# United States Patent [19]

**Palkovic et al.**

[11] **3,741,535**

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[54] **SHEET STOCK FEEDING MECHANISM**


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[52] **U.S. Cl.** ..... **271/101**, 271/113

[51] **Int. Cl.** ..... **B65h 3/08**

[58] **Field of Search** ..... 271/29, 2, 41, 51



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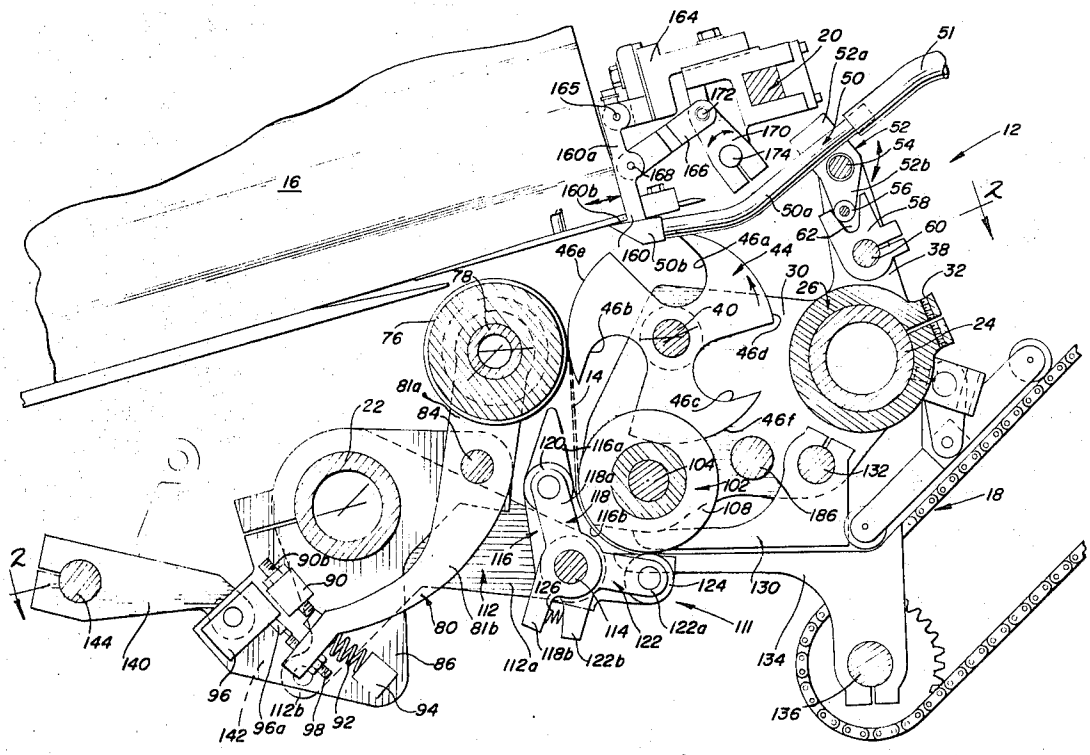
[57] **ABSTRACT**

The described apparatus feeds sheet stock such as envelope blanks from the bottom of a supply stack into a transporting conveyor such as the conveyor for an envelope-converting machine. The apparatus includes a pair of transverse load-supporting members. A segment feed roll is mounted on a drive shaft which is journaled in a first bearing member affixed to one of the supporting members. A pinch feed roll is disposed adjacent the segment feed roll to form a nip through which the sheet stock may be drawn. The pinch roll has a drive shaft journaled in a second bearing member which is resiliently mounted on the other of the transverse supporting members, and this drive shaft is driven through a universal coupling.


