

[54] PROCESS AND APPARATUS FOR TRANSFERRING SEPARATED MATERIAL

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271/21, 22, 51-53, 71, 72, 80-83

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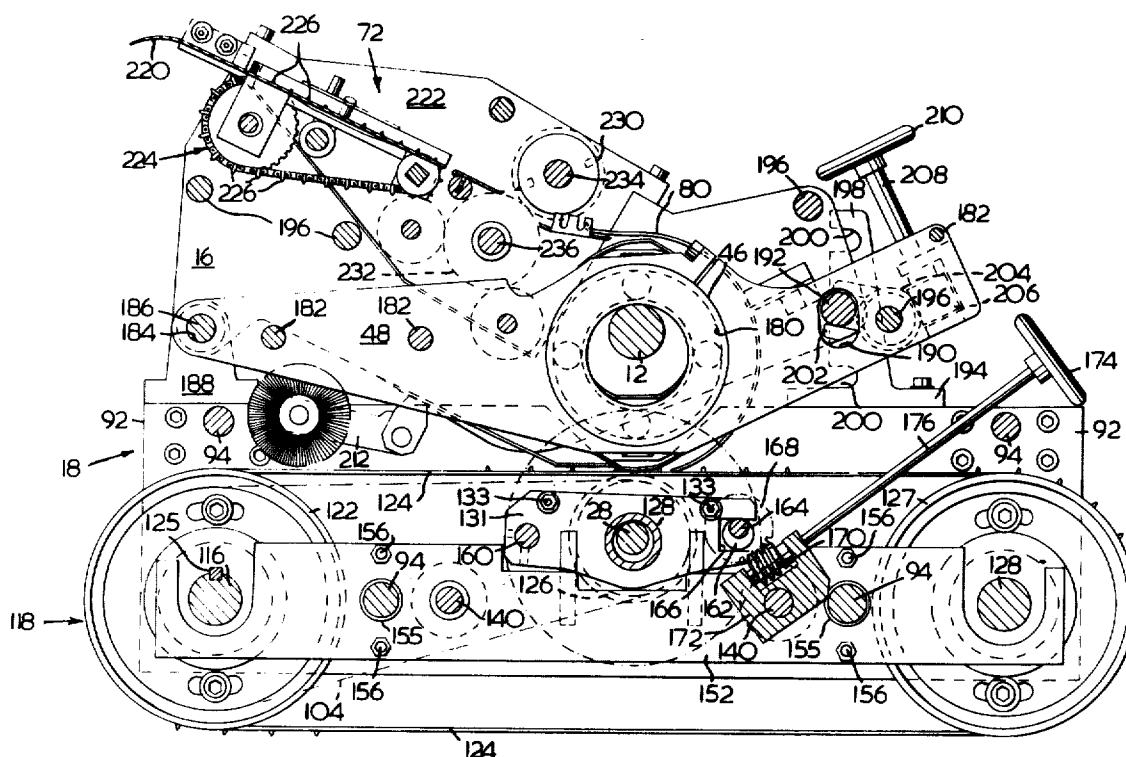
Attorney, Agent, or Firm—Cushman, Darby & Cushman

[57] ABSTRACT

An apparatus and process are to be disclosed for transferring separated material from a continuous or

non-continuous source onto a web of indeterminate length. The web is adapted to be conveyed at the predetermined line speed through a collating apparatus or the like. The transfer mechanism herein includes a support member which receives separated material from a source and accelerates that material to a velocity having a component equal to the line speed of the web for application to that web. The separated material can be in the form of an envelope, separate plies of paper or other sheet material on which information can be printed, credit cards, or the like. The separated material is received from a source at a pick-up position and carried by the transfer mechanism to a transfer position for placement on the web with selected positioning. This preferably involves spacing one item of separated material in a predetermined orientation relative to the web and at a selected spacing from a previously transferred item. The separated material is accelerated preferably by causing it to travel along a path eccentrically of an axis of rotation. In a preferred embodiment of applicant's transfer mechanism the separated material is accelerated by varying the radial spacing of that material from an axis of rotation. The radial positioning of the separated material relative to the axis of rotation, for instance, can be a minimum at the pick-up position adjacent the source of such material, and at a maximum at the transfer position. Movement of the separated material eccentrically of the axis of rotation is achieved preferably by following a circular path whose center is spaced from the axis of rotation.

