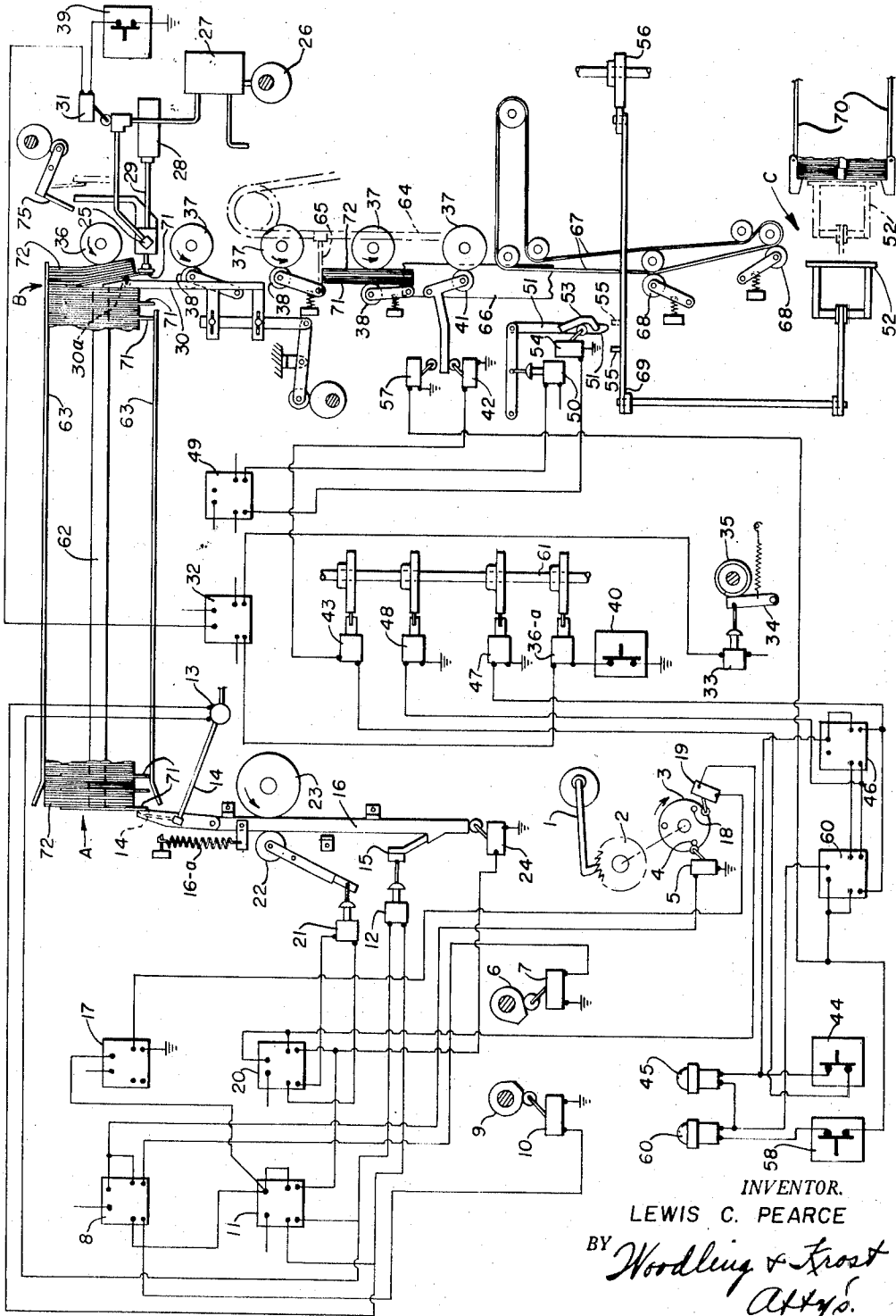


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APPARATUS FOR GROUPING ENVELOPES
AND LIKE FLAT ARTICLES
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APPARATUS FOR GROUPING ENVELOPES AND LIKE FLAT ARTICLES

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My invention relates to apparatus for grouping envelopes and flat flexible articles, such as cards.