**15 Claims, 10 Drawing Figures**



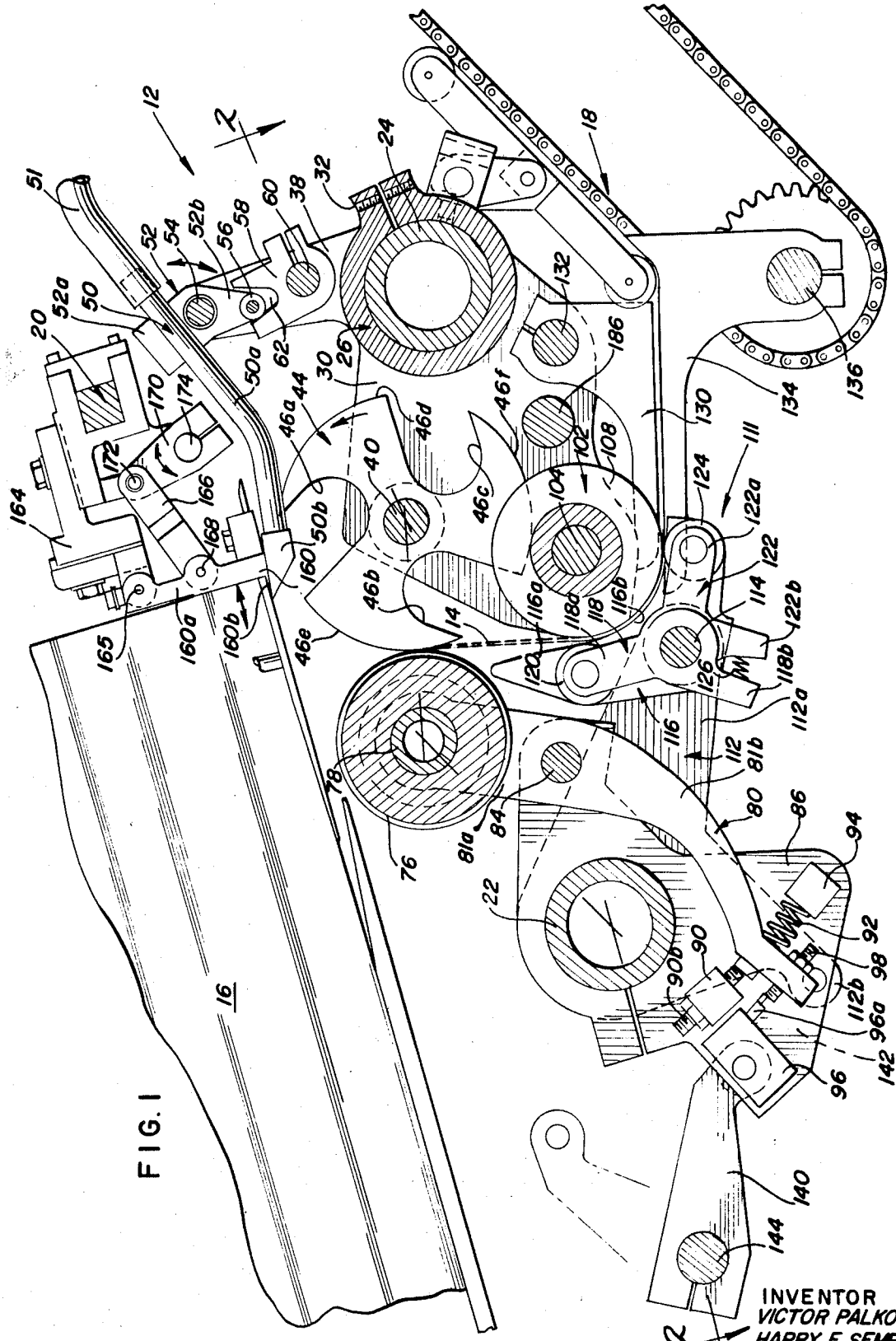



FIG. 1

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FIG. 2

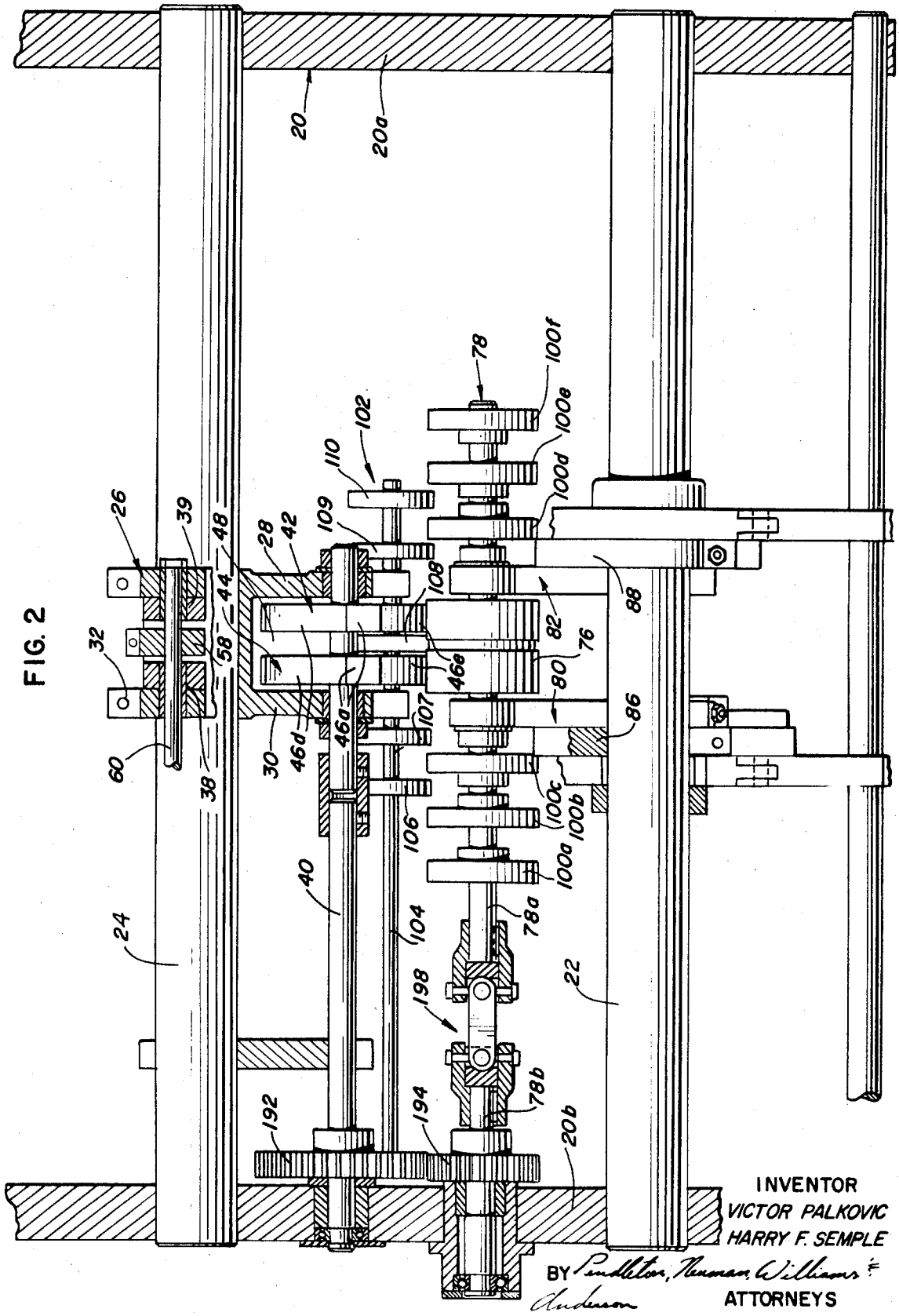


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FIG. 4

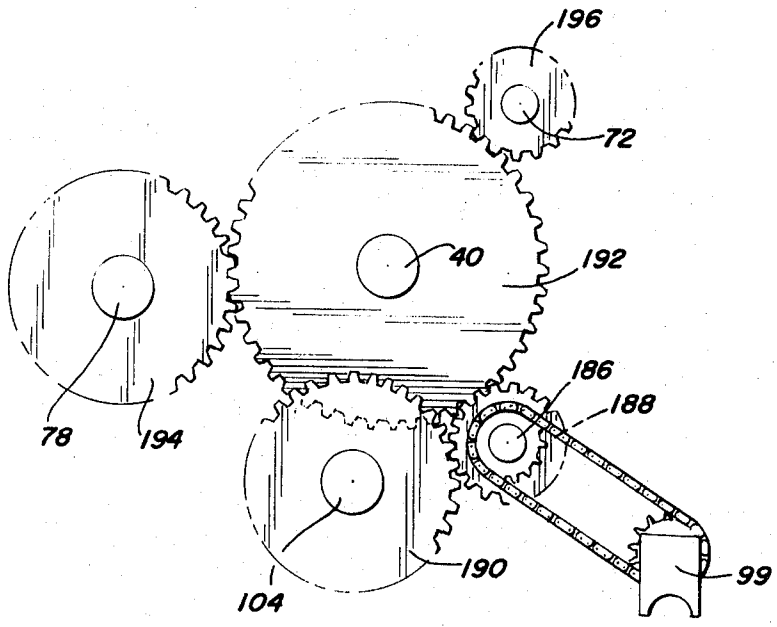


FIG. 3

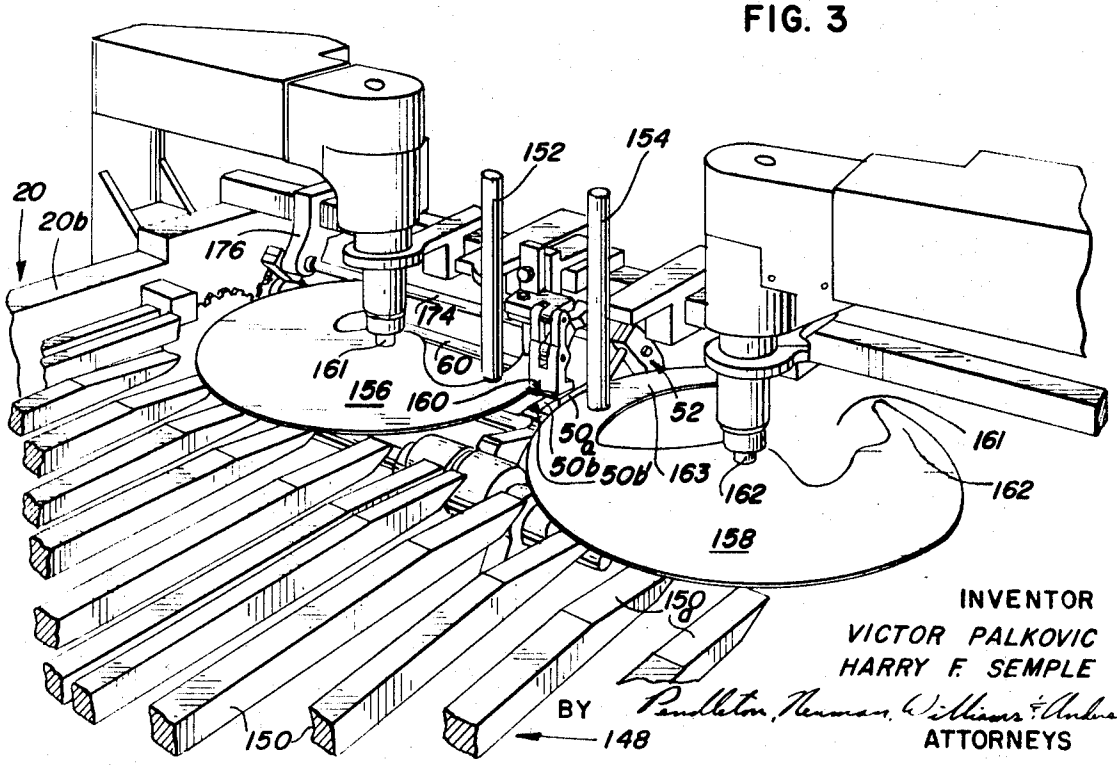


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FIG. 5

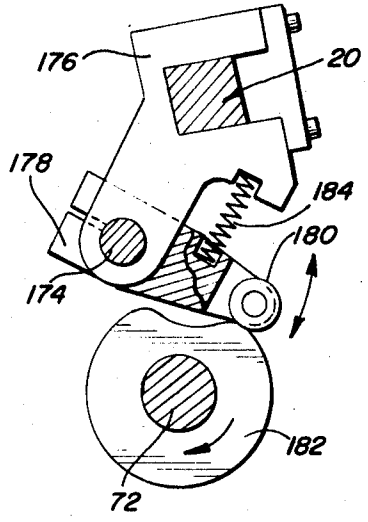


FIG. 6

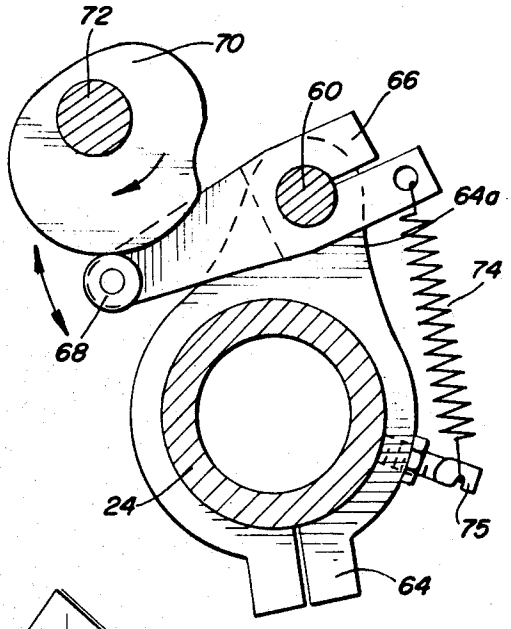


FIG. 7

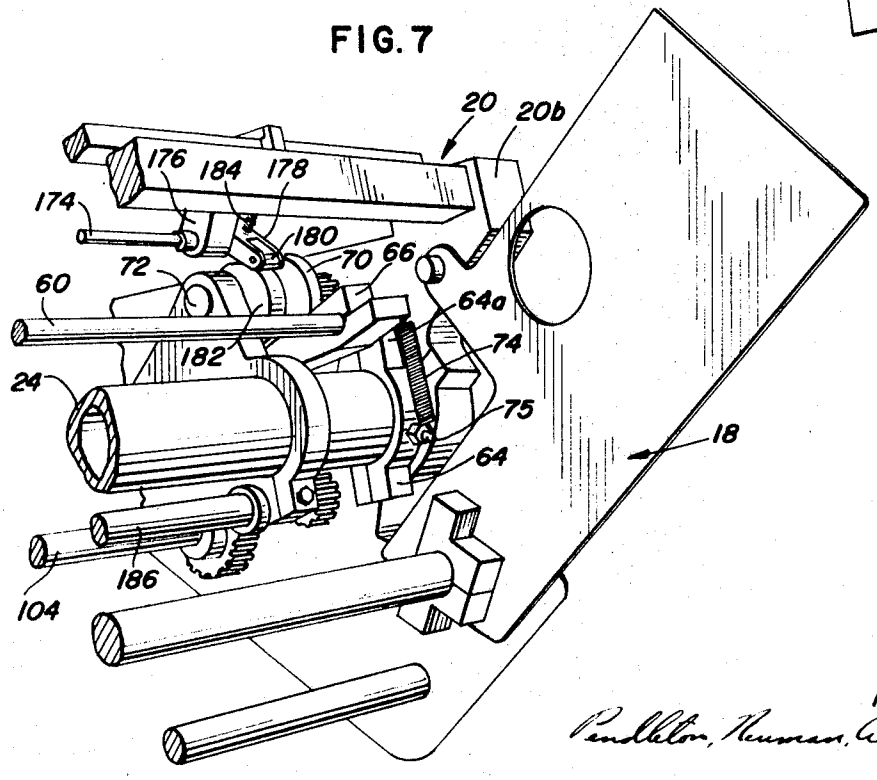


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FIG. 8

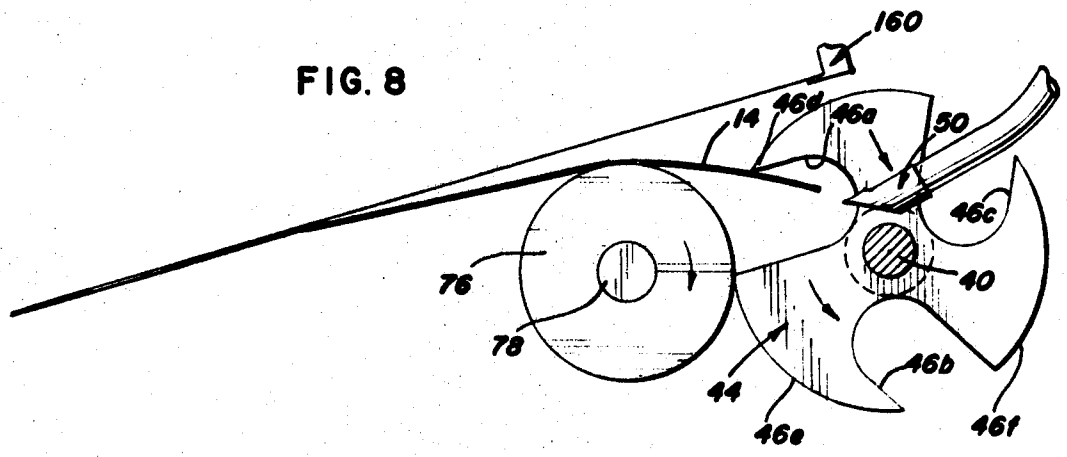



FIG. 9

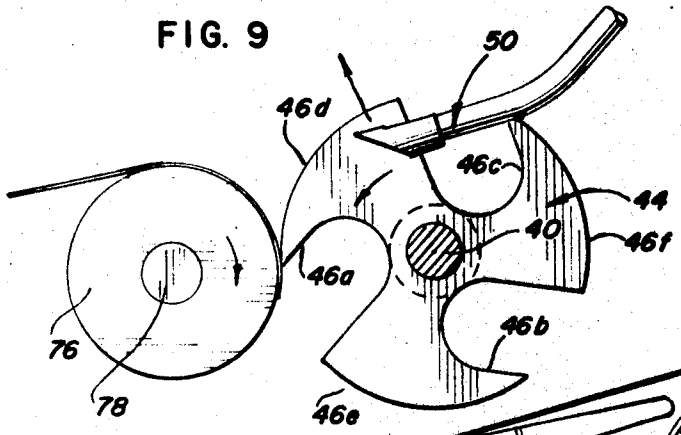
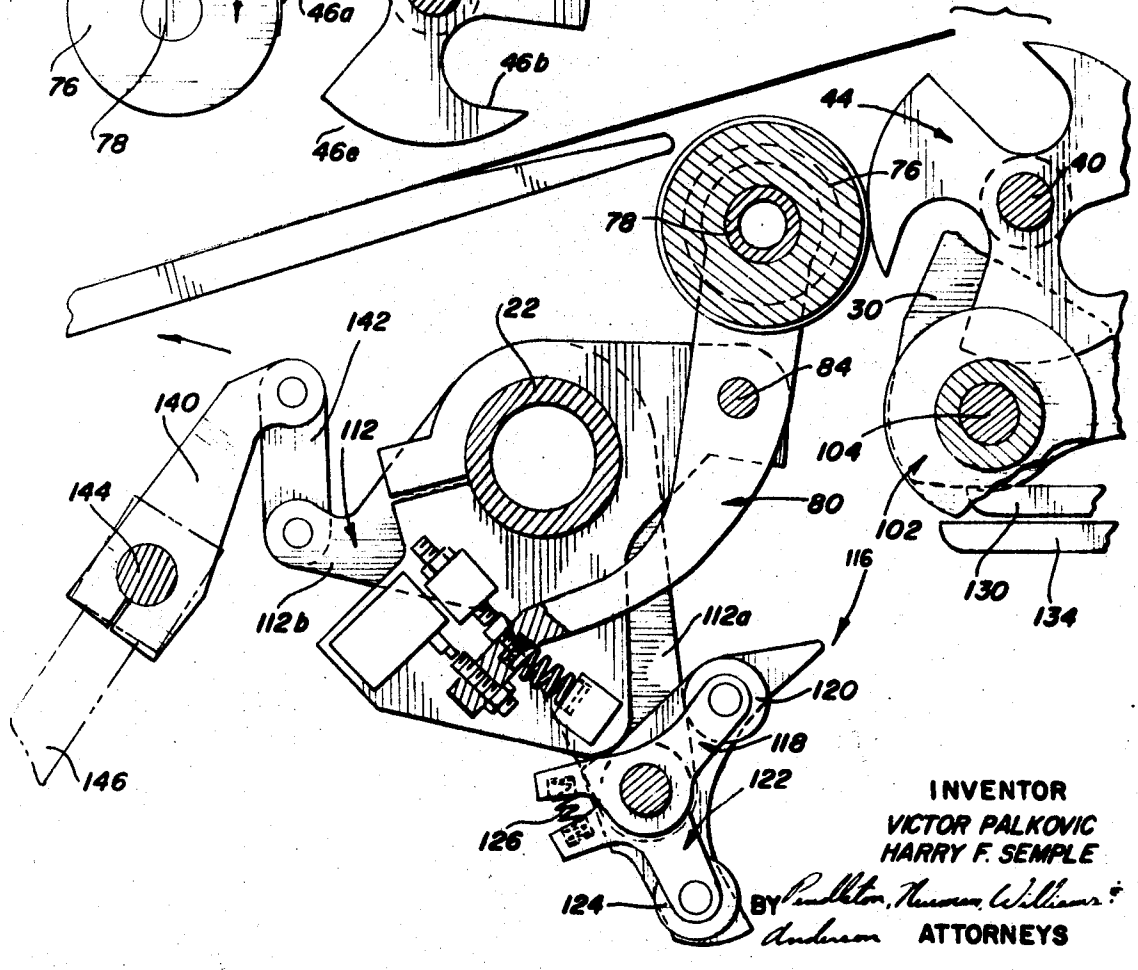



FIG. 10

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# SHEET STOCK FEEDING MECHANISM

## BACKGROUND OF THE INVENTION

This invention relates to a mechanism for feeding sheet stock such as envelope blanks from a supply stack into a transporting conveyor such as, for example, a machine for folding and gluing the blanks to form the finished envelopes. While the mechanism is herein described in connection with an envelope machine, it will be understood that certain features of this mechanism may be employed in various other machines for feeding sheet stock into a transporting conveyor.

The mechanism is particularly adapted for use in connection with machines which are adapted to make large envelopes where large sizes of blanks are used, and, therefore, a large spacing is required between the sides of the machine. Such machines are commonly used to form large open end and open side envelopes.

