May 23, 1972 H. W. WEEKS ET AL 3,664,661

LETTER FEEDER, SYNCHRONOUS FRICTION TYPE

Filed Sept. 4, 1970 2 Sheets-Sheet 1

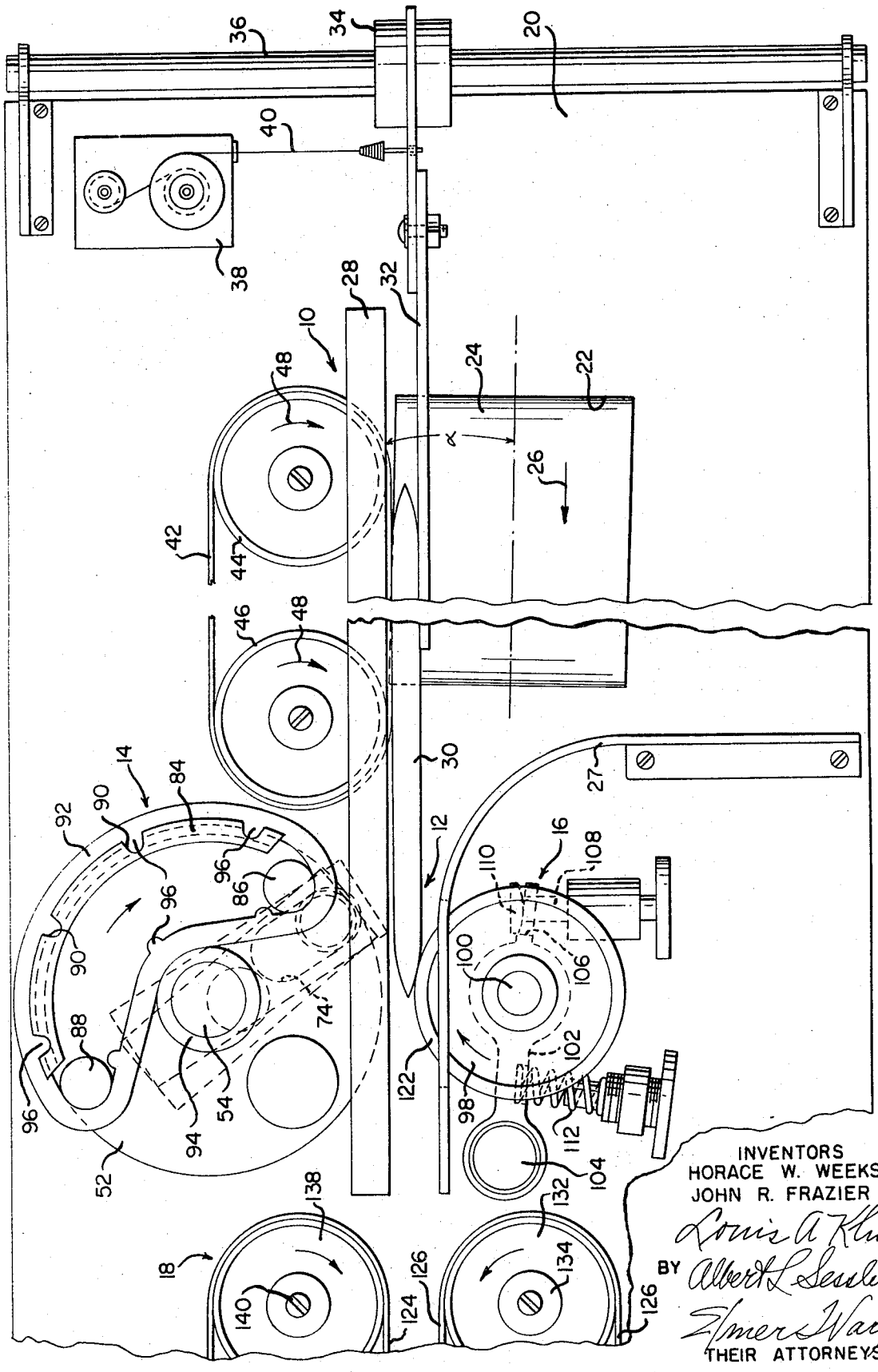

FIG. 1

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LETTER FEEDER, SYNCHRONOUS FRICTION TYPE