An object of my invention is to divide a series of envelopes and like flat articles into groups for the packing of the articles into such groups having a uniform number of articles therein.

Another object is the provision for separating a sequence of flat articles, such as envelopes, into groups of uniform number and moving the separated groups from the sequence to a position for banding or other packing.

Another object is the provision for ready and fast grouping of flat articles, such as envelopes, being fed in sequence and in side-by-side relationship through an apparatus.

Another object is the provision for an efficient system in an apparatus for taking envelopes and like flat articles from a machine upon which they are sequentially fabricated and separating the sequentially produced articles into groups of a predetermined size.

Another object is to provide unique results in a novel and useful manner.

Other objects and a fuller understanding of my invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawing, in which:

The drawing illustrates my apparatus in a largely schematic and diagrammatic arrangement.

The invention is described in connection with the handling of flat paper envelopes sequentially fabricated by an envelope-making machine. The envelopes sequentially produced by an envelope-making machine are collected into groups of predetermined plurality and separated from the series of other envelopes being produced and advanced in the apparatus. The separated groups are then moved to a banding machine which packs the groups individually in an encircling paper band. While similar flat flexible articles may be grouped in the same manner, the invention has its particular use in the handling of paper envelopes and the present description will be based upon that use.

Envelopes are sequentially produced and presented at the station indicated by the letter A in the drawing. At station A, the envelopes as produced are advanced in side-by-side relationship with the next preceding envelope so that the envelopes are advanced in a column of envelopes in which these envelopes are beside each other. From station A in the apparatus, the envelopes are advanced by a conveyor belt 62 between the side guides 63 to station B. At station B, groups of envelopes of predetermined size are successively moved laterally from the column of sequentially arranged envelopes and delivered by conveyor means to a banding machine at station C. The groups of envelopes are automatically banded at station C and moved forwardly between the guides 70 by successive groups of envelopes pushed therealong.

As the envelopes are delivered at station A from the

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envelope-making machine, a reciprocating arm 16 reaches laterally inward toward the column of envelopes and by suction takes hold of certain of the envelopes as they are presented at the column of envelopes by the envelope-making machine. This arm pulls those envelopes laterally outward so that they protrude from the column.

In the illustration of my invention, the envelopes are being banded in groups of seven, that is, wherein there are seven envelopes in each group. In such a case, according to the preferred embodiment of my invention, every seventh envelope presented at station A by the envelope-making machine is moved laterally outward. This seventh envelope is the final or last envelope in the group of seven as it is delivered to the banding machine.

However, by a suitable rearrangement of parts, the partially withdrawn envelope, that is, the seventh envelope, may be the initial or first envelope of the group of envelopes delivered to the banding machine. The phrase "terminal envelope," or "terminal article," will be understood to include either the final envelope of the group or the initial envelope of the group, as for example, the top or bottom envelope of a group of envelopes horizontally disposed. However, in the illustration shown, the envelopes that are partially withdrawn from the column of envelopes are the seventh envelope, which is the final envelope of the group with which the invention is illustrated. The seventh or final envelope of each group is denoted by the reference character 71 and the other envelopes are denoted by the reference character 72.

Upon arrival of the steadily advancing column of envelopes 71 and 72 to station B, the protruding portion of each final envelope 71 as it arrives at station B is pulled to one side by a reciprocating vacuum device 25. This flexes the seventh envelope 71 in a longitudinal direction and also flexes the other six envelopes which precede that particular final envelope 71. This flexing forwardly of the seven envelopes by pulling on the seventh envelope with the vacuum device 25 permits the reciprocating arm 30 to be inserted between the flexed envelope 71 and the first envelope of the next succeeding group, as shown in the drawing. A roller 30a carried on arm 30 rollingly engages flexed envelope 71 and forces the separated group of envelopes against roller 36. A reciprocating arm 29 moves the vacuum device 25 forwardly and at the same time the envelopes being advanced in the column by the belt 62 are urged toward the continuously rotating roller 36.