In such envelope machines there is a problem in getting the proper support at the center, i.e., inwardly from the sides of the machine where at least initial gripping should occur, while at the same time keeping supporting structures and operating mechanisms clear of the path of the sheets as they are drawn from the stack. In addition, the sheets must be fed accurately and with precision into the folding and gluing machine so that the folding and gluing operations may be done accurately. The machine must also be capable of handling a wide variety of different shapes of blank as well as blanks of different thicknesses, and the operation must be done smoothly and rapidly in order to work in conjunction with high-speed envelope machines.

The present invention features a novel and improved support for the feeding mechanisms providing firmness, strength and rigidity to the mechanisms at the center of the machine. The mechanism permits the accurate feeding of the sheets of various sizes, shapes and thicknesses. The feed is accurate and reliable, and wear is minimized.

## SUMMARY OF THE INVENTION

The apparatus constructed in accordance with this invention is adapted to feed sheet stock such as envelope blanks along a predetermined path from the bottom of a supply stack into a transporting conveyor of the type such as may be used in conjunction with or as an integral part of an envelope gluing and folding machine. In accordance with one embodiment of the invention, the apparatus includes a frame having substantially parallel sides. A pair of spaced, substantially parallel load-supporting members extend transversely between the sides of the frame, one of these members being disposed on one side of the aforementioned path of the envelope blanks and the other of the members being disposed on the other side of the path.