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FIG. 2

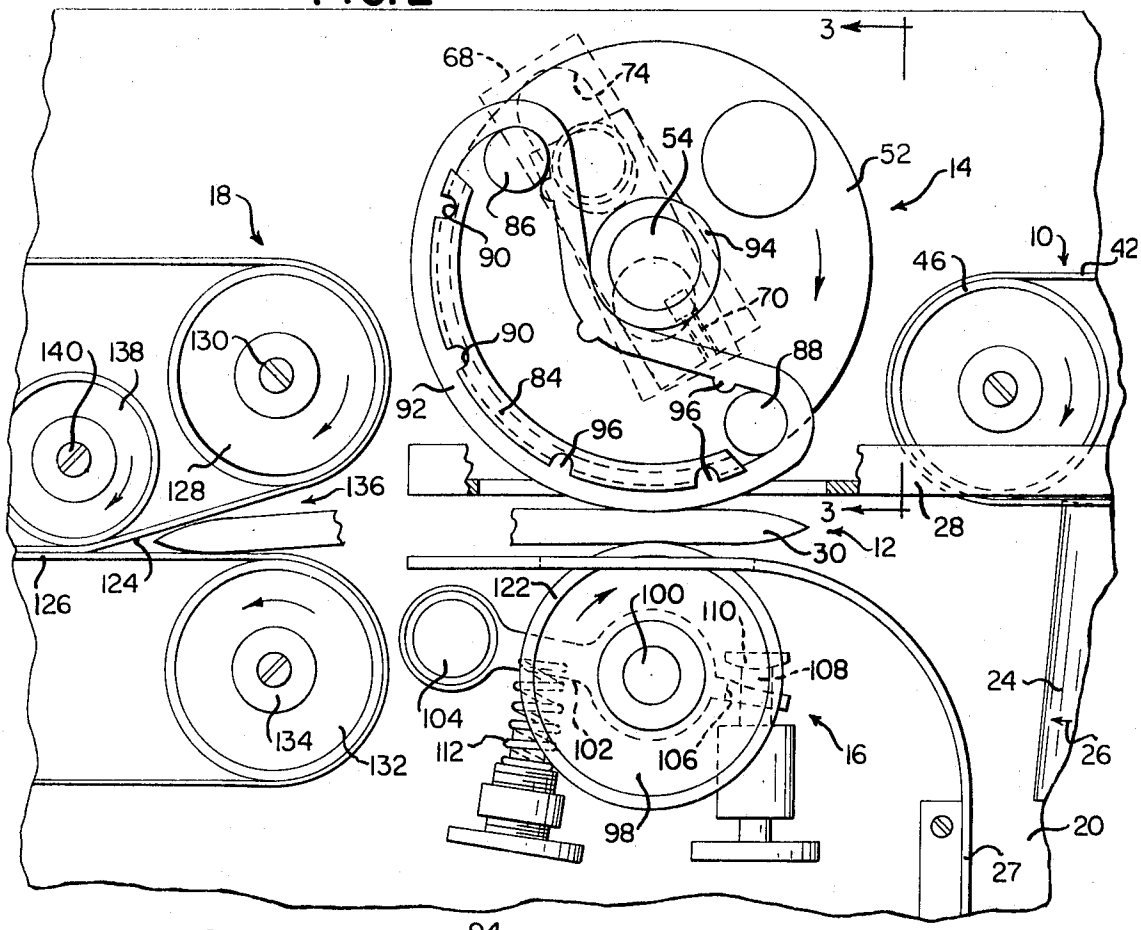


FIG. 3

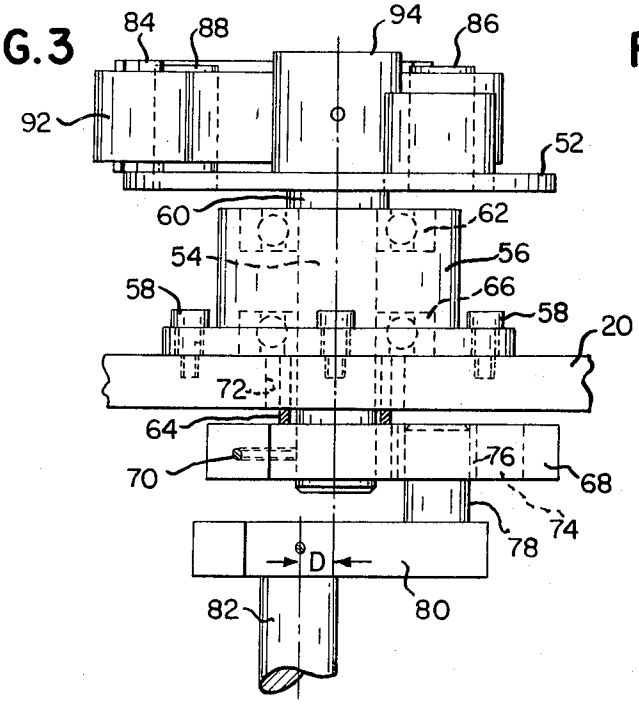


FIG. 4

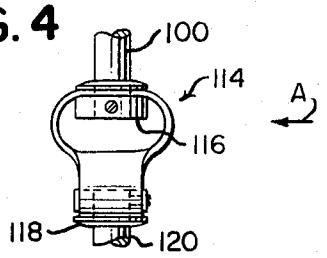
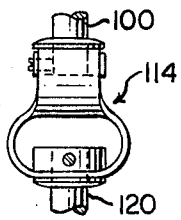


FIG. 5



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LETTER FEEDER, SYNCHRONOUS FRICTION TYPE

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Int. Cl. B65h 3/06
U.S. Cl. 271—36 3 Claims

ABSTRACT OF THE DISCLOSURE

A synchronous-type apparatus for feeding letter mail of various sizes and thicknesses. A feed wheel and a stripper wheel are positioned in opposed relation at a feed area in the apparatus to receive therebetween letters which are to be singulated and fed to a processing unit. An elastomeric member is wrapped around a sector of the feed wheel to engage the letters along a line parallel to the long dimension of the letters. The feed wheel is rotated at varying angular velocities, so that the leading portion of the elastomeric member engages a letter to be fed at a low velocity, and the trailing portion of the elastomeric member discharges the letter at a higher velocity. The low velocity at engagement reduces the "scrubbing" action on the letters being fed and reduces wear on the feed and stripper wheels.

This invention was developed under a contract with the United States Post Office.

BACKGROUND OF THE INVENTION

