

[54] **APPARATUS FOR FORMING A CONTINUOUS ASSEMBLY OF ENVELOPES OR THE LIKE**

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[51] Int. Cl. .... **B31b 1/06, B31b 1/96**

[58] Field of Search ..... **93/36 MM, 36.9, 61-63 M, 93/93 C**

**References Cited**

**UNITED STATES PATENTS**

3,565,728	2/1971	Alton .....	156/566
2,320,021	5/1943	Weik .....	93/93 C
2,987,099	6/1961	Williams .....	93/61 A
3,438,310	4/1969	Woodruff .....	93/63 M
3,391,673	7/1968	Knapp .....	93/62 X
3,429,238	2/1969	Lenk .....	93/61 AC
3,506,472	4/1970	Labombarde .....	93/36 MM
2,061,885	11/1936	Wensler .....	93/61 AC
3,112,680	12/1963	Hew .....	93/61 AC
2,722,369	11/1955	Reuter .....	93/63 M
2,847,915	8/1958	Rapp .....	93/63 M
2,969,003	1/1961	Rapp .....	93/63 M

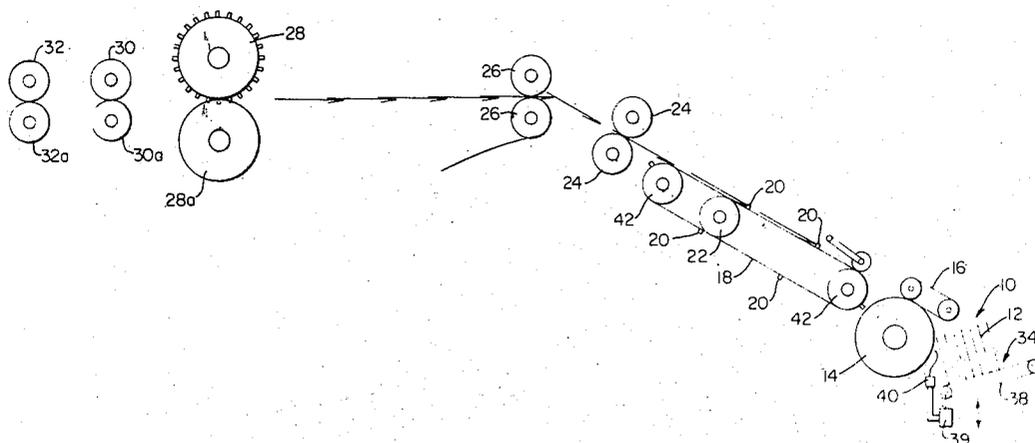
2,690,102	9/1954	Halahan .....	93/61 AC
3,379,103	4/1968	Treff .....	93/61 AC
3,535,186	10/1970	La Coussaye .....	93/36.9 X
3,579,947	5/1971	Kalman .....	93/36 MM
3,387,542	6/1968	Gartner .....	93/1.1 X
3,564,983	2/1971	Grimm .....	93/36.9 X
3,630,125	12/1971	Helm .....	93/36 MM
3,635,128	1/1972	Dohnazik .....	93/36 MM

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[57] **ABSTRACT**

Apparatus for assembling envelopes into a continuous web having removable perforate margins characterized by improvements in: apparatus for feeding envelopes from a supply stack; preventing application of adhesive to undesired zones in the event of absence of an envelope in a spaced series of same; varying the length of adhesive strips applied adjacent edges of the envelopes; changing the angular direction of feed of the envelopes where they are collated or secured together in overlapping relationship; varying the position of the collating station to accommodate envelopes of varying height; optional features include collating the envelopes on a previously perforated carrier web; and, applying reinforcing strips to the edges of the web when the overlap is relatively small and strengthening of the web at such zones is desired.

