction wheel **26** and the pressure roll **28**, they are delivered to the timing chains **30**. The timing chains **30** are driven by the sprocket wheels **124** and **126**. A plurality of timing pins **257** are carried by the timing chains **30** and engage the envelope blanks along the trailing edge of the seal flap as can be best seen in Fig. 7. Any inaccuracies in spacing between adjacent envelope blanks is corrected by the timing pins **257** so that the blanks are properly aligned as they leave the timing chains **30**.

The overall operation of the feeding mechanism will now be described. A plurality of envelope blanks are stacked upon the support rails **68** and the support bars **64**. The angularity of the support bars **64** is adjusted by pivoting them about the pivot point **66**. The envelope width adjustment is then made by rotating shaft **74** whereby to move the bars **64** and the rails **68** toward or away from each other as required. When these members are properly adjusted, the rails contact the envelope blanks at the juncture between the side flaps and the seal flaps and the bars **64** contact the lower edge of the seal flaps.

Adjustment is then made for the height of the envelope blanks so that the upper edge of the blank is disposed substantially tangentially against the periphery of wheel **26** as shown in Fig. 2. This adjustment is accomplished by turning shaft **108** whereby to move the stack frame **50** upwardly or downwardly along the threaded rods **44**. It is to be noted that the drive chain **90** for the jogging cam **84**, the drive chain **146** for the rubber pads **24**, and the drive chain **158** will be substantially automatically adjusted as the stack frame **50** is moved upwardly or downwardly.

It may be necessary to move the sprocket wheels supporting and driving the chains **146** laterally across the face of the blank stack by moving the frame **168** and the sprocket wheels **152** and **148**.

After suitable adjustment has been made for the size and shape of the envelope, the position and size of the gate **140** is adjusted. The position of contact in a lateral direction, that is, in a direction parallel to the drive sleeve **116**, is made by loosening nut **238** and moving the support member **210** longitudinally along bar **236**. The point on the periphery at which the gate **140** is to be positioned is obtained by means of the vertical adjustment actuated by knob **224**. When the vertical adjustment has been made, the width or size of the gate is adjusted by turning knob **200** whereby to move gate member **142** toward or away from the periphery of suction wheel **26**. After these adjustments of the gate **140** have been made, it may be necessary to readjust the height of the stack **20** so that the upper edge of the envelope blanks lies against the underside of gate member **142**. The angularity of block **180** with respect to slide **206** is adjusted by tightening screw **258**. The envelope blanks are held down or weighted by means of a rearwardly extending bar **260** attached to the plate **178**.

The pressure of roller **28** is finally adjusted and the feed mechanism is ready for operation. Motive power is supplied to the main drive sprocket **100**, thereby rotating suction wheel **26** clockwise as viewed in Figs. 2 and 4, rotating pressure wheel **28** counterclockwise, moving the rubber pads **24** vertically upwardly along the face of the adjacent envelope blank, and moving the timing pins on the upper portion of the timing chains **30** to the right when seen in Figs. 2 and 4.

When the suction port **130** moves to a position such that it is about to contact the upper edge of an envelope blank, a rubber pad **24** is in position to contact the lower edge of the same envelope blank. The suction is turned on by means of valve **134**, thereby producing two forces acting upon the envelope blank tending to move the blank upwardly out of contact with the remainder of the stack. The size of the gate **140** is such as to permit only one envelope blank to pass therethrough and accordingly only the blank in contact with port **130** and pad **24** is moved upwardly away from the stack. When the forward edge of the blank being fed contacts the pressure roller **28**, the suction to port **130** is turned off and the roller **28** and the pad **24** continue feeding the blank. As the suction wheel **26** continues to rotate, the rearmost edge of the envelope blank comes into alignment with the pressure roller **28** and at this time the rubber pads **24** are disengaged and the timing pins **257** are moved into engagement. The timing pins **257** correct any slight inaccuracies in the position of the blank and pass the blank on to the next processing station.

There has been provided an improved feed mechanism for feeding envelope blanks from a stack which fulfills all of the objects and advantages set forth above. More specifically there has been provided a feed apparatus for feeding envelope blanks which can feed the blanks at a high rate yet in a sure and uniform manner so that envelope blanks are fed from a stack in a continuous manner without interruption and only one at a time. This positive feed of blanks without interruption is insured by the cooperation of the suction wheel **26** and the rubber pads **24** which positively grip the envelope blanks and the gate **140** formed between the gate member **142** and the suction wheel **26** which positively prevents removal of more than one blank from the stack at a time. The gate member **142** is universally adjustable with respect to suction wheel **26** whereby to provide optimum operating characteristics of the machine. An improved stack support has also been provided, the stack support accommodating a wide range of sizes and shapes of envelope blanks.

In addition, improved means has been provided for continuously urging the entire stack toward the feeding station so that an envelope blank is always in position to be contacted by suction wheel **26** and the pads **24**.

Although a preferred example of the present invention has been shown for purposes of illustration, it is to be understood that various changes and modifications can be made therein without departing from the spirit of the invention. Accordingly the invention is to be limited only as set forth in the following claims.