This invention relates to an apparatus of the synchronous type for singulating and feeding media, like letters, one at a time from a stack to a utilization device, like a coding device or a letter sorter.

While this invention may be used for handling media like cards, sheets, envelopes, and the like, it seems appropriate to describe it in relation to the processing of mail.

A basic mechanism used in mechine handling of mail is a feeding device. The feeding device is used to feed letters which are generally stacked on a long edge to a utilization device like a coding device or a cancelling machine. One of the basic requirements of a feeding device is that it singulate the letters and feed them one at a time to a utilization device. It is also necessary that the feeding device be capable of handling a variety of letter sizes and thicknesses.

Some prior-art feeding devices are shown in the following U.S. patents:

2,368,519—Burckhardt et al., Jan. 30, 1945
2,762,623—Uthenwoldt et al., Sept. 11, 1956
2,887,951—Strother et al., May 26, 1959
2,926,910—Martin, Mar. 1, 1960
2,970,834—Martin et al. Feb. 7, 1961

Some of the advantages of the present invention over the prior-art friction-type letter feeders are as follows:

The present invention:

(1) Reduces "scrubbing" on the face of the media being fed.
(2) Reduces wear on the parts of the device which come into contact with the media being fed.
(3) Eliminates "skipping" of media when thick pieces are being fed.