**9 Claims, 4 Drawing Figures**



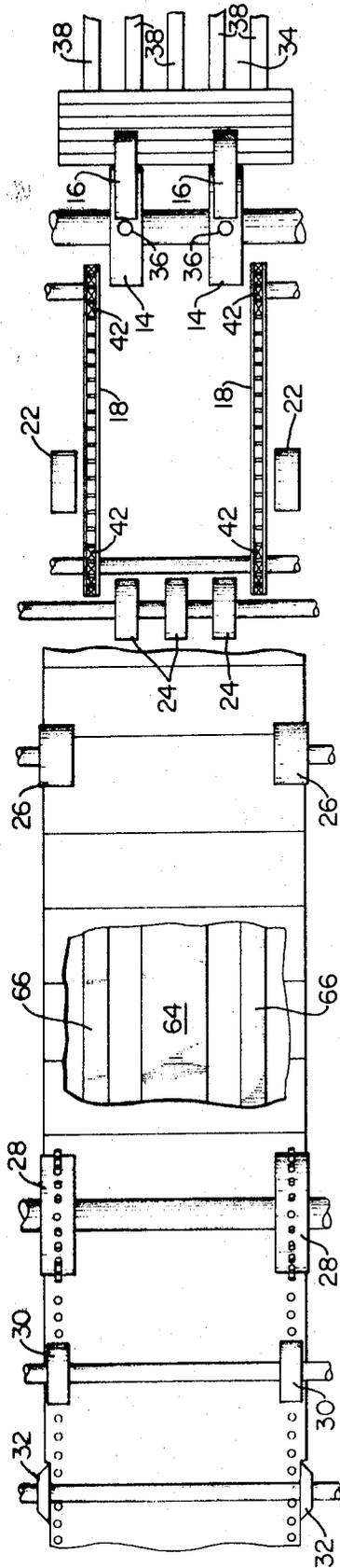


FIG 2

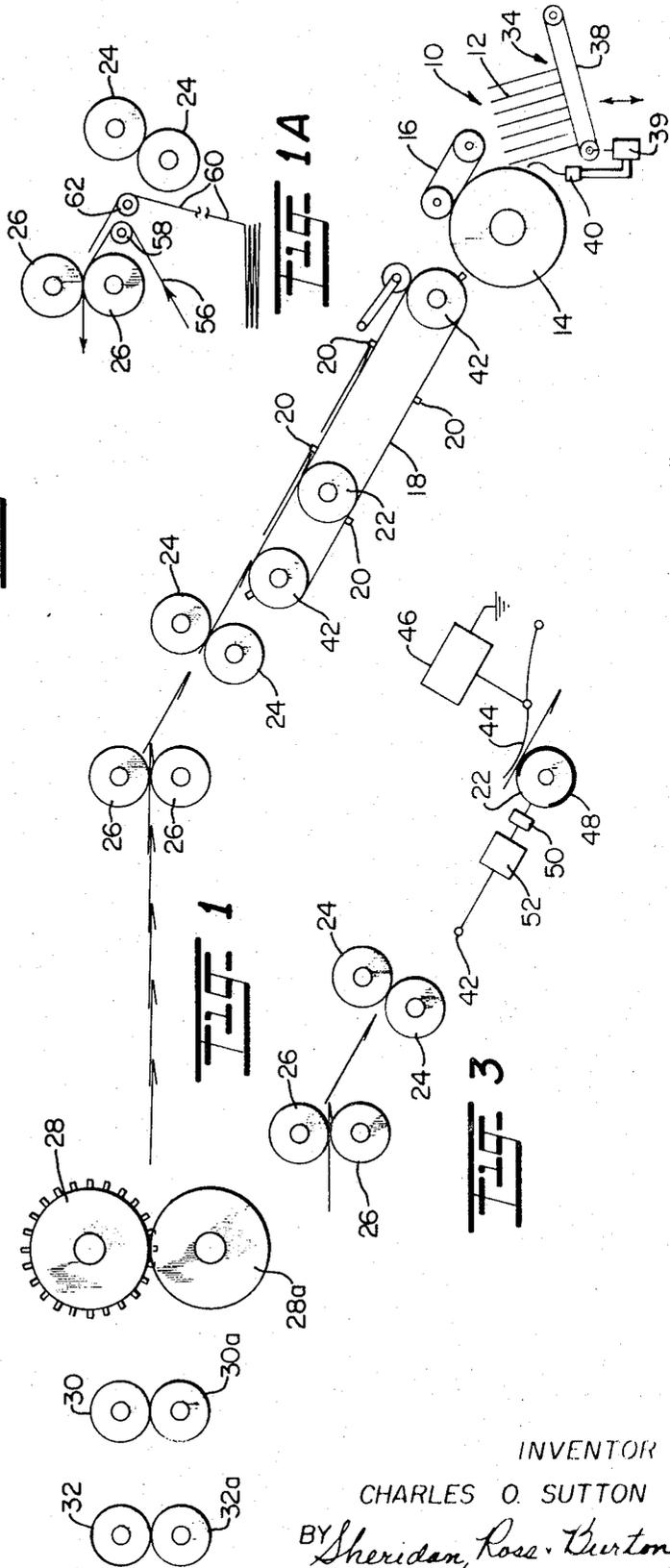


FIG 1A

FIG 1

FIG 3

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# APPARATUS FOR FORMING A CONTINUOUS ASSEMBLY OF ENVELOPES OR THE LIKE