15 Claims, 5 Drawing Figures



SHEET 1 OF 5

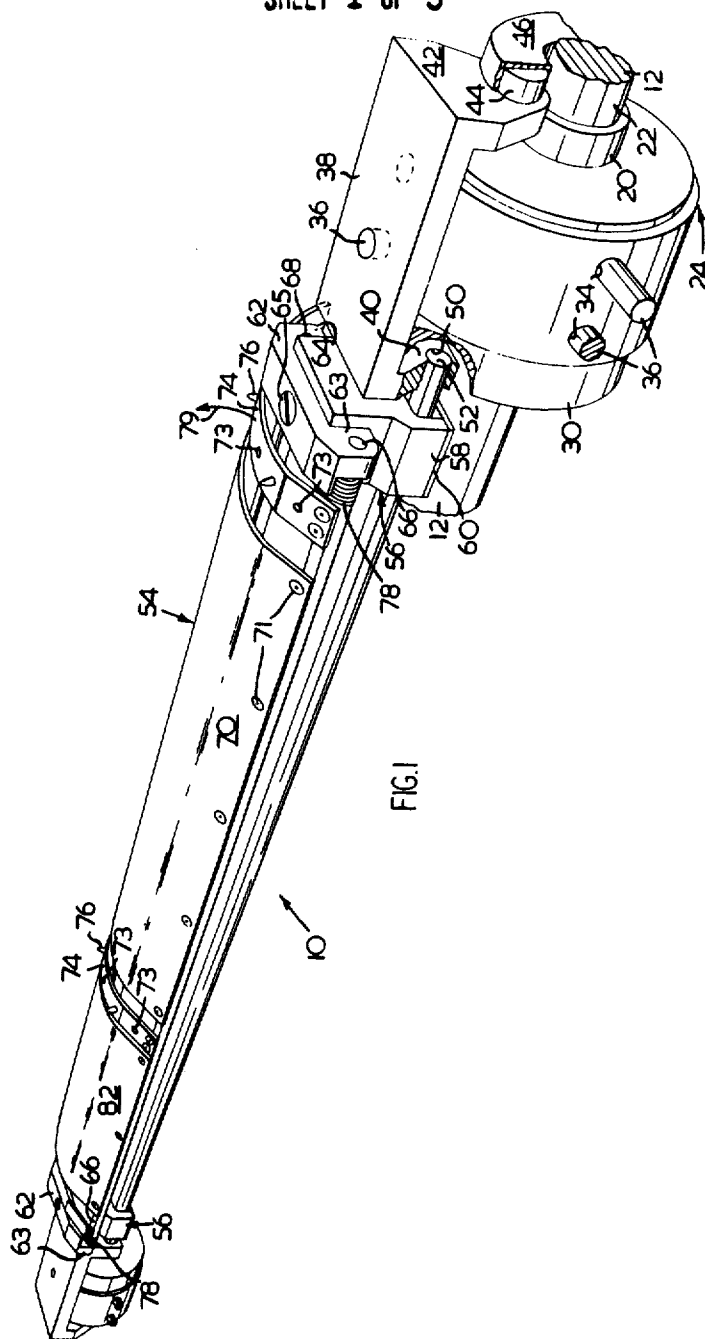


FIG. 1

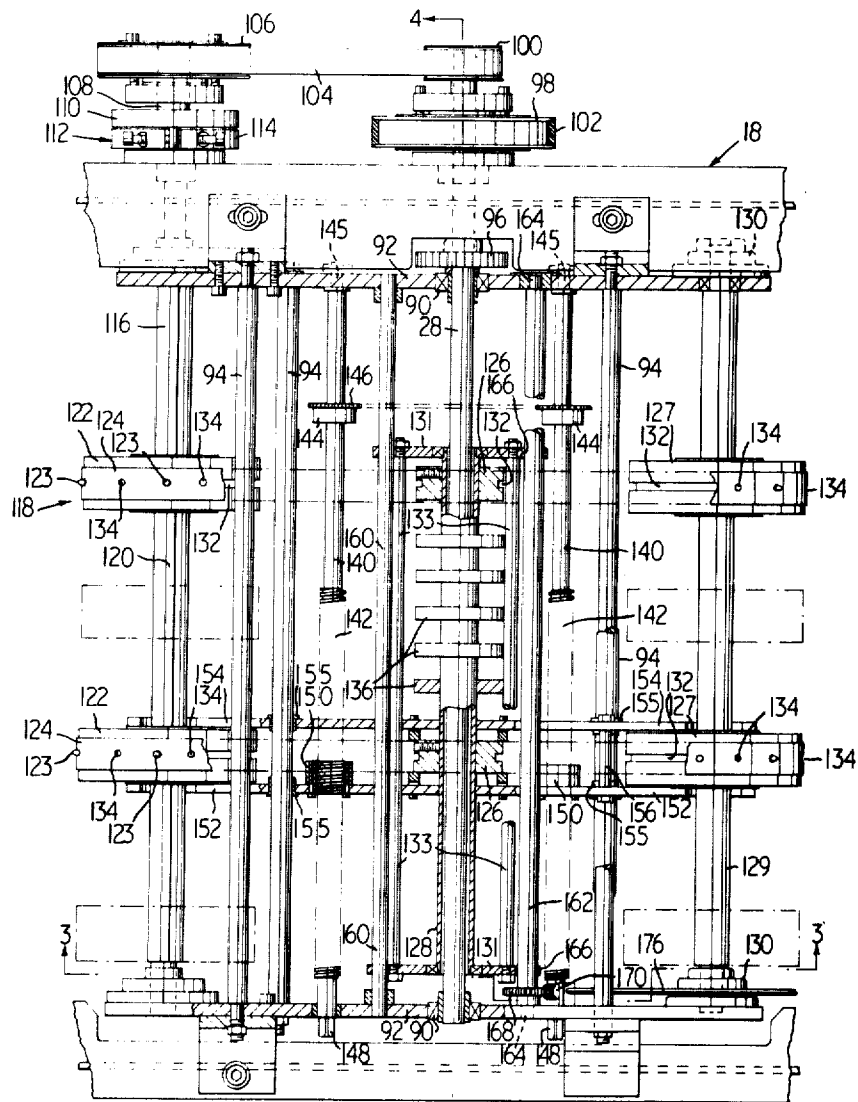


FIG. 2

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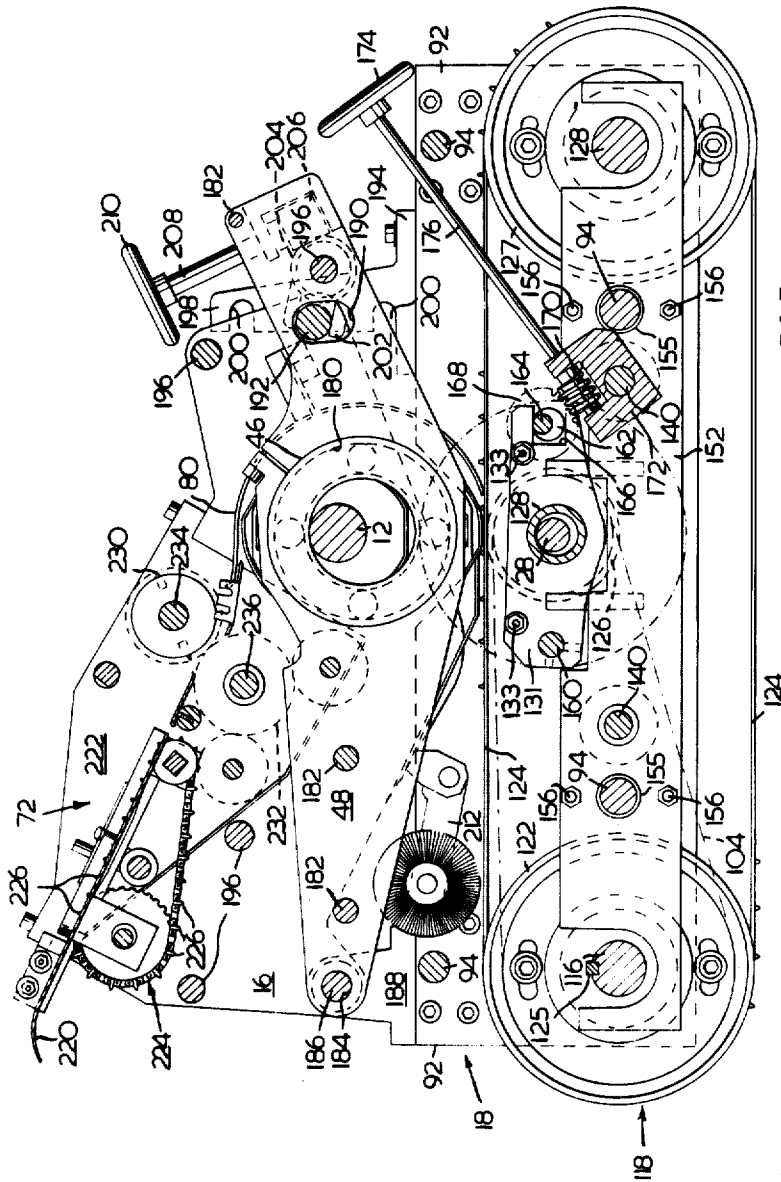
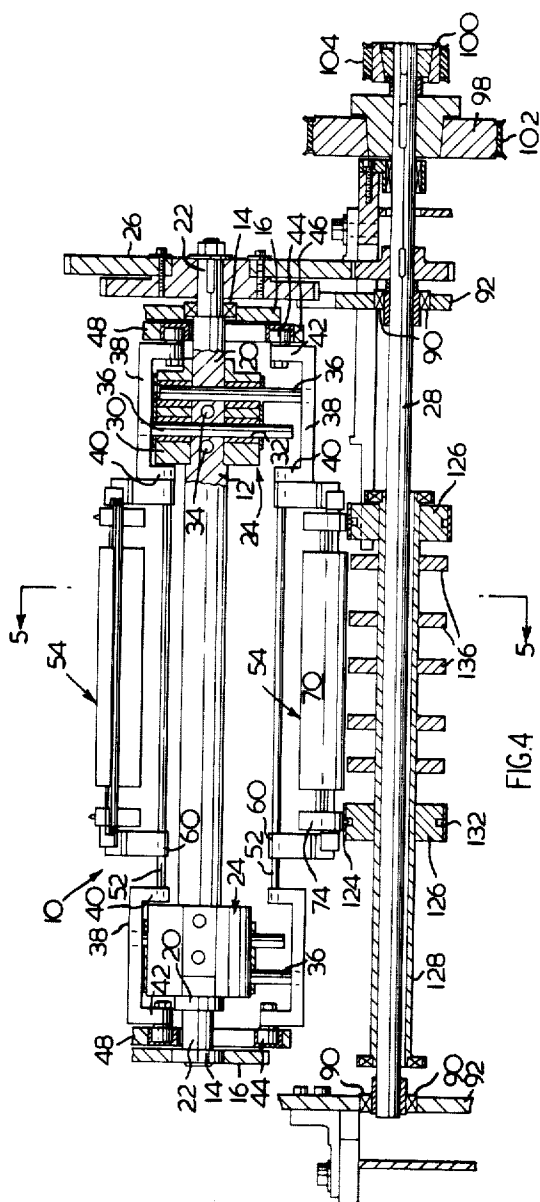