By reason of the direction of rotation of the roller 36 frictionally engaged by the first of the group of envelopes, the group of envelopes so separated by the arm 30 from the column is moved laterally outward from the column toward station C. The envelopes are supported on a supporting surface while traveling toward station C, this supporting surface being partially shown at 66. The group of envelopes so moved out from the column at station B is pressed against feed rollers 37, of which there are four arranged in series on one side of the path for the envelopes. Feed rollers 38, of which there are three in number, on the other side of the path press the group of envelopes as they move in succession from station B toward the rollers 37. The first two rollers 38 in the series are spring-biased and move inwardly toward opposed rollers 37. After each group of envelopes is moved along to where it enters between the opposed rollers 37 and 38 to permit the arriving group of envelopes to enter between the opposed rollers, the first two rollers 38 of the series periodically move to accommodate the group of envelopes being passed to the series of feed rollers from the mechanism at station B. The third roller 38 in the series is spring-biased to press the group of envelopes against the third feed roller 37 in the series.

An endless chain 64 shown diagrammatically in the drawing, carries thereon a lug 65 which moves around as the endless chain 64 revolves. This lug 65 presses against the trailing edge of the group of envelopes as it is pressed by the third pair of rollers 37 and 38 and this evens up all of the seven envelopes in the group. After being so evened up, then the seventh or final envelope no longer protrudes forwardly from the other six envelopes of the group. The group of evenly arranged envelopes now moves on the supporting surface 66 to between the fourth roller 37 of the series and a caliper roller 41. The function of the caliper roller 41 and the mechanism connected therewith is to determine whether the group has the correct number of envelopes, in this case seven envelopes. If there are too many or not enough envelopes in the group, then the mechanism by-passes that group so that it does not travel forward to the banding machine.

The evenly arranged groups of envelopes of uniform size now move forwardly on the supporting surface 66 and are engaged by the endless flat belt 67 which engages the flat side of the group. The successive groups of envelopes pass between the flat belt 67 and the spring-biased rollers 68 to where they arrive at station C. At station C a reciprocating pusher 52 pushes the successively arriving groups of envelopes forwardly to the banding machine where they are sequentially banded by the machine and carried along between the guides 70. The actuating linkage 69 of the apparatus actuates the pusher 52.

The movement of the several parts is synchronized so that each operation occurs at the proper intervals and in accordance with the over-all operation of the machine. The detailed circuit and mechanical details are next described.

The envelope-making machine which presents the finished articles at station A drives an eccentric driven ratchet pawl 1. The rate of operation of this ratchet pawl 1 is therefore synchronized with the speed of the envelope-making machine. The ratchet pawl 1 rotates a ratchet wheel 2 which has one tooth per revolution of the envelope-making machine. The number of teeth on the ratchet wheel depends on the predetermined number of envelopes to be grouped and to be banded. In the illustration of the invention here given, there are seven envelopes being put in each group for banding. Because of size and tooth formation, the ratchet wheel 2 has 21 teeth. A round counting plate 3 is driven by the ratchet wheel 2 so as to move at the same speed as the ratchet wheel 2. This counting plate 3 has three projecting pins equally spaced to represent seven teeth of the ratchet wheel 2 or the seven envelopes being counted or grouped. The operation will be described in connection with the engagement of projecting pin 4 (one of the three pins) with the arm of a normally open microswitch 5 and the depression of that arm. As the arm of the microswitch 5 is about to be depressed, cam device 6 opens the normally closed microswitch 7, blocking the ground circuit.

At this point, pin 4 depresses the arm of normally open microswitch 5, closing the ground circuit and energizing the coil of normally open relay 8 and closing the contact points. Although as pin 4 holds microswitch 5 closed for only a fraction of a revolution, cam 6 will hold microswitch 7 open to give enough time to complete the cycle. While cam 6 is holding relay 8 contacts closed, cam 9, timed with the envelope-making machine delivery arm, closes the normally open microswitch 10 to complete the circuit and energize the coil of normally open relay 11. This closes the contact and completes the electrical circuit which energizes solenoid 12, and opens solenoid-operated valve 13. This allows air to be drawn from atmosphere through the sucker or vacuum device 14, creating a vacuum when the sucker 14 is in close contact with an envelope. When the solenoid 12 is energized, it pulls latch 15 from spring-loaded arm 16, allowing it to advance to an envelope pick-up position. Spring 16a re-

siliently urges the arm 16 toward the column of envelopes at station A. A relay 17 and relay 11 are energized at the same time.