A first bearing means is mounted on a first one of the supporting members, and a first feed roll disposed adjacent to the first bearing means has a drive shaft journaled in the first bearing means. A second bearing means is mounted on the second of the transverse supporting members, and a second feed roll is disposed adjacent the first feed roll to form a nip therewith through which the sheet stock may be drawn. The second feed roll is also disposed adjacent the second bearing means and has a drive shaft which extends through and is journaled in the second bearing means.



Means is provided for moving the sheet stock into position for engagement by the feed rolls, and power means is provided for rotating the drive shafts of the feed rolls, whereby the sheet stock will be drawn between the rolls and pulled from the stack.

In the preferred embodiment the first feed roll is formed of two spaced segment rolls, and the means for moving the sheet stock into position for engagement by the rolls comprises a cam-operated suction arm or sucker tube mounted for movement between the segment rolls and adapted to pull the leading edge of the bottom sheet in the stack downwardly for engagement by the segment rolls. The segment rolls, in turn, move the sheet further downwardly into the nip between the segment rolls and the second feed roll.

A cam-operated edge support finger or separator blade may be employed to support the leading edge of the bottom sheet in the stack until the suction arm begins to move downwardly, at which time the finger may operate to release the bottom sheet. A pair of horizontal rotating crescent-shaped discs may also be employed to separate the bottom sheet from the remaining sheets in the stack.

Also, in the preferred embodiment of the second feed roll serves as a power driven pinch roll and is resiliently mounted with respect to both the segment rolls and the second support members, and this second feed roll is preferably driven through a universal coupling.