FIG 3



PROCESS AND APPARATUS FOR TRANSFERRING SEPARATED MATERIAL

This invention relates to a process and apparatus by which separated material is transferred and placed with preselected positioning onto a web of indeterminate length. More particularly, the present invention relates to an improved transfer mechanism which is adapted to be mountable in a collating apparatus or the like. The separated material is preferably in the form of a return envelope, a mailer document, a credit card, one or more plies of sheet material, or a combination thereof. A preferred embodiment of the invention relates to the production of a stuffed envelope assembly or other such business form.

BACKGROUND OF THE INVENTION

The business forms art involves many different configurations of products assembled from assorted constituent parts. For ease of manufacture, continuous operations usually require the use of webs of indeterminate length. These may be used singly or in combination with other such webs, to be collated and assembled with other parts that frequently are of a separated form, i.e., individual entities. Mailer or stuffed envelopes for example, may require insert material to be retained between two enclosing webs of indeterminate length. A continuous carrier web may be used in connection with other types of business forms to receive credit cards, return envelope, or other such items that are individual entities.

Business forms such as those just mentioned will inevitably have to meet certain standards of processability. Otherwise they will not be acceptable commercially. It is also evident that modern day business forms must often be susceptible to continuous feed as a zig-zag folded form through automated accounting equipment, computer print-out devices, and the like. Under these circumstances considerable accuracy and reliability is required during assembly, in relation to the alignment and registration of parts. The orientation and/or placement of insert material, credit cards, return envelopes, or other such separated material on a carrier web may be important, and especially so if they are to be retained between enclosing webs. Accurate alignment is needed particularly if indicia and other information printed or embossed on the outside ply of a stuffed envelope is to be transferred to one or more interior plies of insert material.

In addition to being available in different configurations, modern business forms are also available in a variety of sizes, depending on the ultimate use. The necessity of being able to apply separated material to a continuous web is therefore a common requirement, irrespective of the dimensions of that material. Equipment currently in use for this purpose has difficulty in handling such separated material when sizes change; specifically, when the length of such material changes. For purposes herein, "length" refers to that dimension of the separated material which is in the direction the web is to be moved. This is a generally accepted convention in this art for the meaning of length of series connected business forms.

Prior to this invention, separated material was applied to a continuous web by means of devices which frequently contained a magazine or stack of that material. Means were provided to extract or discharge one

item of separated material at a time, without causing damage such as turned-over corners, etc. The structure achieving such extraction or discharge of material inevitably had to be flexible in order to accommodate separated material which was thicker or thinner, or longer or shorter than another. Thus, the design and operation of such extraction or discharge means was difficult to achieve. Items of transfer material usually had to be engaged or gripped in a manner ensuring transfer and application of that material to the web with a constant predetermined orientation. Moreover, these devices for applying separated material to a web are usually spaced away from the collating apparatus. Often these devices were not even in the same line of feed of the continuous web. In those situations subsequent operations were thus needed to collate the separated material on a "carrier" web with any other plies which were to be assembled therewith.

SUMMARY OF THE INVENTION

The present process and apparatus avoids problems and shortcomings associated with prior art arrangements having a magazine, or stack feed system for separated material. Applicant has devised a transfer mechanism adapted to be incorporated into an improved collating apparatus. The present invention therefore provides a possibility of applying separated material to a web as that web is carried through a collating apparatus. The necessity which frequently existed in the past for providing separate lines of feed can therefore be avoided. The transfer mechanism to be described below is designed to be removably mountable in a collating apparatus. The present invention therefore facilitates flexibility in the configurations of separated material to be applied to a web, while maintaining high accuracy in the alignment and registration of separated material applied to that web.

One exemplary configuration of apparatus contemplated herein is embodied in a transfer mechanism mountable in collating apparatus through which a web of indeterminate length is to be carried, the mechanism being operable to transfer separated material of a selected length from a source to said web, comprising; a support member to receive the separated material and having retainer means thereon engageable with said material to hold the latter securely; a main shaft rotatably mountable in spaced apart frame elements in said apparatus for rotation about an axis extending coaxially of the shaft, said main shaft being adapted to be driven in synchronism with the collating apparatus; and connecting means supported by a bearing assembly for guided reciprocal movement thereof radially of said axis of rotation; said connecting means being operative to carry the support member and coact with support structure in the collating apparatus to move the support member along a path eccentrically of the axis of rotation, in response to rotation of the main shaft, whereby separated material is carried by the support member to a transfer position for placement onto said web with preselected positioning. This transfer mechanism is so constructed to accelerate separated material from a rate of delivery which is received from the source to a transfer speed having a component equal to a predetermined velocity at which the continuous web is to be carried through the collating apparatus. In the preferred embodiment to be described herein, the connecting means of the transfer mechanism and coacting

support structure in the collating apparatus accommodate acceleration of the separated material by varying the radial positioning of the support member relative to the axis of rotation from a minimum when the support member receives separated material from the source, to a maximum when the support member transfers that material onto the continuous web.

In one form of the transfer mechanism described herein, the support member which receives the separated material is preferably comprised of a curved elongated plate. This plate is removably attached at opposite edges thereof to a replaceable block mounted on rods having opposed free ends fixedly secured to a U-shaped member at a free end of one arm of the U. This saddle member constitutes a part of the connecting means mentioned earlier. The other arm of the U is provided with follower means engageable in an adjustably positionable circular race supported on plates in the collating apparatus. The center of this race is spaced or off-set from the axis of the main shaft, so that rotation of that shaft causes the curved plate and separated material carried thereon to traverse a path eccentrically of the axis of rotation.

The present invention also contemplates a process for transferring separated material from a source to a continuous web traveling through a collating apparatus at a predetermined line speed, comprising the steps of, receiving and supporting the separated material in a selected position; accelerating said separated material to a velocity having a component thereof equal to said line speed; and transferring said separated material to the continuous web with a preselected orientation and positioning relative to said web. The transfer mechanism is so arranged as to accommodate more or less acceleration of the separated material depending upon the dimensions of the separated material being processed at any given time. In one embodiment contemplated herein the separated material is accelerated by varying the radial positioning of that material relative to an axis of rotation about which that material is carried by the transfer mechanism.

Various features and advantages of the process and apparatus contemplated herein will become apparent from the following detailed description, especially when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings which are provided to illustrate by way of example only one configuration embodied by the present invention;

FIG. 1 is a perspective view to show some details of a preferred form of transfer mechanism envisaged herein;

FIG. 2 is a plan view taken partly in section to show details of part of a collating apparatus with which the present invention is to be utilized;

FIG. 3 is a side elevation view taken in section along line 3—3 of FIG. 2;

FIG. 4 is a side elevation view taken partly in section generally centrally of the embodiment of FIG. 2, along the drive shaft shown therein; and

FIG. 5 is a side elevation view taken partly in section along line 5—5 of FIG. 4.