SUMMARY OF THE INVENTION

This invention relates to an apparatus of the synchronous type for singulating letters and feeding them, one at a time, from a stack to a utilization device. The letters are

stacked with the long edges positioned horizontally and are fed to a feed area, where a feed wheel means and stripper wheel means are positioned in opposed relation to receive therebetween the letters and to discharge them one at a time to the utilization device. The feed wheel means includes a feed wheel, which is mounted in a frame means for rotation in a horizontal plane and has an elastomeric member mounted around a portion of the periphery of the feed wheel, so that the elastomeric member engages the letters along a line which is parallel to the long edges of the letters. A drive means rotates the feed wheel at varying angular velocities, so that, when the elastomeric member first contacts a letter to be fed, it is travelling at a "low" velocity, and, by the time the letter is discharged by the elastomeric member, it is travelling at a "high" velocity. The stripper wheel means includes a stripper wheel which is mounted in the frame means for rotation in a horizontal plane and is rotated at a constant velocity in a direction opposite to the direction of rotation of the feed wheel. The stripper wheel is mounted on a spring-loaded pivot arm to facilitate the handling of letters of varying thicknesses.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of the feeding apparatus of this invention showing the leading edge of a letter entering a feed area where a feeder wheel means and stripper wheel means are placed in opposed relation.

FIG. 2 is a plan view similar to FIG. 1 showing a letter about to leave the feed area and enter a receiving means.

FIG. 3 is a side elevational view taken along the line 3—3 of FIG. 2 showing details of a drive means for rotating a feeder wheel of the feeder wheel means.

FIG. 4 is a front elevational view of a universal-type coupling used to drive the stripper wheel means.

FIG. 5 is a side elevational view of the coupling shown in FIG. 4 and is taken from the direction marked "A" in FIG. 4.

BRIEF DESCRIPTION OF THE INVENTION

FIG. 1 is a plan view of the feeding apparatus of this invention. In general, the apparatus includes an input means **10**, a feed area **12**, a feed wheel means **14**, which is placed in opposed relation with a stripper wheel means **16**, and a receiving means **18**.

The input means **10** (FIG. 1) includes a flat horizontal area or table **20** having a rectangular opening **22** therein. An endless belt **24**, travelling in the direction indicated by the arrow **26**, is positioned near the opening **22**, so that its upper moving surface extends into the opening **22** to move a stack of letters towards a feed fence **27**. The feed fence **27** is a vertical wall which is arcuately shaped near the entrance to the feed area **12**, as shown in FIG. 1. As the belt **24** moves, it tends to align one edge (the leading edge) of the letters against the feed fence **27**. The moving belt **24** has a center line, which is positioned at an angle α (FIG. 1) of about five degrees relative to a guide bar **28**. The belt **24** also assists in moving the letter towards the guide bar **28** due to the angle at which the center line of the belt **24** is positioned relative to the guide bar **28**. The letters (only one, marked **30**, being shown in FIG. 1) are stacked vertically, with their long edges positioned horizontally, and are also assisted in their movement towards the bar **28** by a spring-loaded arm **32**. The arm **32** has one end fixed to a bushing **34**, which is slidably mounted on a bar **36**, which is suitably fixed to the table **20**. A conventional constant-tension spring unit **38**, whose extensible member **40** is secured to the arm **32**, is used to maintain a constant tension on the stack of letters to move them towards the bar **28**.