The invention is hereby claimed as follows:

1. An apparatus for feeding envelope blanks from a stack of the blanks comprising means for supporting said stack with the plane of the blanks disposed at an angle with respect to the horizontal, suction means for gripping the blank disposed at one end of the stack, said suction means serving to initiate removal of said blank from said stack, means for pressing rearwardly against and frictionally gripping said blank at a point spaced away from and behind the point of contact between said blank and said suction means with respect to the direction of movement of the blanks, and means for moving said suction means and said frictional gripping means in the same direction and for moving said gripping means across said stack whereby to remove said blank from the stack.

2. An apparatus for feeding envelope blanks from a stack of the blanks comprising means for supporting said stack with the plane of the blanks disposed at an angle with respect to the horizontal, a suction wheel mounted adjacent said stack and positioned to contact the outermost envelope in said stack at a point near the upper edge of said envelope, a suction port in said wheel for grasping said envelope blank adjacent the upper edge thereof, means for rotating said suction wheel in a direction to move the associated envelope blank upwardly away from the stack when the blank is engaged by said wheel, said suction wheel serving to initiate removal of said blank from said stack, means for pressing rearwardly against and frictionally gripping said blank at a point spaced away from and below the point of contact between said blank and said wheel and at a point spaced away from the edges of said blank, and means for moving said frictional gripping means across said stack in a direction to aid removal of said blank from the stack.

3. An apparatus for feeding envelope blanks from a stack of the blanks comprising means for supporting said stack with the plane of the blanks disposed at an angle with respect to the horizontal, a suction wheel mounted adjacent said stack and positioned to contact the outermost envelope in said stack at a point near the upper edge of said envelope, a suction port in said wheel for grasping said envelope blank adjacent the upper edge thereof, means for rotating said suction wheel in a direction to move the associated envelope blank upwardly away from the stack when the blank is engaged by said wheel, means for pressing rearwardly against and frictionally gripping said blank at a point spaced away from and below the point of contact between said blank and said wheel at a point spaced away from the edges of said blank, means for moving said frictional gripping means across said stack in a direction to aid removal of said blank from the stack, and a gate member disposed adjacent said suction wheel in a position such that the envelope blank being withdrawn from the stack must pass between said gate member and said wheel, the distance between said gate member and said wheel permitting only one envelope blank to be drawn from said stack at a time.

4. An apparatus for feeding envelope blanks from a stack of the blanks comprising means for supporting said stack with the plane of the blanks disposed at an angle with respect to the horizontal, a suction wheel mounted adjacent said stack and positioned to contact the outermost envelope in said stack at a point near the upper edge of said envelope, a suction port in said wheel for grasping said envelope blank adjacent the upper edge thereof, means for rotating said suction wheel in a direction to move the associated envelope blank upwardly away from the stack when the blank is engaged by said wheel, means for pressing rearwardly against and frictionally gripping said blank at a point spaced away from and below the point of contact between said blank and said wheel, means for moving said frictional gripping means across said stack in a direction to aid removal of said blank from the stack, and a pressure roll disposed adjacent said suction wheel at a point on the periphery of the suction wheel removed from the point of contact between the suction wheel and the stack, said roll in cooperation with said suction wheel serving to move said envelope blank when the suction applied to said suction port is removed.

5. An apparatus for feeding envelope blanks from a stack of the blanks comprising means for supporting said stack with the plane of the blanks disposed at an angle with respect to the horizontal, a suction wheel mounted adjacent said stack and positioned to contact the outermost envelope in said stack at a point near the upper edge of said envelope, a suction port in said wheel for grasping said envelope blank adjacent the upper edge thereof, means for rotating said suction wheel in a direction to move the associated envelope blank upwardly away from the stack when the blank is engaged by said wheel, means for pressing rearwardly against and frictionally gripping said blank at a point spaced away from and below the point of contact between said blank and said wheel, means for moving said frictional gripping means across said stack in a direction to aid removal of said blank from the stack, a gate member disposed adjacent said suction wheel in a position such that the envelope blank being withdrawn from the stack must pass between said gate member and said wheel, the distance between said gate member and said wheel permitting only one envelope blank to be drawn from said stack at a time, and means for universally adjusting the position of said gate means with respect to said suction wheel.

6. An apparatus for feeding envelope blanks from a stack of the blanks comprising means for supporting said stack with the plane of the blanks disposed at an angle with respect to the horizontal, a suction wheel mounted adjacent said stack and positioned to contact the outermost envelope in said stack at a point near the upper edge of said envelope, a suction port in said wheel for grasping said envelope blank adjacent the upper edge thereof, means for rotating said suction wheel in a direction to move the associated envelope blank upwardly away from the stack when the blank is engaged by said wheel, means for pressing rearwardly against and frictionally gripping said blank at a point spaced away from and below the point of contact between said blank and said wheel, means for moving said frictional gripping means across said stack in a direction to aid removal of said blank from the stack, a gate member disposed adjacent said suction wheel in a position such that the envelope blank being withdrawn from the stack must pass between said gate member and said wheel, the distance between said gate member and said wheel permitting only one envelope blank to be drawn from said stack at a time, and a pressure roll disposed adjacent the periphery of said suction wheel at a point spaced away from said gate member in the direction of rotation of said suction wheel.