DESCRIPTION OF PREFERRED EMBODIMENTS

In the drawings, a preferred form of transfer mechanism embodied by this invention is shown at 10. The transfer mechanism 10 is movably supported to be rotatable about an axis of rotation. That axis is coincident in this instance with the central axis of a drive shaft 12.

The drive shaft 12 is rotatably supported in bearings 14 (as seen in FIG. 4) secured in suitable openings in upper side frame members 16 of a collating apparatus shown overall at 18. The collating apparatus 18 is basically conventional in structure and function, and reference may be had to a Hamilton collator, available commercially and being exemplary of the type of apparatus 18 with which this invention can be used. The collating apparatus 18 has been modified slightly and adapted to accommodate practicing the present invention with such a collator. The extent of these modifications will become more apparent from the description below.

The drive shaft 12 has opposite ends formed with inner and outer shoulders 20 and 22 that are diametrically reduced in cross-sectional size. This is partly illustrated in FIG. 1, and can best be seen in FIG. 4. The inner shoulders 20 are adapted to carry a bearing assembly 24, while outer shoulders 22 engage the bearings 14 that rotatably support the drive shaft 12. One of the outer shoulders 22 is adapted to also carry differential gearing shown overall at 26, arranged to be driven synchronously from a main drive shaft 28 of the collating apparatus 18. In the preferred embodiment illustrated here, each bearing assembly 24 comprises a bearing block 30 having a first set of apertures 32 and a second set of apertures 34 disposed at 90° thereto. These apertures 32 and 34 may be provided with sleeve bushings, or other such inserts which minimize friction between relatively movable surfaces. The apertures 32 and 34 are aligned so as to extend radially of the axis of rotation about which the drive shaft 12 is adapted to turn. Cooperating plunger pins shown at 36 are received by, and slidably movable in the apertures 32 and 34. Each plunger pin 36 is fixedly supported by a press fit, or by welding, from a U-shaped saddle member 38 that has two arms 40 and 42 defining the arms of the U. The arm 42 is adapted to carry a cam follower or roller 44 which is engageable in a cam way or race 46. The race 46 is supported in a suitable opening in one of the eccentric frame side plate 48. For convenience, the race or cam way 46 is preferably of a circular configuration, being mounted in the side plate 48 with its center spaced apart from the center of rotation of the drive shaft 12. This will be evident from FIG. 4. As an alternative configuration, non-circular races or cam ways can also be used. The reasons and advantages of using such configurations for the race or cam way 46 will become apparent below.

The other arm 40 of the U-shaped saddle member 38 is formed with a pair of openings or apertures 50, of which one is seen in FIG. 1. These openings 50 are adapted to receive the ends of a pair of mounting tie rods 52 which can also be seen in the end elevation view of FIG. 5. The tie rods 52 will usually be of equal cross-sectional size as shown herein, or they may be of different sizes. The tie rods 52 are operable for mounting a transfer sub-assembly 54 which supports separated material thereon in a predetermined position, relative to the axis of rotation about which the drive shaft 12 turns. To achieve this, the tie rods 52 are used to secure a pair of spacer blocks 56 to such rods adjacent the opposite ends thereof. These blocks 56 are each formed with spaced apart flange members 58. The ends

of the tie rods 52 are seated in the zone between the flange members 58, and are removably secured thereto by a retainer plate 60. The retainer plate 60 is connected to the spacer blocks 56 by screws (not shown) or other suitable fastening means.

FIG. 1 shows the spacer blocks 56 as including a base or body portion which supports a removable bridge element 62. The bridge element 62 is generally U-shaped, with the arm of the U being indicated at 63 and 64. At least one threaded fastener 65 is usually used to secure the bridge element 62 to the spacer blocks 56. The arms 63 of each bridge element 62 are provided with apertures to receive opposed ends of a pivot shaft or rod 66. The arms 64 of each bridge element 62 are similarly provided with apertures for receiving opposite ends of a cross tie rod 68. A curved and elongated plate 70 is secured along opposite long edges thereof to the pivot shaft 66, and tie rod 68 by suitable fastening means shown schematically at 71. The elongated plate 70 can be of a metal or polymeric material, and is operable to receive and support separated material delivered from a source indicated at 72 in the upper left corner of FIG. 3. Associated with opposite ends of the elongated plate 70 is a pair of support bands 74 which are provided in this instance with pins 76. The pins 76 are engagable in suitable feed holes or apertures normally provided adjacent opposed edges of the separated material. Engagement of these pins 76 in those feed holes serves to hold the separated material securely in place during transfer thereof from the source 72. A torsion spring 78 is conveniently mounted on the pivot shaft 66, and is adapted to bias the support band 74 in the direction shown by arrow 79 in FIG. 1. Pivotal biasing of the support band 74 can be with respect to either of the shafts or rods 63 or 64 about the particular rod on which the torsion spring 78 is carried. In any event, the biasing is toward a paper guide 80 seen in FIGS. 3 and 5. It will be apparent to those knowledgeable in the business forms art that separate material as contemplated herein can be in the form of one or more plies. This separated material is, therefore, to be held securely in place during transfer of the latter, by the support bands 74 and pins 76, with the separated material being biased toward the paper side 80.

FIG. 1 shows two elongated support plates, one at 70 and another at 82. Each of these plates 70 and 82 is secured to the rods 66 and 68. The spacing between each of the support bands 74 on which the pins 76 are provided, is adjustable. Accordingly, at least the support band 74 spaced farthest from the cam follower and race 44 and 46 is removably secured to one of the rods 66 or 68. In the embodiment illustrated in FIG. 1, the spacing between the two support bands 74 is of a distance designed to accommodate handling separated material which is of a single width only. Separated material in the form of a double width unit is accommodated by removing the support band 74 which is now shown in FIG. 1 as being disposed between the elongated plates 70 and 82. That intermediate support band 74 can be removed and secured to the end of rods 66 and 68 adjacent the outboard end of the elongated plate 82. With such a modification, the arrangement of FIG. 1 could then handle separated material which was of a double width.

Operation of the transfer mechanism 10 in the context of a collating apparatus such as that shown at 18, can best be seen from FIGS. 2, 3 and 4. The collating

apparatus 18 is itself known in this art, being substantially in the form of a device known in this art as a "Hamilton collator", as mentioned earlier. A brief description of such a collator will therefore suffice for an understanding of this invention.

With particular reference to FIG. 2, the main drive shaft 28 of the collating apparatus 18 is rotatably supported by bearings 90. These bearings 90 are secured in suitable openings provided in lower side frame members 92. A series of tie rods 94 are also supported at opposite ends thereof by the frame members 92. One end of the shaft 28 is provided with a spur gear 96, adapted to be drivingly coupled to the differential gearing 26 of FIG. 4. Beyond the spur gear 96, the drive shaft 28 carries an interior, large diameter pulley 98 and an outboard, smaller diameter pulley 100. The large pulley 98 supports a timing belt 102 which is adapted to be driven from a line shaft (not shown) that drives other pieces of equipment in the production line which includes the collating apparatus 18. The smaller pulley 100 also carries a timing belt 104. The timing belt 104 is operatively coupled to another pulley 106 whose diameter exceeds that of the pulley 100. That larger pulley 106 is carried on a stub 108 connected to an outer part 110 of a clutch-like slip disc 112. An inner part 114 of the slip disc 112 is adjustable relative to a drive shaft 116 on which the part 114 is carried. The drive shaft 116 in turn causes driving movement of a pin feed mechanism 118 which conveys a web of indeterminate length through the collating apparatus 18.