A third feed roll and idler pinch roll assembly is preferably disposed downstream from the first and second feed rolls to engage and move the sheet stock into the conveyor for the folding and gluing operations.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional elevational view of a sheet stock feeding apparatus constructed in accordance with this invention showing one of the segment rolls, the power driven pinch roll, the suction arm, the edge support finger, the third feed roll and the idler pinch roll assembly, and further showing the manner in which these elements are operatively mounted on the apparatus frame;

FIG. 2 is a sectional view of the apparatus taken substantially along 2—2 of FIG. 1;

FIG. 3 is a perspective view of a portion of the apparatus taken from above and to one side thereof;

FIG. 4 is a schematic view of the gear train used to drive the various mechanisms;

FIG. 5 is an enlarged sectional view showing the cam drive for the edge support finger;

FIG. 6 is an enlarged sectional view showing the cam drive for the suction arm;

FIG. 7 is a perspective view showing the drive mechanisms including the cam drives for the edge support finger and suction arm;

FIG. 8 is an enlarged sectional elevational view of the segment and power driven pinch rolls, showing the position of these rolls after the leading edge of the bottom sheet in the stack has been pulled downwardly by by the suction arm and has been engaged by the segment rolls;

FIG. 9 is an enlarged sectional elevational view of the segment and pinch rolls, showing the position of these rolls just after the leading edge of the bottom sheet in the stack has been moved into the nip between the segment rolls and the pinch roll; and

FIG. 10 is a sectional elevational view of a portion of the mechanism showing the idler roll means moved to

its inoperative position providing access to the feeding mechanism from beneath.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With further reference to the drawings and more particularly to FIG. **1**, the apparatus **12** is designed to feed sheet stock **14**, such as, for example, envelope blanks, from a supply stack **16** into a transporting conveyor **18** which may be part of a machine which folds and glues the envelope blanks and converts them into the finished envelopes. The apparatus is particularly adapted for handling large sheets which require a wide spacing between the sides of the machine and, thus, a wide spacing between the supports for the elements of the feed mechanism. The apparatus provides an accurate and rapid feeding of the sheet stock **14** from the bottom of the supply stack **16** and is adapted to feed a wide variety of shapes, sizes and thicknesses of blanks or sheets.

The sheet feeding apparatus **12** includes a frame **20**, portions of which are illustrated in FIGS. **2, 3** and **7**. The frame has two substantially parallel side members **20***a* and **20***b* with the spacing between these members being sufficient to accommodate sheets or blanks of relatively large size. The frame **20** is preferably securely fastened to, or it may actually be an integral part of the frame of the converting machine **18** with which the feeding mechanism **12** is adapted to cooperate and into which it is adapted to feed the sheets or blanks.

One of the features of the invention is the novel means in which the sheet-engaging rollers and other mechanisms are mounted on the frame, this mounting being such that substantial support is provided at the midpoint where the gripping and feeding of the sheets takes place. Extending transversely between the sides **20***a* and **20***b* of the mechanism frame **20** are two heavy, tubular, steel supporting members **22** and **24**. These supporting members are parallel and are horizontally disposed. All of the sheet-engaging rollers and guides of the apparatus **12** are operatively attached to and supported by these tubular supporting members. This gives maximum support for the sheet-engaging devices where it is most needed, that is, at the center of the apparatus, and it minimizes the load which has to be carried by the drive shafts and other parts of the roller mechanisms and guides.

Mounted on the tubular supporting member **24** is a collar **26** having a pair of spaced, parallel, integral flange plates **28** and **30** (see FIGS. **1** and **2**). The collar **26** is actually a split collar as best illustrated in FIG. **1** and is locked in position on the tubular supporting member **24** by means of suitable threaded fasteners **32**. The flange plates **28** and **30** are disposed perpendicularly to the axis of the collar **26** so that when the collar is positioned in place on the transversely-extending horizontally-disposed tubular supporting member **24**, the flange plates will be vertically oriented. In the illustrated embodiment the flange plates **28** and **30** have an identical configuration, and the configuration of plate **30** is shown in FIG. **1**. Also attached to or forming an integral part of the collar **26** are the pair of parallel upstanding arms **38** and **39**.

A horizontal drive shaft **40** extends through and is journaled for rotation in the vertical flange plates **28** and **30** as best illustrated in FIG. **2**. The opposite end of the drive shaft **40** is journaled for rotation in the side **20***b* of the frame **20**. Affixed to the drive shaft **40** between the vertical flanges **28** and **30** of the collar **26** are two identically constructed steel segment rolls **42** and **44**. Each of these segment rolls has three equiangularly spaced recesses **46***a*, **46***b* and **46***c* which divide the segment roll into three equal segments at the periphery thereof, these segments being identified by the numerals **46***d*, **46***e* and **46***f*. It will be noted that the recesses **46***a–c* are disposed at an angle with respect to the radius of the segment roll, the angle being in the direction of rotation as indicated by the arrow, so that the outer portions of the recess lead the inner portions of the recess. As will be hereinafter more fully described this permits the leading edge of the sheet to be engaged and moved downwardly by the segment rolls.

The segment rolls **42** and **44** are mounted in spaced relationship on the drive shaft **40** providing a spacing **48** of such width that a suction arm **50** may move vertically within this spacing above the drive shaft **40**. The suction arm or sucker tube is best illustrated in FIG. **1** and includes a body portion **50***a* and a nozzle portion **50***b*, the body portion **50***a* being tubular and the nozzle portion **50***b* having an opening **50***b'* adjacent its uppermost and outermost end as seen in FIG. **3**. The body portion of the suction arm is upwardly curved, and the end opposite the nozzle portion **50***b* is connected to a vacuum line **51**.

The body portion **50***a* is affixed to an arm **52***a* of a member **52** which is mounted for pivotal movement on a horizontal stub shaft **54** extending between the spaced upwardly-extending arms **38** and **39** of the collar member **26**. The other arm **52***b* of the member **52** carries a roller **56**. A rocker member **58** mounted on a horizontal operating shaft **60** caries a recess **62** at its outer end for accommodating the roller **56** of the member **52**. The operating shaft **60** extends through and is journaled for rotation with respect to the arms **38** and **39** of the collar member. As best illustrated in FIG. **7** the operating shaft **60** extends toward the side **20***b* of the frame **20**, and the end of the shaft **60** is journaled for rotation in an extension **64***a* of a collar **64** affixed to the tubular support member **24**. As seen in FIG. **6**, affixed to the shaft **60** adjacent the collar **64** is a follower **66** which carries a roller **68** at its outer end. The roller is adapted to engage the peripheral surface of a cam **70** mounted on a cam shaft **72**. The roller **68** of the follower **66** is maintained in contact with the surface of the cam **70** by means of a spring **74** which is connected to a hooklike element **75** on the collar **64**.

The follower **66** will thus move in accordance with the configuration of the cam **70** which rotates with the cam shaft **72**, and the movement of the follower **66** will be transmitted to the suction arm **50** through the operating shaft **60**, the operating member **58** and the member **52**.

Cooperating with the steel segment roll **44** is a power driven steel pinch roll **76** mounted on a horizontal drive shaft **78**. The drive shaft **78** is journaled for rotation in two substantially identically constructed parallel bearing arms **80** and **82** (see FIG. **2**) which are mounted for pivotal movement on a horizontal pivot shaft **84** (see FIG. **1**). The pivot shaft **84** extends between two fixed collar members **86** and **88** which are mounted in fixed position on the tubular supporting member **22**. The arms **80** and **82** are identically constructed with arm **80** being illustrated in FIG. **1**.