7. An apparatus for feeding envelope blanks from a stack of the blanks comprising means for supporting said stack with the plane of the blanks disposed at an angle with respect to the horizontal, suction means for gripping the blank disposed at one end of the stack, means for pressing rearwardly against and frictionally gripping said blank at a point spaced away from and behind the point of contact between said blank and said suction means with respect to the direction of movement of the blanks and spaced from the edges of said blanks, means for con-

tinuously moving said suction means and said frictional gripping means in the same direction whereby to remove said blank from the stack, and a timing conveyor disposed adjacent said suction means and frictional gripping means to receive the envelope blanks fed from said stack by said suction means and said frictional gripping means.

8. An apparatus for feeding envelope blanks from a stack of the blanks comprising means for supporting said stack with the plane of the blanks disposed at an angle with respect to the horizontal, gripping means for gripping the blank disposed at one end of the stack at a point disposed away from the edges of said blank, said gripping means initiating removal of said blank from said stack, means for moving said gripping means initially in a direction substantially parallel to the plane of said blank, and positively positioned gate means positioned along the edge of said blank disposed in the direction of movement of said gripping means, said gate means providing an opening substantially in the plane of said blank permitting only one blank to be removed from said stack at a time.

9. An apparatus for feeding envelope blanks from a stack of the blanks comprising means for supporting said stack with the plane of the blanks disposed at an angle with respect to the horizontal, gripping means for gripping the blank disposed at one end of the stack at a point disposed away from the edges of said blanks, said gripping means initiating removal of said blank from said stack, means for moving said gripping means initially in a direction substantially parallel to the plane of said blank, positively positioned gate means positioned along the edge of said blank disposed in the direction of movement of said gripping means, said gate means providing an opening substantially in the plane of said blank permitting only one blank to be removed from said stack at a time, and means for adjusting said gate means to accommodate varying thicknesses of blanks.

10. An apparatus for feeding envelope blanks from a stack of the blanks comprising means for supporting said stack with the plane of the blanks disposed at an angle with respect to the horizontal, a surface having gripping means formed thereon positioned adjacent the outermost blank in the stack for engaging a side surface only of said outermost blank, means for moving said surface while the surface is engaging said blank with respect to said stack to remove said blank from said stack, a positively positioned gate member positioned adjacent said surface so that said blank must move through the space between said gate member and said surface as the blank is removed from the stack with said space being located substantially in the plane of the outermost blank in the stack, means for adjusting the position of said gate member along said surface and the angularity of said gate member with respect to said surface, and means for adjusting the distance between said gate member and said surface to accommodate varying thicknesses of envelope blanks to insure that only one blank is removed from said stack at a time.

11. In an apparatus for feeding sheets from a stack of the sheets, a support for the stack comprising main support means disposed longitudinally of the stack and inclined with respect to the horizontal, end support means disposed at the end of said main support means positioned lowermost, auxiliary support means disposed substantially parallel to said main support means, and means for reciprocating said auxiliary support means in a vertical direction and toward and away from said main support means to move the sheets towards said end support means as sheets are removed from the stack at the end adjacent said end support means.

12. In an apparatus for feeding blanks from a stack of the blanks, a support for the stack comprising main support means disposed longitudinally of the stack and inclined with respect to the horizontal, means for adjusting the distance between said main support means to accommodate a plurality of sizes of blanks, end support means disposed at the end of said main support means positioned lowermost, auxiliary support means disposed substantially parallel to said main support means, means for adjusting the distance between said auxiliary support means to accommodate a plurality of sizes of blanks, and means for reciprocating said auxiliary support means in a vertical direction and toward and away from said main support means to move the blanks toward said end support means as blanks are removed from the stack at the end adjacent said end support means.

13. An apparatus for feeding blanks from a stack of the blanks comprising a frame, a suction wheel mounted upon said frame, a support for said stack comprising main support means disposed longitudinally of the stack and inclined with respect to the horizontal, the lowermost ends of said main support means being disposed toward said suction wheel, end support means disposed at the end of said main support means positioned adjacent said suction wheel, means for rotating said suction wheel to remove blanks from said stack, auxiliary support means disposed substantially parallel to said main support means, means for reciprocating said auxiliary support means in a vertical direction and toward and away from said main support means to move the blanks toward said end support means as blanks are removed from the stack by said suction wheel, and means adjustably mounting said main support means and auxiliary support means on said frame.

References Cited in the file of this patent

UNITED STATES PATENTS

584,007	Moehn et al.	June 8, 1897
1,982,823	Meredith	Dec. 4, 1934
2,016,711	Ford	Oct. 8, 1935
2,057,279	Shomaker	Oct. 13, 1936
2,220,073	Belcher et al.	Nov. 5, 1940
2,244,250	Johnson	June 3, 1941
2,265,007	Ryan	Dec. 2, 1941
2,395,497	Nordquist	Feb. 26, 1946