The drive shaft 116 has a key-way 120 extending coaxially thereof along its outer surface. This key-way 120 enables a pair of drive sprockets or pulleys 122 having teeth 123 to be secured to the drive shaft 116. At least the lowermost sprocket wheel or pulley 122 seen in FIG. 2 is fixedly secured to the drive shaft 116 by means of a key 125 for rotation therewith. This key 125 can be seen in FIG. 3. A pin band 124 is carried by each of the drive pulleys or sprocket wheels 122 to be driven by those pulleys. Each of the pin bands 124 passes over a pair of idler pulleys 126 and 127 which are fixedly mounted on shaft 128 and 129 respectively. The shaft 128 is tubular in cross-section and encloses a portion of the main drive shaft 28. Opposite ends of the tubular shaft 128 are mounted in bearings carried by spaced apart bearing holders or plates 131. Tie bars 133 are provided to connect the bearing holder plates 131 together as a sub-frame. The opposite ends of idler shaft 129, on the other hand, are mounted for rotation in flanged bearings 130 that are secured to lower side frame members 92. This is best seen in the lower part of FIG. 2.

Each of the driving and idler pulleys 122, 126 and 127 has a groove or recess 132 on the outer surface thereof, extending circumferentially around each pulley. The recess 132 is of a predetermined depth, sufficient to receive feed pin 76 which project through feed holes in separated material being transferred, and which also project through apertures 134. The apertures 134 are provided in the pin bands 124 with a common pitch as the feed pins or teeth 123 which are intended to engage in complementary feed holes provided along the marginal side edges of the continuous web to be fed through the collating apparatus 18. Projection of the feed pins 76 into the circumferential grooves 132 occurs at the transfer position illustrated in FIG. 5, when separated material is being applied to,

or set upon, the web of indeterminate length carried forwardly by the pin feed mechanism 118. Primarily for convenience, the transfer illustrated in FIG. 5 is colinear with a line passing through the axis of rotation of each of the shafts 12 and 28. It will be evident, however, that the drive shaft 28 and idler pulley 126 could be offset from the positions shown in FIGS. 3 and 5 where a linear, vertical orientation, is shown.

Fig. 2 shows a number of idler wheels or pulleys 136 being carried by the tubular shaft 128. These idler wheels 136 can vary in number and size, so long as their diameter is compatible with that of the centrally located idler pulleys 126. The idler wheels 136 are normally adjustably positionable axially of the tubular shaft 128, in order to accommodate positioning of the left hand pin band 124 of FIG. 2 to the positions shown in ghosted lines in that drawing. Such repositioning is required by a continuous web which is of a double width size, or merely by a change in the width of the continuous web from one web to another. A corresponding adjustment for lateral spacing must also be made of the support band 74 in each of the transfer sub-assemblies 54, in addition to an adjustment in the feed mechanism 72. This will, of course, be apparent to those knowledgeable in this art.

FIGS. 2 and 3 best show the arrangement for adjusting the spacing between the pin bands 124 and the pulleys on which these pin bands are carried. Specifically, the lower hand pin band as seen in FIG. 2 is adjustable, although, it will be evident that the right hand pin band could be mounted for adjustment instead of, or in addition to, the other pin band. In any event, lateral adjustment of the left hand pin band and pulley wheels of FIG. 2 is achieved by a cooperating pair of adjustment screws 140. These two screws 140 are threaded over a portion thereof, as shown as at 142. Opposite ends of the screws 140 are rotatably mounted in sleeve bearings such as a bronze bushing provided in openings in the lower side frame members 92. A pair of sprocket pulleys 144 are mounted on the unthreaded portion of the screw shafts 140, and cooperate with a rollerless chain 146 to interconnect the shafts 140 for synchronous movement. The end of each of the screw shafts 140 adjacent the main drive pulley 98 is formed with a stub axle 145 which projects into the bronze bushing to be rotatable therein. The opposite end of each of the screw shafts 140 is squared off as shown at 148, in order to receive a wrench or other tool required to cause turning of the screw shafts.

An internally threaded collar in the form of a tractor screw nut 150 is adapted to receive and operatively coact with the threaded portion 142 of the screw shafts 140. Each of the screw nuts 150 is fixedly secured to one of a pair of spaced apart frame members or plates 152 and 154. These two frame members or plates 152 and 154 are suitably apertured to be supported by bushings 155 on spaced apart tie rods 94 which are shown both in FIG. 2 and 3, the plate 152 also being shown in side elevation in FIG. 3. FIG. 2 shows a number of tie rods 156 which secure the plates 152 and 154 firmly together as a structural sub-frame.

In order to adjust the left hand pin 124 laterally a suitable wrench is placed over the squared end 148 of one of the screw shafts 140. Rotation of one of these screw shafts 140 in either a clockwise or counter clockwise direction will cause rotary movement of those shafts to be translated by the screw nuts 150 into linear

movement of the sub-frame made up of the plates 152 and 154. Idler wheels 136 can likewise be adjusted laterally to provide for adequate support of the continuous web between the two pin bands 124. When the desired lateral adjustment has been achieved, the tool is disengaged from the squared end 148 of the screw shaft 140.

A vertical adjustment mechanism is provided to accommodate taking up any slack in the pin bands 124. It will be recalled that the bearing holders or plates 131 are coupled together by tie bars 133 in the form of a sub-frame. This sub-frame is carried at one end thereof on a pivot shaft 160. This pivot shaft extends laterally beyond the bearing holder plates 131 and has opposite ends thereof seated in suitable apertures provided in the lower side frame members 92. An eccentrically movable shaft 162 is supported at opposite ends thereof by stub axles 164 which are received in openings also provided in the lower side frame members 92. The axis of the shaft 162 is off-set from the axis common to the stub axles 164. As best seen in FIG. 3, the shaft 162 extends through a cut-out 166 provided in the end of each of the bearing holder plates 131 opposite to the pivot shaft 160. To actuate the movable shaft 162, a worm wheel 168, is secured to one end of the shaft 162.

The worm wheel 168 is adapted to be driven by a worm 170, mounted at opposite end thereof in a bearing block 172. The bearing block is itself secured to the lower side frame member 92 shown at the lower hand part of FIG. 2.

The worm 170 is carried at the lower end of a shaft 176. Rotation of the hand wheel 174 will be translated into rotation of the shaft 162, about the axis common to the stub axles 164. Due to the off-set relationship between these axes, the shaft 162 will travel a path eccentrically of the axis of rotation, i.e., eccentrically of the axis of the stub axles 164. Movement of the shaft 162 will therefore cause pivoting movement of the bearing holder plates 133 clockwise or counterclockwise relative to the axis of the pivot shaft 160 on which those plates are mounted. Thus, the idler wheels 136 and tubular shaft 198 on which those wheels are carried, will be positioned to take up or increase any slackness existing in the pin bands 124. This vertical positioning can also be used at times to accommodate separated material that is either thicker or thinner than had been processed previously. FIG. 3 shows that movement of the tubular shaft 128 is possible in spite of the enclosure of the main drive shaft 28 by the former, because of the relative diametrical sizes of those shafts. It may also be desirable in some instances to provide for additional vertical adjustability by mounting of the tubular shaft 128 in a manner which provides such adjustability.