## BACKGROUND OF THE INVENTION

In the processing of large quantities of items preparatory for mailing, it is known practice to initially assemble the items, such as envelopes, into a continuous web of overlapped items, feed the web through a high speed computer-printer in which the desired printing is applied, and subsequently separate the items prior to mailing.

The U.S. patent application of T. W. Alton, Ser. No. 608,631, filed Jan. 11, 1967, now U.S. Pat. No. 3,547,343, exemplifies a web of the type referred to and the U.S. patent application of T. W. Alton, Ser. No. 727,776, filed May 8, 1968, now U.S. Pat. No. 3,565,728 exemplifies improvements in method and apparatus for assembling items, such as envelopes, into a continuous web of overlapped, or shingle-like items. The web is then wound onto a reel and, as will be understood, the web is subsequently fed from the reel through the printer, after which the items are separated and are ready for mailing. If the items are envelopes with sealable flaps, these may be sealed at a desired station during the processing.

U.S. Pat. No. 3,565,728 discloses, briefly, an envelope supply hopper, vacuum transfer rolls for individually feeding the envelopes to an endless conveyor in spaced relationship, a subsequent adhesive applying station where strips of adhesive of desired length are applied to the margins of the envelopes, after which they are overlapped a distance corresponding to the lengths of the adhesive strips and thence pressed together, forming the web.

## SUMMARY OF THE INVENTION

The present invention probably relates most closely to U.S. Pat. No. 3,565,728 and provides certain improvements thereover which fulfill the exemplary objectives to follow:

Provides a feed hopper in which the envelopes of the supply are disposed on their edges in an upstanding arrangement and maintaining such arrangement at an optimum angle to be transferred to vacuum wheels.

Provides an adjustment in the timing of adhesive applying rolls with respect to the linear movement of an envelope across the rolls to produce various desired lengths of the adhesive strips.

Provides an upwardly inclined conveyor which moves an envelope, with adhesive on same, at an upwardly inclined angle from which it is deposited on a horizontally movable envelope ahead of same after which it moves between the nips of pinch rolls, applying securing pressure to the adhesive.

Provides adjustment for the pinch or collating rolls so that envelopes of various heights may be secured together or collated.

Provides a novel feed of margin tapes or an envelope carrier web to the envelopes ahead of the pinch rolls.

The foregoing objectives are exemplary, only, and further objectives and salient features will become more apparent from the detailed description to follow, the appended claims, and the accompanying drawing to now be briefly described.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic side elevation of the subject of the invention;

FIG. 1A is a like schematic of a portion of FIG. 1, illustrating two modifications of FIG. 1;

FIG. 2 is a schematic top elevation of FIG. 1, portions of FIG. 1 being omitted; and

FIG. 3 is a schematic side elevation of a portion of FIG. 1.

## DESCRIPTION OF PREFERRED EMBODIMENTS

### General Description and Operation

Referring now to the drawing and first to FIGS. 1 and 2, the subject of the invention comprises, in general; an envelope supply station 10 which contains a stack of envelopes 12 resting on their lower edges; a pair of suction transfer wheels 14,14; a pair of endless transfer belts 16,16; endless conveyor chains 18,18, having spaced envelope conveying lugs 20 carried thereby; a pair of adhesive applying rolls 22,22; transfer rolls 24; pressurizing or pinch rolls 26,26; pairs of matched perforating punch wheels 28,28a; pairs of matched feed pinwheels 30,30a; and pairs of rotary knives 32,32a.