The drive shaft 78 for the pinch roll 76 is journaled in the upper portion 81*a* of each of the arms 80 and 82, and the lower portion 81*b* of each of the arms 80 and 82 extend downwardly between an adjustable fixed stop 90 and a resilient member 92 which are mounted on each of the collar members 86 and 88 for controlling the movement of the adjacent arm 80 or 82 as the case may be. Each of the fixed stops 90 has an adjustable threaded element 90*b* which stops the pivotal movement of the associated arm 80 or 82 in the clockwise direction as viewed in FIG. 1 about the pivot shaft 84, and each of the resilient members 92 bears against a block 94 affixed to the associated collar member 86 or 88, as the case may be, to resist the counterclockwise rotation of the arms 80 and 82 about the pivot shaft 84.

This arrangement permits limited resilient movement of the pinch roll 76 away from the segment roll 44 against the resistance of the springs or resilient members 92. The axis of the pinch roll remains horizontal and parallel to the axis of the segment rolls 42 and 44 because of the horizontal parallel relationship between the drive shaft 78 and the pivot shaft 84. If desired, additional transverse connections may be made between the two arms 80 and 82. The threaded elements 90*b* may be adjusted so that even when there is no sheet stock between the rolls, the pinch roll 76 comes within close proximity to the surface of the segment roll 44, but the two do not engage each other. This adjustment may be changed for variations in the thickness of the sheet stock being fed through the machine. A safety cut-off microswitch 96 mounted on the collar member 86 has its operating element 96*a* in engagement with an adjustable threaded element 98 on the lower portion 81*b* of the arm 80. The switch 96 is preferably connected in the line to the motor 99 for the machine (see FIg. 4) so that if a jam-up of sheet stock should develop between the pinch roll 76 and the segment roll 44, the arm 80 will be moved out of contact with the operating element 96*a* of the switch 96, and the motor 99 will be de-energized.

It is also desirable to provide a plurality of guide rolls on the drive shaft 78 of the pinch roll 76. This is best illustrated in FIG. 2 where six guide rolls 100*a*, 100*b*, 100*c*, 100*d*, 100*e* and 100*f* are illustrated. These rolls will be driven with the pinch roll 76 by the drive shaft 78 in a manner which will be more fully hereinafter described.

Operating below the segment rolls 42 and 44 and the segment roll drive shaft 40 is a third or supplemental feed roll assembly 102 which in the illustrated embodiment consists of a horizontal drive shaft 104 on which are mounted five supplemental feed rolls 106, 107, 108, 109 and 110. The drive shaft 104 extends through the flange plates 28 and 30 of the collar 26 and is journaled for rotation therein. It will be noted from FIG. 2 that the middle supplemental feed roll 108 is disposed between the segment rolls 42 and 44, whereas the other supplemental feed rolls 106, 107, 109 and 110 are disposed on either side of the parallel flange plates 28 and 30.

Operating with each of the supplemental feed rolls 106, 107, 108, 109 and 110 is a backup or pressure roll mechanism 111 which operates to guide the sheets 14 partly around and resiliently maintain them in frictional engagement with the associated supplemental feed roll. The pressure roll mechanisms 111 for the five supplemental rolls have the same construction and mounting arrangements, and, therefore, in FIG. 1 only one of these mechanisms 111 is illustrated, this being the mechanism which cooperates with the middle supplemental roll 108.

Mounted for pivotal movement on the tubular supporting member 22 is a bell crank 112 having a first arm 112*a* and a second arm 112*b*. Toward the end of the arm 112*a* is a pivot stub shaft 114 on which is pivotally mounted an arcuate guide element 116 having a tapered nose piece 116*a* and an arcuate guide surface 116*b*. Also mounted for pivotal movement on the pivot shaft 114 is an element 118 having an arm 118*a* and an arm 118*b*, the arm 118*a* carrying a roller 120. A similar element 122 is mounted on the pivot shaft 114, this element 122 having an arm 122*a* and an arm 122*b*, the arm 122*a* carrying a roller 124. A compression spring 126 is disposed between the arms 118*b* and 122*b* and operates to urge these arms apart and thus to urge the element 118 in a clockwise direction about the pivot shaft 114 and the element 122 in a counterclockwise direction about the pivot shaft 114.

When the bell crank 112 is in its operative position as illustrated in FIG. 1, the rollers 120 and 124 will be resiliently urged toward engagement with the associated supplemental feed roll, which in FIG. 1 is roll 108, and in this position the arcuate surface 116*b* of the guide element 116 will be in close proximity to but spaced from the associated supplemental roll. Thus the sheets 14 will be guided about the supplemental feed roll by the guide element 116 and will be held in position against the associated supplemental feed roll by means of the resiliently mounted rollers 120 and 124 of the pressure roll mechanism. The rollers 120 and 124 thus serve to hold the sheets 14 against the power driven supplemental feed rolls so that these sheets may be driven through the machine. While only one of the guide elements 116 is illustrated in FIG. 1, it is preferred that there actually be two guide elements for each of the pressure roll mechanisms 111 so that the pivotally mounted elements 118 and 122 may be sandwiched between two of the guide elements 116.

The bottom of each supplemental feed roll 106, 107, 108, 109 or 110, as the case may be, is aligned with the bottom of a fixed upper guide element 130 which is connected to a fixed horizontal shaft 132, and the shaft 132 is affixed to the flange plates 28 and 30 of the collar 26. Spaced below the fixed upper guide element 130 is a fixed lower guide element 134 which is mounted on a fixed horizontal shaft 136. The shaft 136 in the illustrated embodiment is part of the transporting conveyor 18. The supplemental feed roll assembly 102 cooperates with the pressure roll mechanisms 110 to receive the sheets as they are feed by the segment rolls 42 and 44 and the pinch roll 76 and to move the sheets between the upper and lower guide elements 130 and 134, respectively, into the transporting conveyor 18.

The pressure roll mechanism 111 may be moved from its operative position illustrated in FIG. 1 to its retracted or open position as illustrated in FIG. 10 to provide access to the undersides of the three power driven feed rolls, i.e., the segment rolls 42 and 44, the pinch roll 76 and the supplemental feed roll assembly 102. For this purpose an operating arm 140 is connected to the arm 112*b* of the bell crank 112 by means of a connecting link 142, one end of which is pivotally connected to the arm 140, and the other end is pivotally

connected to the arm 112*b*. The pivotal movement between the link 142 and the arm 140 is limited. The arm 140 is mounted on a horizontal operating rod 144 to which is also affixed a handle 146. By swinging the handle 146 the operating rod 144 and the arm 140 may be moved between the position illustrated in FIG. 1 and the position illustrated in FIG. 10.

When in the operative position illustrated in FIG. 1, the arm 140 and the connecting link 142 actually pass over the center to form a toggle lock which will hold the backup roller mechanism in position until the handle 146 is swung to again move these elements over center at which time the backup or pressure roller mechanism 111 will drop to the position illustrated in FIG. 10.

When the pressure roller mechanism is in its operative position as illustrated in FIG. 1, the guide elements 116 will guide the sheets 14 around the feed rolls 106, 107, 108, 109 and 110. The tapered forward end of each of the curved elements 116 extends to adjacent the pinch roll 76 so that as the sheets 14 are drawn through the nip between the segment rolls 42 and 44 and the pinch roll 76, they will be guided by the guide elements 116 around the feed rolls and will be resiliently held against the feed rolls by the rollers 120 and 124. Should a jam-up occur between the segment rolls 42 and 44 and the transporting conveyor 18, this may be cleared by simply moving the backup or pressure roll assembly 111 away from the feed rolls as previously described to permit access to the stock in the area of the feed rolls.