Additional flexibility is built into the transfer mechanism 10 of FIGS. 2 and 3 by having a number of the transfer sub-assemblies shown in FIG. 1 mounted on a pivotally movable frame. This can best be seen from FIGS. 3 and 4. There, the movable frame just mentioned can be seen to comprise the side plates 48 which support cam-ways or races 46, and a number of the interconnecting tie bars 182 which secure those plates together. The side plates 48 are themselves of an elongated form, and have a number of apertures or openings provided therein. One large opening 180 is formed generally centrally of the plates 48 and serves to closely receive a cam-way or race 46 therein, such as by press

fitting. The race 46 is shown in this particular example as being of a circular configuration. An oval or other generated form could also be used, in another situation. The elongated side plates 48 are also provided with apertures 184 adjacent one end thereof, for receiving a pivot shaft 186. This pivot shaft 186 is rotatably mounted in journal bearings, or the like, provided in mounting brackets 188 which are secured to an upwardly facing edge of the lower side frame members 92. See the left central part of FIG. 3.

Each of the elongated side plates 48 is formed with an oblong opening 190, approximately three-fourths of the distance along each plate, taken in a direction away from the pivot shaft 186. These openings 190 are adapted to coact with a hold down shaft 192 which extends through such openings. The hold down shaft 192 is itself supported at opposite ends thereof in a pair of upper side frame supports 194 which are secured to the upwardly facing edge of lower side frame members 92. The upper side frame members 16 are also received on the opposed ends portions of the hold down shaft 192, and are coupled together as an upper frame by a number of tie bars 196. Openings are further provided in the upper side frame members 60 to receive the pivot shaft 186, as can be seen in FIG. 3. The upper side frame supports 194 have an upwardly extending stem portion 198 in which a series of recesses or cut-outs 200 are formed. The hold down shaft 192 rests in one of these recesses. Moreover, the hold down shaft 192 is adapted to coact with a double-pronged fork element 202 which is movable about the axis of that shaft 192. The fork element 202 is operatively coupled to a worm gear 204 to be rotatably mounted therewith on a tie bar 196 disposed adjacent to the hold down shaft 192. The worm gear 204 is in turn adapted to be driven by a worm 206 connected by a shaft 208 to a hand wheel 210. Manipulation of the hand wheel 210 causes rotation of the worm gear 204 in either a clockwise, or counter clockwise direction, as seen in FIG. 3. Movement of the worm gear 204 and fork element 202 in a direction clockwise of the axis of hold down shaft 192 will cause pivoting movement of the movable upper frame in a corresponding clockwise direction relative to the axis of the pivot shaft 186. In a similar manner, movement of the worm gear 204 and fork element 202 in a counter clockwise direction relative to the axis of the shaft 192 will be translated into movement of the upper frame in a direction counter clockwise of the axis of the pivot shaft 186.

Clockwise movement of the upper frame relative to the axis of pivot shaft 186 will cause a decrease in the vertical spacing between the feed band 124 and the elongated plates 70 and 82 on which separated material is supported, at the transfer position. Pivotal movement of the upper frame in a counter clockwise direction relative to the axis of pivot shaft 186 will increase that vertical spacing from the pin bands 124. Such adjustability in the vertical spacing is desirable to accommodate the transfer of separated material of either greater or lesser thickness for application to the continuous web of material being carried through the collating apparatus 18.

As indicated earlier, modification of the basic Hamilton collator 18 also includes the incorporation therein of the tractor feed mechanism shown at 72 in FIG. 3. This tractor feed mechanism 72 is also an item that is available commercially. It will be recognized in this art that the tractor feed mechanism 72 is commonly used

for feeding continuous business forms, and it may be the kind of device manufactured and sold by the American Binder Company, of California.

A brief description of the tractor feed mechanism 72 should suffice at this time for an adequate understanding of the present invention. It is noted that the tractor feed mechanism 72 does not, per se, form a part of the present invention in the broad sense. Turning to FIG. 3, the tractor feed mechanism 72 includes a base plate 220 which coacts with side plates 222 to define a feed channel. A pin feed mechanism 224 is provided as part of the feed mechanism 72. A multiplicity of feed pins 226 are carried along on chains disposed in operative relation to the lateral side edges of the base plate 220. The feed pins 226 of the feed mechanism 72 are engageable with feed holes in the separated material. That separated material is normally supplied by the feed mechanism 72 as a continuous form, initially. Transversely extending perforations are provided at points spaced equally apart lengthwise of the continuous form.

Since the tractor feed mechanism 72 generally feeds material as a continuous form, it is necessary to burst or separate individual portions of that continuous material. Thus, a burster blade assembly 230 and a cooperating anvil 232 are mounted in operative relation to the discharge end of the feed channel, on shafts 234 and 236. Each of the shafts 234 and 236 is rotatably supported at opposite ends thereof in the side plates 222. Rotation of those shafts 234 and 236 is in synchronism with motion of the pin feed mechanism 224, as well as being in synchronism with rotation of the shaft 12 and main drive shaft 28. The main drive shaft 28 is the source of driving power for each of the other shafts just mentioned. As stated earlier, the main drive shaft 28 is itself adapted to be driven from the line shaft which provides power to the assembly line in which the Hamilton collator 18 is intended to be operated.

It will be evident from FIG. 3 that the diametrical size and/or spacing of the burster blades 230 can be varied. Such adjustability in size and spacing may be required to accommodate separated material of a selected length. The separated material is itself generally derived from a continuous form of the type already mentioned. Perforations or other lines of weakening which extend transversely across the continuous web at right angles thereto define or delimit the length of a piece of separated material from the next piece. Thus, the burster blades 230 sever the continuous form to provide individual pieces of separated material for delivery to the transfer sub-assemblies 54.

It will be recognized from the foregoing description that problems often encountered in using a deck or stack type of delivery mechanism for feeding individual items of separated material to the transfer sub-assemblies 54 can be significantly reduced by the present invention. Thus it can be seen that the apparatus of FIG. 3, for instance, can receive material that is initially a continuous series of interconnected items of transfer material. This continuous series of material is separable to provide individual items of separated material. That separated material is delivered one item at a time to one of a series of transfer sub-assemblies 54 which are adapted to accelerate the separated material from the speed at which it was originally received to another and higher speed at a transfer position. At that transfer position the separated material is either moving in a direc-

tion exactly parallel to the feed bands 124, or has a velocity component which may be parallel to those feed bands. In either instance the velocity of the separated material in a direction parallel to the feed bands 124 will, for all practical purposes, be identical to the velocity at which a web of continuous material is being carried through the collating apparatus 18 by those feed bands 124. It is also to be noted that at the transfer position, the feed pins 76 on the transfer sub-assembly 54 at the six o'clock position (in FIG. 3) will penetrate the openings 134 provided in the feed bands 124. Simultaneously therewith, the feed pins 123 in each feed band 124 will correspondingly penetrate the apertures 73 provided in each of the support bands 74. In this way, the individual items of separated material are brought up to the speed of the continuous web. The separated material is in complete registration with that continuous web at the transfer position, can be transferred or applied to that continuous web by the engagement of feed pins 123 with that separated material.