In the general operation of the parts just described, suction wheels 14 pick up the foremost envelope 12 from the supply 10 and convey it to the lower runs of transfer belts 16 which transfer it to endless chain conveyor 18, the spaced lugs 20 on which move the envelopes in predetermined spaced relation across the adhesive applying rolls 22. As the individual envelopes leave the chain conveyor they pass between transfer rolls 24 and are sequentially deposited in overlapping relation on the envelope next ahead of same. The overlapped adhesive coated area is then pressurized against the envelope ahead of it and on which it overlaps and the envelopes thence all travel as a continuous connected web through the remainder of the apparatus. At a subsequent station, spaced perforations are formed in the margins of the web by perforating punch wheels 28,28a. Feed pin wheels 30,30a then engage the perforations and feed opposite edges of the web between rotary knives 32,32a which trim narrow strips from the opposite margins of the web to provide a uniform width of same. Thereafter, the web may be processed in conventional manner, through printing apparatus, it being understood that after printing, the perforate margins are removed to separate the web into individual envelopes. As hereinafter referred to, the height of an envelope will be considered as its dimension in the direction of its movement or along its side edges or margins and its width as its dimension in a direction normal thereto. The various components just described will now be described in greater detail.

### Supply Station

The supply station or feed hopper 10 comprises a downwardly inclined platen 34 which is mounted for vertical adjustment relative to the suction wheels 14 as indicated by a double head arrow therebeneath to thereby position envelopes of varying height in optimum position relative to the suction apertures 36 in such wheels, the latter being of conventional construction as understood in the paper conveying art. The optimum position is with the foremost envelope disposed substantially tangential to the suction wheels so that they may wipe across and pick up the foremost enve-

lope. As this process continues, however, the stack begins to lean forwardly and space the foremost envelope at a non-optimum angle relative to the suction wheels thus impairing the feeding operation. To obviate this, a plurality of endless belts 38 are provided having upper runs which move across the top of platen 34 which are power driven, such as by motor 39, in response to a signal from a switch 40 which senses change of inclination away from the optimum position. Since the lower edges of the stack of envelopes rest on these belts, forward movement of same carries the lower edges toward the wheels and restores the stack to optimum angular position relative thereto. When the stack is restored to optimum position the signal is broken and movement of the belts discontinues until receipt of the next like signal. The control switch may be of any suitable type such as a sensitive microswitch which moves between on-off positions in response to relatively small variations in the angle of inclination of the foremost envelope, this variation being within sufficiently small limits to always permit the vacuum wheels to pick up the foremost envelope and remove it from the supply station.

#### Chain Conveyor

This is of substantially conventional construction, such as disclosed in U.S. Pat. No. 3,565,728, it being understood that the two chains 18 are driven in synchronism by sprockets 42 and lugs 20 are adjustable along the links of the chains so that a desired spacing may be provided between successive pairs of the lugs to accommodate envelopes of various heights.

#### Adhesive Station

Adhesive applying rolls 22 are preferably of the hot melt type, such as supplied by the Nordson Company of Buena Park, California, in which the adhesive is maintained in a molten state and the wheels are provided with spaced apertures which apply the adhesive in a plurality of spaced dots which rapidly set. As best shown in FIG. 3, the side edges and adjacent margins of the envelopes pass across the wheels in spaced relation thereto, each margin being distorted downwardly by a movable resilient finger 44 operated by an actuator 46 to place the rolls into rolling contact with the envelope margins, forming dotted strips of adhesive thereon of desired length. As will subsequently appear, it is desirable that the lengths of the adhesive strips be adjustable. To attain this end, each wheel is provided with a segmented portion 48 of the apertures referred to which is of an arcuate length sufficient to transfer the longest strip of adhesive desired. It rotates in timed relation to the linear movement of the spacing conveyor 18 and a clutch 50 is disposed therebetween which may be adjusted in any desired phase relationship with respect to the movement of the spacing conveyor. Also, a speed ratio changer 52 is preferably disposed between the clutch and the drive source. When the clutch is positioned for the longest length of adhesive, the segment of the wheel carrying the adhesive, contacts the envelope at one end of the segment and continues contact to the other end of same. If a shorter length is desired, however, the phase angle of the wheel is angularly advanced by clutch 50 so that when the envelope begins to register with the segment a portion of the segment has previously rotated ahead of the advancing envelope and hence the length of the adhesive

strip is only the length of the remaining portion of the segment. Otherwise stated, the clutch may be so adjusted to utilize all or only a desired portion of the adhesive transferring segment thereby transferring a strip of adhesive to the envelope of any length less than its maximum potential length. Each wheel 22 rotates in a reservoir of molten adhesive which is automatically maintained at constant level and suitable doctor blades are provided to remove all adhesive except the portion desired at segmental portion 48. Since these features are conventional, they have not been illustrated in the interests of simplification of the disclosure.