The input means **10** (FIG. 1) also includes an endless belt **42**, which is used to feed the letters to the feed area **12**. The endless belt **42** is mounted on two rollers **44** and **46**, which are rotated at uniform velocity in the direction of the arrows **48** by conventional drive means (not shown). The guide bar **28** has a suitable slot therein to permit the belt **42** to pass through the bar **28** and engage the letter **30** immediately adjacent to the bar **28** and move the letter **30** to the left (as viewed in FIG. 1) to the feed area **12**. A letter **30** is shown in the process of entering the feed area **12** in FIG. 1. This letter **30** is positioned on its long edge and is viewed from above, so that its thickness is shown in FIG. 1.

As the letter **30** enters the feed area **12** (FIG. 1), it is engaged by the feed wheel means **14** and the stripper wheel means **16**. The feed wheel means **14** includes a feed wheel **52**, which is fixed to a vertically-aligned shaft **54**. The shaft **54** is rotatably mounted in a conventional bearing unit **56** (shown in FIG. 3), which is secured to the flat area or table **20** by fasteners **58**. The shaft **54** is restrained against axial movement by a shoulder **60** thereon, which abuts against the upper bearing **62** (FIG. 3) of the unit **56** and a bushing **64**. The bushing **64** is rotatably mounted on the shaft **54** and is positioned between the lower bearing **66** of the unit **56** and a guide block **68**. The shaft **54** is fixed to rotate with the guide block **68** by a set screw **70**. A suitable hole **72** in the table **20** provides clearance for the bushing **64**. The guide block **68** has a radially-aligned slot **74** therein, as shown, into which a cam roller **76** is positioned. The cam roller **76** is rotatably supported on a shaft **78** perpendicularly upstanding from a crank arm **80**, as shown in FIG. 3, and the crank arm is driven by a shaft **82**, whose axis of rotation is offset from the axis of rotation of the wheel **52** by a distance *d*. The shaft **82** is conventionally driven at a constant rate.

The feed wheel means **14** has a letter-engaging surface, which is constructed as follows. The wheel **52** has an arcuately-shaped rim **84** upstanding from a portion of the perimeter of the wheel, as is best shown in FIGS. 1 and 2. Two pins **86** and **88**, upstanding from the feed wheel **54**, are positioned near the ends of the rim **84**, which has a plurality of equally-spaced, axially-aligned recesses **90** therein. A relatively thick, endless, elastomeric band **92** is wrapped around the rim **84**, around the pins **86** and **88**, and around a bushing **94**, which is mounted on the shaft **54**, as shown in FIGS. 1 and 2. The band **92** has equally-spaced, axially-aligned projections **96** positioned on the side thereof which engages the rim **84**. These projections **96** extend along the axial length of the band **92** and are arcuately-shaped in cross-section, so as to fit into the recesses **90**, which are complementary in shape to receive them.

The stripper wheel means **16**, shown in FIGS. 1 and 2, includes a wheel **98**, which is fixed to a shaft **100** to rotate therewith. The shaft **100** is rotatably mounted in an arm **102** having one end pivotally mounted on a shaft **104** secured perpendicularly to the table **20**. The free end of the arm **102** is apertured at **106** to permit a stop pin **108** to pass therethrough. The pin **108** has an enlarged head **110** to act as a stop and is adjustable to control the extent to which the arm **102** will pivot counter-clockwise (as viewed in FIGS. 1 and 3) under the influence of a spring **112**, whose compression can be adjusted. The shaft **100** is connected to a universal-type coupling **114**, shown in FIGS. 4 and 5. The coupling **114** is commercially available and is described in U.S. Pat. No. 3,224,224, which issued Dec. 21, 1965, on the application of Peter Kudriavetz, Jr. The coupling **114** is made of flexible urethane with metallic ends for coupling to shafts and has the general shape shown. The shaft **100** is secured to one metallic end **116** of the coupling, and the other metallic end **118** is secured to a driving shaft **120**, which is rotated at a constant rotational velocity by a conventional drive means (not shown). The universal-type coupling **114** is