The stack 16 of sheets is held on a table 148 formed by means of a plurality of parallel bars 150 which extend parallel to the sides 20*a* and 20*b* of the frame 20 as best seen in FIG. 3. The forward ends 150*a* of these bars terminate short of and are preferably tapered toward the pinch roll 76. Forwardly of the table there are disposed two vertical guide bars 152 and 154 which engage and guide the forward or leading edges of the sheets 14 in the supply stack 16. Most of the sheet supply stack 16 will rest on the parallel bars 150.

The leading edge of the stack 16 is supported by means of two spaced horizontal discs 156 and 158 and by means of a support finger 160. The discs 156 and 158 are mounted on vertical drive shafts 156*a* and 158*a*, respectively, which through suitable gearing and chain drives are rotated in synchronization with each other and with the drives of the segment rolls 42 and 44 and the pinch roll 76. The discs are rotated in opposed relationship, i.e., the disc 156 rotates in the clockwise direction as viewed in FIG. 3, and disc 158 is rotated in the counterclockwise direction. The discs have an identical but opposite configuration, i.e., they are mirror images of each other.

Each of the discs 156 and 158 is substantially crescent-shaped having a large opening 161 with a peripheral leading blade 162 and a peripheral trailing blade 163 which extend toward one another and partially close the opening 161. The discs are operated not only in synchronization with the feed rolls but also in opposed synchronization with each other so that the corresponding leading and trailing blades 162 and 163 will be rotated in precise, opposed relationship to one another. The spacing between the discs is sufficient to accommodate the suction arm 50 and the edge support finger 160. The support for the leading edge of the sheets in the area between the discs 156 and 158 is by means of the suction arm 50 and the edge support finger 160 which cooperates with the suction arm 50 to move momentarily rearwardly out of supporting contact with the bottom sheet in the stack as the suction arm applies a suction to the leading edge of that sheet and moves it downwardly.

The edge support finger or separator blade 160 includes a body portion 160*a* and a transverse blade portion 160*b*, the latter of which is adapted to be moved into position beneath the forward edge of the stack of sheet stock between the discs 156 and 158, and this blade portion thus engages and supports the stack in this area. The upper end of the body portion 160*a* is pivotally connected to a fixed support 164 by means of a pin connection 165. A link 166 has one end pivotally connected by means of a pin 168 to the body portion 160*a* of the support finger below the pin connection 165, and the opposite end of the link 166 is pivotally connected to an arm 170 by means of a pin connection 172. The arm 170 is connected to a horizontal operating rod 174. The other end of the operating rod 174 extends through and is journaled for rotation within a bracket 176 attached to the transverse member of the frame 20 (see FIGS. 4 and 7). Carried at this end of the operating rod 174 is a follower arm 178 having a roller 180 at its distal end. The roller 180 is urged into contact with the peripheral surface of a cam 182 by means of a spring 184 acting between the follower arm 178 and the bracket 176 as best illustrated in FIG. 5. The cam 182 is affixed to and rotates with the cam shaft 72, and the shape of the cam 182 is such that a very quick forward (release) and rearward (return) movement is given to the operating rod 174 and thus to the edge supporting finger 160.

The entire sheet feeding apparatus 12 may be operated by means of a single motor 99 which may be the motor for the transporting conveyor 18. The motor 99 may have a chain drive 183 to a sprocket 184 affixed to a drive shaft 186 as schematically shown in FIG. 4. Mounted on the drive shaft 186 are two gears 188, one of which is in mesh with the gear 190 on the drive shaft 104 for driving the third roller 102. The other of the two gears 188 meshes with the gear 192 which is affixed to the drive shaft 40 for the segment rolls 42 and 44. The gear 192, in turn, is in mesh with a gear 194 which is affixed to the drive shaft 78 for the pinch roll 76, and this gear 192 is also in driving engagement with the gear 196 keyed to the cam shaft 72 for driving the cam 70 for the suction arm and the cam 182 for the edge support finger.

For fast, accurate and smooth feeding, the power driven, resiliently mounted pinch roll 76 should be maintained in parallel relationship with respect to the segment rolls 42 and 44. The drive shaft 78 for the pinch roll must, therefore, be capable of limited parallel movement while maintaining a power connection. Since the pinch roller 76 is power driven off of the drive shaft 78, it is highly desirable that the portion of the shaft 78 on which the roller 76 is mounted be permitted to remain parallel to the drive shaft 40 for the segment rolls 42 and 44. While limited movement could be accommodated by permitting sufficient play in the gearing, this would result in substantial wear and would not give the accuracy and dependability needed in the type of machine with which the feeding apparatus of this invention is designed to operate.

In accordance with the present invention, the drive shaft **78** for the pinch roll **76** is divided into two segments **78***a* and **78***b*, and a universal coupling **198** is disposed therebetween. Thus the drive shaft portion **78***b* on which the gear **194** is mounted may be journaled for rotation in the side **20***b* of the frame **20** so that the gear **194** is in firm, continuous and full meshing engagement with the gear **192** which drives the segment rolls **42** and **44**. All movement of the pinch roll **76** (and of the drive shaft portion **78***a* on which that roll is mounted) is taken up by the universal coupling **198**.

In operation a stack **16** of sheet stock **14** is placed on the table **148** with the forward edge of the stack being positioned against the vertical guide bars **152** and **152** as best illustrated in FIG. **3**. The forward or leading edge of the sheets will rest upon the discs **156** and **158**, and between the discs the edges will be supported on the edge support finger **160**. The apparatus is then started, and the discs **156** and **158** will rotate in the clockwise and counterclockwise directions, respectively. When the openings **164** are rotated under the leading edges of the stack, a vacuum is applied to the suction arm **50** through the vacuum line **51** (which may be controlled by a cam-operated valve, not shown), and as the cam **70** is rotated to cause the suction arm **50** to move downwardly, the edge support finger **160** will be quickly moved rearwardly by means of the cam **182** operating through the operating rod **174**, the arm **170** and the link **166**. This movement is a quick forward movement to withdraw the blade portion **160***b* and release the bottom sheet at the center of the leading edge so that it may be drawn downwardly by the suction arm **50**, whereupon the edge support finger moves quickly back into its normal position to support the edge of the remaining sheets in the stack **16**. At this point the leading blade **162** of each of the discs **156** and **158** moves into position between the bottom sheet in the stack and the next sheet which is being held in position by the edge support finger **160**. The central portion of the leading edge of the bottom sheet, of course, is being drawn downwardly by the suction arm, so that the blades **162** may readily enter above the bottom sheet. As the discs **156** and **158** continue to rotate, they effectively separate the entire forward or leading portion of the bottom sheet from the remaining sheets in the stack **16**.

As this sheet separation is taking place, the segment rolls **42** and **44** rotate, and as the suction arm **50** moves down between these segment rolls, the central portion of the leading edge of the bottom sheet will be brought into one of the recesses which in FIGS. **1**, **8** and **9** would be the recess **46***a* of each of the segment rolls. As the segment rolls continue to rotate the leading edges **46***d* of the segment rolls will engage and capture the leading edge of the sheet as best illustrated in FIG. **8**.

It will be noted that the suction arm **50** is required to move the leading edge of the sheet downwardly only below the periphery of the segment rolls, and the forwardly canted configuration of the segments will cam the edge downwardly as the rolls rotate.