While the resilient hold down fingers have been illustrated and described as movable to distort the envelope margins, with the adhesive rolls operated about fixed axes, it will be apparent that this may be reversed, if desired, to actuate the adhesive rolls upwardly into contact with the envelope margins, the hold down fingers then being fixed other than for their resilience. While this reversal of parts would normally be more complicated, it is nevertheless contemplated within the scope of the claimed invention.

#### Collating Station

Referring again to FIG. 1, the envelopes are moving in an upwardly inclined path as they leave the spacing conveyor and continue such motion as they pass between the nips of transfer rolls 24. After passing between rolls 24 the assembled web moves in a horizontal direction. This change of direction is desirable since an envelope, about to enter the nips of rolls 26, is angularly spaced above the envelope next ahead of it so that it may lay onto the top of the latter in overlapping relation and, as it enters a nip, is pressurized or pinched into contact with the envelope immediately ahead thereof having a portion therebelow. As will be understood, a predetermined distance of overlap occurs since the horizontal run is moving at a velocity less than the inclined run, these relative velocities being the same as in U.S. Pat. No. 3,565,728 previously referred to. As previously alluded to, envelopes vary in height. One of the features of the collating station is thus to provide suitable adjustment for effecting collation of envelopes of varying height. This is attained by mounting rolls 26 in a manner such that their positions are horizontally adjustable along the horizontal run. If, then, envelopes of a height greater than illustrated are to be collated, rolls 26 are bodily shifted to the left (FIG. 1) which provides a sufficient space between transfer rolls 24 and collating rolls 26 for the incoming envelopes to overlap and be laid upon the horizontally moving assembled web. Since the manner of attaining such adjustment is a matter of mechanical expediency, variations of which will be apparent to those skilled in the art, no specific construction of such adjustment has been illustrated in the interests of simplification of the disclosure. In an operative embodiment, however, the collating rolls 26 are journaled on a subframe slidably mounted on the main frame and moved by rack and pinion mechanism. As will be apparent, after positioning such subframe it may be rigidly locked to the main frame in any desired manner.

#### Perforating, Feeding and Trimming

When the envelopes pass beyond collating rolls 26 they are now adhesively connected together along their side margins in overlapping relation, forming a continu-

ous web and uniformly spaced relative to each other. It is important, however, that their spacing be maintained while passing through subsequent addressing apparatus, prior to their separation, so that suitable printing may be applied to their faces. Uniformly spaced perforations along their margins are therefore employed to cooperate with apparatus for performing such subsequent operations, this as will be apparent, also being disclosed in U.S. Pat. No. 3,565,728.

The assembled web then passes between the nips of rotary punches 28,28a which perforate the margins of the web with timing perforations, analogous to those employed in moving picture photographic film, which serve the purpose of timing the position of the envelopes relative to addressing or printing apparatus. The now perforated web is engaged by pin wheels 30,30a which deliver it to rotary trimming knives 32,32a to slice off unwanted slight irregularities so that the web emerges from the apparatus as a collated plurality of overlapping envelopes forming a web of uniform width. When pin wheels 30,30a are employed with punch wheels 28,28a, which is not always the case as will subsequently appear, they serve to punch out any loose perforations in the web so that the web is devoid of such loose perforations when it emerges from the apparatus.

#### Optional Features

Referring to FIG. 1A, which is a fragmentary portion of FIG. 1, but with added features, a pair of tapes 56 may be fed from supply reels (not shown) about an idler roll 58 into the nip of collating rolls 26, one along each margin of the envelopes. These are desirable when the overlap of the envelopes is small and the margins require reinforcing. When this is employed, the driving clutch for the adhesive applying rolls is adjusted to apply adhesive to the entire heights of the envelopes so that they are not only secured together at the overlap but the remainders of their heights are secured to the tapes. Normally, unperforated tapes are employed which, together with the envelopes, are perforated when the web passes between rotary perforating punches 28,28a.

Optionally, a carrier web 60, of substantially the same width as the envelopes, may be similarly fed about an idler roll 62 into the nips of the collating rolls 26. Normally such web will be pre-perforated and, if desired, the envelopes may be secured to the carrier web in spaced relationship, without overlap, to provide flexible hinges therebetween to permit the web to be fan-folded after it emerges from the apparatus. The carrier web, upon which suitable printing or coding may be applied, also serves as a permanent record, after being severed from the envelopes which have been processed. In this modification, as with the tapes, adhesive is applied to the entire heights of the envelopes. Since the carrier web has been perforated prior to being fed to the apparatus, perforating punches 28,28a are not required and are either removed from the apparatus or moved to inoperative position.