needed to handle misalignment between the shafts **100** and **120** when the arm **102** moves away from the head of the stop pin **108** due to a letter **30** being fed as shown in FIG. 2. The stripper wheel is rotated clockwise (as viewed in FIGS. 1 and 2), which is a direction opposite from the direction of rotation of the feed wheel **52**. The stripper wheel **98** has an elastomeric band **122** located around its periphery. The band **122** has an axial length equal to the axial length of the elastomeric band **92**, shown in FIG. 3, and the center of the band **92** as measured in the axial direction, the center of the band **122** similarly measured, and the center of the belt **42** as measured in an axial direction all lie in a common plane, which is parallel to the table **20**. This is important for feeding the letters **30** to avoid their skewing in a vertical plane, or, stated another way, to keep the long edges of the letters **30** horizontal as they are fed to the receiving means **18**.

The receiving means, designated generally as **18**, is best shown in FIG. 2 and includes two endless belts **124** and **126**. The belt **124** is supported on a roller **128**, which is fixed to a vertically-aligned shaft **130**, and the belt **126** is similarly supported on a roller **132**, which is fixed to a vertically-aligned shaft **134**. The rollers **128** and **132** are spaced apart from each other to provide a throat area **136** for receiving letters from the feed wheel **52**. The shafts **130** and **134** are driven at the same constant speeds by conventional means (not shown) to rotate the rollers **128** and **132** in the directions shown by the arrows thereon. A third roller **138** is fixed to a shaft **140**, which drives the roller **138** in the direction shown by the arrow thereon. The shaft **140** is driven at a constant velocity by conventional means (not shown). The roller **138** forces the belts **124** and **126** together, so as to sandwich a letter therebetween and transport it to a utilization device like a coder, a facer-canceller, etc., not shown.

The particular sizes and speeds selected for the various moving components of this invention are naturally dependent upon the particular application in which it is used. The particular application selected to portray the invention was a letter-feeding apparatus. The range of letters which this feeding apparatus can handle is:

	Inches
Length	4.25–11.5
Width	3.0–6.125
Thickness	0.006–0.25

The particular relationships of the various elements of this invention are as follows. The surface speed of the belts **24** and **42** of the input means **10** is thirty inches per second. The shaft **82**, which drives the feed wheel means **14**, is rotated at a constant rate of 600 revolutions per minute, and, because of the crank (**78**, **80**) used to rotate the feed wheel **52**, the feed wheel's surface velocity as measured on the elastomeric band **92** will vary between about 85 inches per second and about 140 inches per second. The surface velocity of the belts **124** and **126** of the receiving means **18** is about 145 inches per second, which is slightly higher than the maximum discharge velocity from the feed wheel **52**. The clearance between the elastomeric band **92** on the feed wheel **52** when it is opposite the stripper wheel **98** is 0.004 inch. The distance between centers of the roller **138** and the feed wheel **52** is equal to or less than the minimum length of letter which is to be fed by the apparatus to avoid a "free-floating" letter. Because the apparatus is synchronous, only one letter will be fed for each revolution of the feed wheel **52**. This rate is six hundred letters per minute. The elastomeric band **92** on the feed wheel **54** passing through the guide bar **28** cannot be longer than the minimum length of letter to be fed, and the rate at which the band **92** is exposed through the slot in the guide bar **28** is such as to provide a pitch of fourteen inches. That is, the leading edge of a letter received at the receiving means **18** follows the leading edge of the next preceding letter by fourteen inches. The coefficient of friction of the elasto-

meric band **92** is about four times greater than the coefficient of friction on the band **122** on the stripper wheel **98**. The surface velocity of the stripper wheel **98** as measured on the band **122** is thirty inches per second and is in a direction opposite to the velocity of the elastomeric band **92** on the feed wheel **52**.