In accordance with the preferred embodiment illustrated herein, acceleration of the separated material is obtained by increasing the radial positioning of that material from the axis about which it is being moved. Specifically, each transfer sub-assembly 54 can be seen from FIG. 4 to be movable about a path defined by cam followers 44 travelling in the race 46. In this particular embodiment, race 46 is circular in configuration, and its center is off-set from the axis of the shaft 12. It is a well known mathematical equation that the tangential velocity component relative to an axis about which an item is turning is proportional to both the radial positioning of that article, and the speed of rotation. It will therefore be apparent that if the speed of rotation is held constant, and increase in the radial positioning will cause a resultant increase in tangential velocity component.

The present invention is therefore able to accept material to be transferred to a moving continuous web, delivered at a first velocity and subsequently accelerated to have at least a velocity component which is substantially identical to a second and higher velocity, the velocity at which the continuous web is being moved. Items of insert material which are separable from a continuous web can have a variable length taken in the direction longitudinally of the web. For any given length of such separable items of material, the burster blades 230 will be provided on a wheel whose radius will be selected to provide a pitch length between successive burster blades which is identical to the selected length of the material to be transferred. Individual, separated items of material can therefore be delivered to a pick-up position for engagement with a transfer sub-assembly 54. Once received and held by a transfer sub-assembly 54, the separated material is rotated about an axis coincident with the axis of the main drive shaft 12. The relative diameters of the pulleys 106 and 100 (in FIG. 2) can be chosen to provide any desired relationship between the rotation of the pin band drive shaft 116 and the main drive shaft 28 of the collating apparatus 18. Thus, the linear velocity of the pin bands 24 and any continuous web being carried thereby can be established at a predetermined value.

This invention, transfers material from the feed mechanism 72 in separated form to a continuous web being conveyed by the pin band mechanism 118. Application of that separated material to the continuous web

will take place with a predetermined, selected spacing between successive individual items of material being transferred to that continuous web. The present invention is particularly useful in transferring separated material which may be in the form of one or more plies, return envelopes or the like and which are to be applied to the continuous web carried by the feed mechanism 118 for subsequent assembly as a stuffed envelope. In that situation, a second continuous web would be set down in registration with and overlying the continuous first web onto which the separated material was previously applied with a constant pitch or spacing between individual items. The techniques by which assembly of such stuffed envelopes occurs does not form part of the present invention and need not be described at this time. It will suffice to state that the first continuous web to which separated material had been applied in the collating apparatus 18 will subsequently be provided with glue lines extending transversely of that continuous web, and between individual items of separated material. The subsequent application of a second overlying continuous web will result in the production of a stuffed envelope having the edges of individual envelopes defined by glue lines, and cross perforated in a manner known in the art to yield a series connected assembly of envelopes separable one from another.

To indicate the dimensional relationships between linear and rotational velocities, lengths of separated material and other similar operating parameters, see the tabulated material below. This descriptive material is for purposes of example only. It is not in any way intended to limit the applicability of the present invention to only a structure of the type illustrated herein and having operating parameters described below. The need for changes in operating parameters can arise, for instance, from new postal regulations established by the government. Such regulations could, for example, limit the size of the forms with which this invention could be used to a certain maximum size compatible say, with equipment designed for processing and sorting mail automatically. Thus, the exemplary embodiments mentioned herein are to be considered as indicative only of some particular embodiments preferred at this time.

EXEMPLARY EMBODIMENTS

1) Spacing between shafts 28 and 12	4.297 inches (10.91 cms)	5.570 inches (14.15 cms)
2) Gear ratio between shafts 28 and 12	1: .6875	1: .458
3) Line speed of continuous web	200 ft/min 61 meter/min	61 meter/min
4) Delivery speed of separable material	150 ft/min (45.7 meter/min)	134 ft/min (41 meter/min)
5) Rotational speeds of shaft 28	218 rpm	
of shaft 12	150 rpm	100 rpm
6) Off-set of race center to center of shaft 12	.318 inches (.80 cms)	.636 inches (1.61 cms)
7) Diameter of race	4.456 inches (11.4 cms)	6.366 inches (16.16 cms)
8) Radial spacing of separated material for a given race	max. 2.546 inches (6.46 cms)	3.819 inches (9.7 cms)
	min. 1.904 inches (4.83 cms)	2.546 inches (6.46 cms)
9) Form size on continuous web	4 by 18 inches (10.16 cms by 44.72 cms)	6 by 18 inches (15.24 cms by 44.72 cms)
65 Form size of transferable material	3 by 18 inches (7.62 cms by 44.72 cms)	4 by 18 inches (10.16 cms by 44.72 cms)
10) Radial position	1.904 inches	2.546 inches

EXEMPLARY EMBODIMENTS-Continued

of transferable material to center axis 12	(4.83 cms)	(6.46 cms)
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Another advantage of the present invention can be seen by referring to the embodiment of FIG. 3. In order to accommodate transferring of separated material which has changed from one size to another, the following change is made. With a decrease in the length of separated material, the Bridge member 62 (FIG. 1) is removed to allow replacement of the spacer blocks 56 with another such block having a greater depth. When the bridge member 62 is again connected to the replacement spacer block, the radial positioning of the elongated plate 70 and 82 and separated material carried thereby will have been increased relative to the axis of rotation of the main shaft 12. Along with a change in the radial positioning of the separated material, it is necessary to adjust the positioning of the hold down shaft 192 from one of the recesses 200 in the upper side frame supports 194, to another of such recesses. Thus, an increase in the radial positioning of separated material carried by one of the transfer heads 54 will require a simultaneous adjustment of the hold down shaft 192 to another recess 200 in a manner which accommodates pivoting of the sub-frame (including side plates 48) in a direction counter clockwise of the pivot shaft 186. The changes in positioning which arise from an alteration in the radial positioning of separated material is provided primarily by repositioning of the hold down shaft 192. Vertical positioning of the centrally located idler wheels 136 (of pin feed mechanism 118) will provide for minor variations arising, say, by a change in the thickness of the separated material to be transferred or by the existence of glue lines, and so on. The presence of glue lines presupposes the assembly of a second and overlying play or continuous web, with a continuous web to which material is being transferred. This would occur, say, during assembly of what is known in this art as a stuffed envelope. These webs are aligned, collated and assembled, and for convenience, the glue lines smoothed out by a brush 212 carried by one of the upper side frame plates 48.

Recalling the relationship between rotational and tangential velocities and radius, it will be apparent that a larger tangential velocity component for the separated material is required at the transfer position when the length of the transfer material is decreased and no change is made in the velocity at which the continuous web is being fed through the collating apparatus 18. With the arrangement just described, the center to center distance between successive items of separated material transferred onto that continuous web will remain constant. Conversely, an increase in the length of the separated material to be transferred to the continuous web will require a corresponding decrease in the radial positioning of that material in order to end up with a tangential velocity component substantially equal to the line speed of the continuous web.

As an alternative way of achieving changes in the radial spacing of material to be transferred from an axis which it travels, the races 46 could be made in segments which are removably secured to the frame plates 48. Such a modification could also be used to accommodate a change in the configuration of the races 46, say, from circular to some generated form. It is appar-

ent, however, that for any given collating apparatus 18 there is a limit to the maximum radial displacement of separated material from the axis of main shaft 12. That maximum radial displacement is governed by the spacing between the main drive shaft 28 and the drive shaft 12 of the transfer mechanism 10. To change the spacing between the drive shaft 28 and 12, it would be necessary to remove the tractor feed mechanism 72 from the upper frame, and then extract the pivot shaft 186 and hold down shaft 192 from the pivotable frame made up from the eccentric frame plates 48. The entire upper frame would then be detached from the upper side frame supports 194. Having done that, the entire upper frame could then be substituted, and in that frame, the location of the opening 180 as well as the openings in upper side frame members 16 would be changed to accommodate, say, an increased displacement between the axes of the main drive shaft 28 and that of the drive shaft 12 of the transfer mechanism of the substitute upper frame.