The purpose of pin feed rolls 30,30a will now become more apparent. When the perforating rolls are employed they not only perforate but their perforating pins also form sprocket teeth for feeding the web. Pin feed wheels 30,30a, while driven in synchronism with the perforating rolls, do not serve as sole drive means, this function being performed principally by the perfo-

rating punch rolls. When the latter are moved to inoperative positions, however, when the carrier web is employed, pin wheels 30,30a then become the sole drive means for the web between the collating rolls 26 and the discharge or exit end of the apparatus.

As will now be apparent, the tapes and carrier web serve somewhat different purposes. The utility of the former resides principally in their reinforcing feature where the envelope overlap is small and thus strengthens the web when it is needed for subsequent processing. The carrier web, however, allows the envelopes to be secured thereto in spaced relation, forming hinge lines for fan-folding the web, providing areas upon which a record may be printed, and also rendering available the entire area of an envelope for printing, which entire area is not available when the envelopes are overlapped.

#### Miscellaneous Features

To render the apparatus versatile to process envelopes of various heights and widths, many of its operative parts are constructed adjustable. As illustrated in FIG. 2, the floor of the horizontal station, subsequent to the roll collating station, is formed with a central plate 64, which remains fixed, and laterally adjustable plates 66. By moving plates 66 laterally relative to plate 64 a floor of various widths is provided on which envelopes of various widths may slide. The floor of the inclined chain conveyor is constructed in like manner (not shown). Starting with the right end of FIG. 2, a sufficient number of erecting belts are provided so that envelopes of various widths may rest on at least several belts. As previously described, the floor formed by these belts is vertically adjustable to dispose envelopes of various heights in optimum position to be picked up by the vacuum wheels, the latter being adjustable to dispose same in optimum positions relative to the widths of the envelopes. The sprockets which drive the conveyor chains are laterally adjustable to various positions on their supporting shafts and lugs 20 may be secured to selected chain links to provide requisite longitudinal spacing of the envelopes fed by same. The lateral positioning of transfer rolls 24, collating rolls 26, punch rolls 28,28a, feed rolls 30,30a and rotary knives 32,32a may also be varied for envelopes of various widths.

With the exception of the erecting belts 38, which operate intermittently, all of the movable parts are interconnected by chains or gears so that they operate in synchronized timed relationship and the relative ratios of the various parts may be varied by suitable selection of the sprockets or gears. As an example, if it is desired to increase the overlap at the collating station, the peripheral speed of the collating rolls 26 is decreased relative to the linear speed of the envelopes fed thereto. Similarly, if the overlap is to be decreased, the speed of rotation of the collating rolls is increased relative to the linear speed of the envelopes fed thereto. The power source may be a variable speed motor or may include a variable speed transmission so that the speed of the various instrumentalities may be varied between various synchronized values, this being desirable since envelopes of various heights require different speeds for optimum operation. Various devices which are conventionally employed in paper processing apparatus, are employed but have been omitted in the drawing to avoid unnecessary complication of the disclosure.

These may include hold down fingers and various paper guiding devices to maintain movement of the envelopes in their desired paths. An example comprises fixed brushes above the chain conveyor which exert a drag against the envelopes thereon to position them against their conveying lugs so that they move in precise spaced relationship on the top run of the spacing conveyor. Also, suitable deflector or guide devices may be employed, as desired, to constrain movement of the individual envelopes, or the assembled web, to the desired paths of motion. Pairs of any cooperating rolls may be adjusted so that both are positively rotated in synchronism or one is positively rotated and the other serves as an idler. Their axes of rotation may be adjusted relatively or one may be fixed and the other resiliently urged toward the other. Materials employed may be selected, as desired, for their particular adaptability to perform their intended functions. Throughout the specification and claims, specific reference has been made to envelopes but it is to be understood that, as stated in U.S. Pat. No. 3,565,728, such terminology is meant to include, within the scope of this invention, flat type articles generally that are to be assembled in interconnected overlapping form.