It is actually preferred that the configuration of the suction arm cam **70** be such that there is a delay in the downward movement of the arm after it has moved below the periphery of the segment rolls. This will assure that a relatively thick, stiff sheet will be held for the camming action of the segment rolls rather than depending upon the force of suction to hold the sheet as it is moved further downwardly. The valve controlling the suction arm may cut off the suction as the arm **50** reaches its fully lowered position. At about this point the suction arm moves out of contact with the sheet and is ready to move back upwardly into position for vacuum engagement with the next sheet in the stack.

The segment rolls **42** and **44** continue to rotate to bring the leading edge of the sheet **14** downwardly into the nip between the segment rolls **42** and **44** and the pinch roll **76** as best illustrated in FIG. **9**. The gripping of the sheet **14** between the segment rolls **42** and **44** and the pinch roll **76** will draw the bottom sheet from the stack and force it over the power driven guide rolls **100***a–f* and downwardly between the guide elements **116** of the pressure roll mechanisms **111** and their associated supplemental feed rolls **106–110**. The tapered forward end of the arcuate guide **116** guides the sheet as it moves downwardly, and the rollers **120** and **124** resiliently urge the sheet against the associated supplemental feed roll. The sheets **14** are moved in an arcuate path and exit from between the supplemental feed roll assemblies **102** and the pressure roll mechanisms **111** into the opening or guideway between the upper and lower fixed guides **130** and **134** and thence into the transporting conveyor of the machine **18**.

The particular apparatus is adapted to feed the sheets **14** in an overlapping, fanned relationship, and for this reason the peripheral lengths of the segments of the segment rolls **42** and **44** are somewhat less than the lengths of the sheets or blanks **14** being fed.

By changing the size or number of the segments in the segment rolls **42** and **44**, the degree of overlapping may be adjusted, and, if desired, the overlapping may be eliminated, with each sheet being fed singly into the transporting conveying mechanism **18**. Since in the illustrated embodiment the segment rolls are divided into three segments, the apparatus is designed to feed three sheets for every 360° of rotation of the segment roll.

If a jam-up should occur between the segment rolls **42** and **44** and the pinch roll **76**, the pinch roll **76** will be forced away from the segment roll by the jam-up causing the lower portion of the bearing arm **80** to move away from the microswitch **96**, thereby deenergizing the motor **99** and turning off the feed mechanism. Some resilient movement of the pinch roll, however, is essential in view of the overlapping of the sheets **14** and in view of the variation in the thicknesses of the sheets being handled. If necessary, the threaded elements **90***b* and **98** may be adjusted to adapt the machine to handle sheets which are extremely thin or extremely thick.

It is to be noted that all of the feed rolls which engage the sheet on one side are operatively connected to the transversely-extending tubular supporting member **24** while all the feed rolls which engage the sheet on the other side thereof are operatively connected to the transversely-extending tubular supporting member **22**. This manner of suspension to obtain a very high degree of strength and rigidity at the center of the machine where the gripping between the segment rolls **42** and **44** and the pinch roll **76** takes place is an important feature of the invention.

It is to be understood that the present disclosure has been made only by way of example and that many addi-

tional modifications and changes in various details may be resorted to without departing from the invention.

What is claimed is:

1. In an apparatus for feeding sheets of sheet stock, such as envelope blanks, by removing such sheets from a supply stack and feeding the sheets along a predetermined path into a transporting conveyor; a frame including a pair of spaced side members between which said sheets are moved along said path; a pair of spaced, substantially parallel stationary rigid unitary load-supporting members each extending transversely between and rigidly supported in said side members, one of said supporting members being disposed on one side of said path and the other of said supporting members being disposed on the other side of said path; first bearing means mounted on one of said supporting members and disposed between and spaced from said side members of said frame; a first feed roll disposed adjacent to said first bearing means; a drive shaft journaled in said first bearing means and supporting said first feed roll; second bearing means mounted on the other of said transverse supporting members and disposed between and spaced from said side members of said frame; a second feed roll disposed adjacent said first feed roll to form a nip through which such sheets may be drawn during removal from such supply stack, said second feed roll being disposed adjacent said second bearing means; a drive shaft journaled in said second bearing means and supporting said second feed roll; and power means for rotating said drive shafts, whereby sheets moved into position for engagement by said rolls will be drawn through the nip and pulled from said supply stack.

2. The structure of claim 1 wherein said transversely-extending load-supporting members are tubular.

3. The apparatus of claim 1 wherein said first feed roll comprises at least one segment roll having at least one recess therein for receiving and engaging the leading edge of one of said sheets of sheet stock and bending it into the nip of the feed rolls.

4. The apparatus of claim 3 and further including edge manipulating means for sequentially moving the leading edge of each sheet of sheet stock into position for engagement by said segment roll.

5. The apparatus of claim 4 wherein said edge manipulating means includes a suction arm mounted for movement between a raised position in engagement with the bottom sheet in said supply stack above said segment roll periphery and a lowered position below said segment roll periphery, and means synchronized with the rotation of said segment roll for effecting movement of said suction arm between its two positions, whereby the leading edge of the sheet may be drawn downwardly into engagement with said segment roll and may be further moved downwardly by said segment roll into the nip between said rolls.

6. The apparatus of claim 5 wherein said suction arm moving means includes an operating cam of a configuration which will cause the suction arm to move downwardly with a delay in the downward movement after the sheet-engaging end of the suction arm has moved below the level of the periphery of the segment rolls.

7. The apparatus of claim 5 and further including means synchronized with said suction arm moving means for sequentially separating the leading edge of the bottom sheet in the stack and supporting the leading edge of the remaining sheets in the stack as the leading edge of the bottom sheet is being drawn downwardly into engagement with said segment roll by said suction arm.

8. The apparatus of claim 1 wherein at least one of said feed rolls is resiliently mounted, and the drive shaft thereof is driven by said power means through a universal coupling.

9. The apparatus of claim 8 wherein the surface of each of said feed rolls is nonresilient whereby any resiliency in said rolls is as a result of the resilient mounting of said rolls.

10. The apparatus of claim 8 wherein said second bearing means comprises two members connected together for movement toward and away from a predetermined position relative to each other and means resiliently urging said members toward said predetermined position, one of said members being affixed to said other transverse supporting member, the other of said members carrying said second feed roll with the drive shaft of said second feed roll being journaled therein.

11. The apparatus of claim 1 and further including a third feed roll disposed downstream from and adjacent to said first and second feed rolls and having a drive shaft journaled in said first bearing means and operatively connected to said power means, and pressure roll means operatively mounted on said second bearing means for movement between an inoperative position remote from said third feed roll means and an operative position adjacent said third feed roll means for holding the sheet stock passing therebetween in driving engagement with said third feed roll.

12. The apparatus of claim 11 and further including means for moving said pressure roll means between its inoperative and operative positions and for releasably locking said pressure roll means in its operative position.

13. The apparatus of claim 11 wherein said pressure roll means includes a pair of spaced idler rolls and an arcuate guide member for guiding the sheet stock partially around said third feed roll.

14. The apparatus of claim 13 wherein means is provided resiliently urging said idler rolls toward said third feed roll when said pressure roll means is in its operative position.

15. The apparatus of claim 1 and further including a third feed roll disposed downstream from and adjacent to said first feed roll and having a drive shaft generally parallel to said drive shaft of said first feed roll, said first and third feed rolls being positioned in mutually overlapping relation with one another as viewed parallel to their axes of rotation, and means for maintaining sheet stock in driving engagement with said third feed roll along the peripheral segment thereof adjacent a line through said nip between said first and second feed rolls and tangent to said third feed roll.

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