By this construction, the letters are positively driven throughout the feeding apparatus. The stripper wheel means **16** prevents the passage of a letter until the elastomeric band **92** approaches it. When the band **92** engages a letter, it is travelling at a "low" velocity, about eighty-five inches per second, to minimize "scrubbing" the surface of the letter during contact. Because of the coefficient of friction of the band **92** and its velocity, the letter **30** is driven to the left (as viewed in FIG. 1), while the letters next in line to be fed are prevented from moving with the letter **30** by the stripper wheel means **16**. Because the band **92** does not extend completely around the periphery of the feed wheel **52**, a thick letter (like 0.25 inch thick) can easily enter the feed area **12** and can easily be accommodated by the apparatus. By the time the trailing edge of the band **92** on the feed wheel **52** engages a trailing portion of the letter **30**, the letter **30** has been accelerated to a velocity of about 140 inches per second.

What is claimed is:

1. A synchronous-type feeding apparatus for feeding letters of various sizes and thicknesses to a receiving means, comprising:

a frame means;

a feed area;

input means on said frame means for feeding the letters to the feed area with a long edge of each letter positioned horizontally;

a receiving means; and

a feed wheel means and a stripper wheel means positioned in opposed relation at said feed area to receive therebetween letters from said input means and to discharge the letters singly to the receiving means;

said feed wheel means comprising:

a feed wheel rotatably mounted on said frame means to rotate in a horizontal plane;

an elastomeric member having leading and trailing portions and extending around a portion of the periphery of the feed wheel to engage a letter along a line parallel to the long edge of the letter and transfer it to the receiving means; and

variable velocity drive means for rotating the feed wheel so that the letters being fed thereby will be gradually accelerated from the time that the leading portion of the elastomeric member engages a letter to be fed until the time when the letter leaves the trailing portion of the elastomeric member;

said stripper wheel means including:

a stripper wheel mounted on said frame means for rotation in said horizontal plane and having a letter-engaging periphery to engage the letters being fed; and

drive means for rotating the stripper wheel at a constant velocity in a direction opposite to the direction of rotation of the feed wheel so as to permit only one letter at a time to be fed between said elastomeric member and said stripper wheel.

2. The apparatus as claimed in claim **1** in which the variable velocity drive means for rotating the feed wheel includes:

a shaft fixed to said feed wheel;

a lever fixed to one end of said shaft to rotate said feed wheel, said lever having a radially-aligned slot therein; and

a crank member having an axis of rotation offset from the axis of rotation of said shaft and having a member adapted to fit into said slot and rotate said lever.

3. A synchronous-type feeding apparatus for feeding letters of various sizes and thicknesses to a receiving means, comprising:

a frame means;

a feed area;

input means on said frame means for feeding the letters to the feed area with a long edge of each letter positioned horizontally;

a receiving means; and

a feed wheel means and a stripper wheel means positioned in opposed relation at said feed area to receive therebetween letters from said input means and to discharge the letters singly to the receiving means;

said feed wheel means comprising:

a feed wheel rotatably mounted on said frame means to rotate in a horizontal plane;

an elastomeric member having leading and trailing portions and extending around a portion of the periphery of the feed wheel to engage a letter along a line parallel to the long edge of the letter and transfer it to the receiving means; and

variable velocity drive means for rotating the feed wheel so that the letters being fed thereby will be gradually accelerated from the time that the leading portion of the elastomeric member engages a letter to be fed until the time when the letter leaves the trailing portion of the elastomeric member;

said stripper wheel means including:

a stripper wheel mounted on said frame means for rotation in said horizontal plane and having a letter-engaging periphery to engage the letters being fed;

drive means for rotating the stripper wheel at a constant velocity in a direction opposite to the direction of rotation of the feed wheel so as to permit only one letter at a time to be fed between said elastomeric member and said stripper wheel;

a fixed stop enabling said letter-engaging periphery of the stripper wheel to be spaced a fixed distance from said elastomeric member, and

means for resiliently urging said stripper wheel towards said stop; and

means for mounting said stripper wheel to pivot towards and away from said feed wheel;

said drive means for rotating the stripper wheel including a universal coupling to accommodate the pivoting of the stripper wheel while it is rotated.

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U.S. Cl. X.R.

271—34