What is claimed is:

1. Apparatus for forming a continuous assembly of envelopes in interconnected form, each envelope having removable margins and a leading and trailing portion, comprising:

- a. an endless conveyor for continuously moving the envelopes in predetermined spaced relationship in a series,
- b. means for applying adhesive material of desired length to the envelope margins during their spaced movement along the endless conveyor,
- c. means for subsequently securing said envelopes together with the previously applied adhesive, and
- d. an upstream feed station for said endless conveyor comprising;

- 1. a feed hopper upon which a stack of envelopes is adapted to rest on their lower edges and normally in a plane perpendicular to the floor of the feed hopper,
- 2. means adjacent the lower end of the hopper adapted to transfer one envelope at a time to said conveyor means,
- 3. means comprising at least one movable endless belt, forming said floor of the feed hopper, and
- 4. means for sensing the angular departure of the stack from said normal position and wherein the lower edges of the envelopes lag the upper edges, the sensing means adapted to operate the belt means and move said lower edges until the stack is restored to its proper position for optimum pick-up by the vacuum transfer wheels.

2. Apparatus for forming a continuous assembly of envelopes in overlapping, interconnected form, each envelope having removable perforate margins and a leading and trailing portion, comprising;

- a. an endless conveyor for continuously moving the envelopes in predetermined spaced relationship in a series,
- b. a pair of continuously rotatable wheels for applying adhesive material of desired length to the envelope margins in their areas of overlap and operated in synchronism with said endless conveyor,

c. each of said wheels having at least one arcuate peripheral portion on which the adhesive is deposited for transfer to a margin, the remainder of the periphery being constructed to remain out of contact with a margin, whereby it is ineffective to transfer adhesive to a margin, and

d. means for varying the phase relationship of the arcuate portion with respect to the movement of the endless conveyor through one increment of its movement, whereby a desired portion of an arcuate peripheral portion is employed to apply adhesive, to thereby apply a strip of adhesive of a desired length in accordance with the length of the overlap of the envelope margins.

3. Apparatus in accordance with claim 2 wherein the means for varying the phase relationship comprises a clutch interconnecting said wheels with the conveyor drive means, and means for locking said clutch in various angular phase relationships to vary the effective length of the adhesive applying peripheral portion.

4. Apparatus for forming a continuous assembly of envelopes in interconnected form, each envelope having removable margins and a leading and trailing portion, comprising;

- a. an endless conveyor for continuously moving the envelopes in predetermined spaced relationship in a series,
- b. a pair of continuously rotatable wheels for applying adhesive material of desired length to the envelope margins and operated in synchronism with said endless conveyor, and
- c. a movable hold-down member associated with each wheel adapted to move between an operative position, at which it distorts an envelope margin into contact with a wheel, and an inoperative position at which a margin may pass beneath same without being distorted into contact with a wheel.

5. Apparatus in accordance with claim 4 including means for moving the hold-down members to inoperative position, whereby a first envelope of a series may pass beneath same without application of adhesive thereto.

6. Apparatus for forming a continuous assembly of envelopes in overlapping, interconnected form, each envelope having removable margins and a leading and trailing portion, comprising;

- a. an endless conveyor for continuously moving the envelopes in predetermined spaced relationship in a series,
- b. means for applying adhesive of desired length to the envelope margins in their areas of overlap and during their spaced movement along the endless conveyor,
- c. said endless conveyor being disposed to transport the envelopes along an inclined plane at a first speed,
- d. a pair of cooperating driven rolls at the end of the endless conveyor between which the envelopes pass and continue movement along the inclined plane,
- e. a second station including means adjacent said end for supporting the envelopes for movement along a horizontal plane, including means for positively moving the assembled envelopes at a continuous but lesser second speed than the linear first speed of said endless conveyor and driven rolls, so that when an envelope is released from said driven rolls

its leading portion is disposed above and falls onto the trailing portion of the envelope ahead of same in overlapped relationship, and

f. a pair of adhesive pinch rolls disposed at the entrance to said second station, for applying pressure to the overlapped envelopes to adhesively attach them to each other.

7. Apparatus in accordance with claim 6 wherein said pinch rolls are adjustable in a longitudinal direction to thereby dispose the nip of same at various distances from said driven rolls for accommodating envelopes of various heights.

8. Apparatus in accordance with claim 6 including

means for feeding reinforcing tapes to the margins at the point where the envelopes enter the pinch rolls, said means for applying adhesive being so arranged to apply adhesive to the margins throughout their entire heights.

9. Apparatus in accordance with claim 6 including means for feeding a carrier web having perforations adjacent its edges to the margins at a point where the envelopes enter the pinch rolls, said means for applying adhesive being so arranged to apply adhesive to the margins throughout their entire heights.

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