It is noted that the parameters which are generally considered to be fixed start with the dimensions of the separated material to be provided by the tractor feed mechanism 72, and the center to center distance of positions on the continuous web on which that separated material is to be transferred and centered. Having established those parameters, it then becomes necessary to select an appropriate rotational speed for the main drive shaft 28 of the collating apparatus 18. That rotational speed in turn will govern the line speed at which a continuous web is fed through the collating apparatus 18. Further, the rotational speed of the main drive shaft 28 coupled with the ratios between the differential gearing 26 and the spur gear 92 will determine the speed of rotation of the main shaft 12 of the transfer mechanism 10. Furthermore, the speed at which separated material is delivered by the tractor feed mechanism 72 is determined by a suitable belt and pulley system which is ultimately connected to the main drive shaft 28. Thus, the speed at which separated material is to be delivered is also a dependent parameter. Finally, since the delivery speed of separated material and the line speed of the continuous web have now been determined, it will be evident that the difference between these two velocities will determine the amount of accelerations required to be provided by the transfer mechanism 10 in order to deliver separated material to the transfer position having a tangential velocity component substantially equal to the line speed of the continuous web. Thus, the lower and upper limits for the radial positioning of separated material carried on the elongated plates 70 and 82 of the transfer mechanism 10 will determine the diameter of the race 46 (in those instances when it is circular) as well as the amount of displacement between the center of that race and the axis of rotation of the main drive shaft 12. It will be evident that for ease of construction, the race 46 is preferably of a circular configuration. Other generated forms could be used equally well, however, these would naturally be more difficult and expensive to produce. Such arrangements are nevertheless contemplated within the scope of this invention.

The foregoing disclosure has set out a description of a preferred embodiment of apparatus contemplated by this invention. The disclosure has also indicated the procedural steps which are followed in transferring separated material from a delivery source for application

to a continuous web with a selected spacing between individual items that have been transferred. Certain changes and modifications have also been described. It is therefore contemplated within the scope of this invention to include all such changes and modifications as would be obvious to those skilled in this art and being encompassed by the claims below.

I claim:

1. A transfer mechanism mountable in a collating apparatus or the like through which a web of indeterminate length is to be carried, said mechanism being operable to transfer separated material of a selected length from a source to said web, comprising:

a support member to receive the separated material, and having retainer means thereon engageable with said material to hold the latter securely;

a main shaft rotatably mountable in spaced apart frame elements in said apparatus for rotation about an axis extending coaxially of the shaft, said main shaft being adapted to be driven in synchronism with the collating apparatus; and

connecting means supported by a bearing assembly for guided reciprocal movement relative to said axis of rotation; said connecting means being operative to carry the support member and coact in response to rotation of the main shaft with support structure in the collating apparatus to move the support member along a path eccentrically of the axis of rotation, whereby separated material is carried by the support member to a transfer position for placement onto said web with preselected positioning.

2. The transfer mechanism defined in claim 1, wherein said connecting means and support structure cause radial positioning of the support member relative to the axis of rotation, said positioning to be varied from a minimum when receiving separated material to a maximum when transferring said material onto the web.

3. The transfer mechanism defined in claim 2, wherein said retainer means comprises feed pins spaced equally apart to be received in complementary feed holes provided in said separated material.

4. The transfer mechanism defined in claim 3, wherein said feed pins are mounted on a base segment, biased to urge the separated material against a guide plate provided on the collating apparatus, the guide plate being delimited by a leading edge disposed in operative relation to receive material in cooperation with said support member from said source, and by a trailing edge disposed in said transfer position and spaced slightly above said web of indeterminate length.

5. The transfer mechanism defined in claim 1, wherein the connecting means is provided with follower means to be engageable with a race of a predetermined orientation relative to said axis of rotation, said race forming part of the support structure.

6. The transfer mechanism defined in claim 1, wherein said separated material is accelerated from a rate of delivery from said source to a transfer speed substantially equal to a predetermined line speed at which said web of indeterminate length is to be carried through the collating apparatus.

7. The transfer mechanism defined in claim 1, wherein said bearing assembly is secured to the main shaft for rotation therewith, said bearing assembly and connecting means being provided with mating coupling

elements which limit movement of the connecting means relative to the bearing element to a direction radially of the axis of rotation.

8. The transfer mechanism defined in claim 7, wherein the support member and connecting means are rigidly interconnected and wherein said connecting means comprises a generally U-shaped saddle member having at least one guide pin secured thereto and projecting toward said axis of rotation, the bearing assembly being formed with apertures in alignment with said guide pin to receive and limit the latter while said main shaft is rotated to reciprocal movement of the support member radially of the axis of rotation.

9. The transfer mechanism defined in claim 1, wherein said support member comprises a curved elongated plate removably attach at each of a pair of opposed edges thereof to a replaceable spacer block, the spacer blocks being mounted on rods having opposed free ends each of which is fixedly secured to a U-shaped saddle member at a free end of one arm of the U, the other arm of the U being provided with follower means engageable with an adjustably positionable circular race whose center is located off-set from the axis of said main shaft, whereby rotation of the main shaft causes the curved plate and separated material carried thereon to traverse a path eccentrically of the axis of rotation of said shaft.

10. The transfer mechanism defined in claim 9, wherein said spacer blocks are replaceable to vary the radial positioning of the curved plate from the axis of rotation, and wherein said circular race is concurrently adjustable to retain without change a pick-up position for the separated material.

11. A transfer mechanism for use with a collating apparatus or the like through which a web of indeterminate length is to be carried, the mechanism being operable to transfer separated material of a selected length from a source to said web, comprising:

an elongated support member having retainer means thereon operable to receive material from said source and hold said material securely;

a bearing assembly adapted to be supported on a drive shaft for rotation therewith about an axis of rotation, the bearing assembly including coupling elements oriented in a direction radially of the axis of rotation; and

connecting means supported by said bearing assembly, the connecting means being operative to mount the support member for movement along a path eccentrically of said axis of rotation, and including a complementally formed member thereon engageable with one of said coupling elements to provide reciprocal movement of the support member radially of said axis of rotation.

12. The transfer mechanism of claim 11, wherein the connecting means comprises a generally U-shaped saddle member having a guide pin thereon which constitute said complementally formed member, one arm of the U-shaped saddle member being adapted to carry said support member, and the other arm being provided with one portion of a two part cam follower and race system so arranged as to yield said movement eccentrically of the axis of rotation.

13. The transfer mechanism defined in claim 11, wherein said separated material is arranged to be accelerated from a rate of delivery from said source to a transfer speed substantially equal to a predetermined

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line speed at which said web of indeterminate length is to be carried through the collating apparatus.

14. The transfer mechanism defined in claim 11, wherein said connecting means and bearing assembly cause radial positioning of the support member relative to the axis of rotation to be varied from a minimum when receiving separated material to a maximum when transferring said material onto the web. 5

15. A method for transferring separated material from a source to a continuous web movable at a predetermined line speed; comprising the steps of, 10

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receiving and supporting the separated material in a selected position;

accelerating said separated material to a velocity having a component thereof equal to said line speed by varying the positioning of said material radially of an axis about which the separated material is movable; and

transferring said separated material to the continuous web with a preselected orientation and positioning relative to said web.

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