The arm 16 carrying the sucker 14 stays in envelope pick-up position for one revolution, at which time the next succeeding pin, denoted by the reference character 18, has advanced enough to depress the arm of the normally open microswitch 19 to close the circuit and energize the coil of normally open relay 20. The relay 20 is energized to close its contacts and complete the electrical circuit, which energizes the solenoid 21, pivoting roller 22 against the arm 16 which then presses against continuously rotating roller 23, the pivoting roller 22 moves back away from envelope delivery until spring-loaded arm 16 depresses normally closed microswitch 24 to break the circuit to relays 20 and 11. This releases the pressure roller 22 and allows latch 15 to snap upward to hold the arm 16 from traveling forward before the correct count of envelopes, seven envelopes in this case, has been delivered. At this moment when relays 20 and 11 have been inactivated, the pin 18 has passed by the arm of normally open microswitch 19, breaking the circuit to relay 17.

Cams 6 and 9 rotate one revolution at each revolution of the envelope-making machine, but this does not energize relay 8 until pin 4 on the counting plate 3 closes the normally open microswitch 5. Relay 8 is inactivated when cam 9 opens normally open microswitch 10.

The envelopes are now advanced in the column toward station B with the seventh envelope of each group of seven envelopes partially protruding from the column. At station B, the final or seventh envelope of each group successively come in contact with the sucker or vacuum device 25. This sucker 25 creates a vacuum between the contacted envelope and the sucker. Cam 26 is timed to allow air to enter the chamber of the sucker and draw air from the atmosphere through the nozzle of the sucker by means of valve 27. When the sucker nozzle is closed off by an envelope, the air is drawn from cylinder 28 through the hollow camshaft drawing the sucker back. A flexible connection permits the reciprocation of the sucker nozzle. Upon the movement of the seventh envelope as drawn by the sucker, this seventh envelope and the others preceding it are flexed to create an intervening space and this allows the cam-operated arm 75 to enter between the seventh or final envelope being flexed aside and the first envelope of the next succeeding group of envelopes.

When the sucker is almost to its withdrawn position, cam-operated arm 75 positively pushes the sucker back to its full stroke, depressing normally open microswitch 31 to complete the circuit and energize the coil of relay 32. This closes the normally open relay to electrically energize the solenoid 33 holding the latch 34 and engaging the clutch 35 on the envelope banding machine. At this point, a normally closed microswitch 36-a is opened, holding relay 32 closed and keeping solenoid 33 energized. The cam operating the microswitch 36-a is carried by a camshaft 61 constantly driven by the envelope-making machine and in synchrony therewith. If the envelopes are not conveyed to station B, the sucker 25 will move forward as before but, since there are no envelopes there, the air drawn from the vacuum pump will escape through the sucker nozzle and it remains there until envelopes arrive in the correct position. Inasmuch as most of the air escapes through the sucker nozzle, there is not enough vacuum pressure to withdraw or move back the sucker. Cam-operated arm 75 continues to operate but by-passes sucker 25 when said sucker is out of position. This will keep sucker 25 in correct time or sequence when the envelopes begin feeding correctly and arrive at station B. Toggle switch 39 controls the circuit to limit switch 31 and toggle switch 40 controls the circuit to limit switch 36-a.

The arm 30 with roller 30a extends into the space between the separated envelopes and presses the seven

envelopes against the continuously rotating roller 36 which feeds them out laterally from the column and between the series of feed rollers 37 and 38. When the envelopes reach the last feed roller 37 of the series, they are calipered by roller 41. If one or more envelopes are missing from the collection of envelopes delivered to that point, normally open microswitch 42 is held closed and cam-operated normally open microswitch 43 is held closed, completing the circuit through the toggle switch 44 lighting the detector light bulb 45 and energizing relay coil 46 to close its contacts.

The cam-operated normally closed microswitch 47 holds relay 46 closed, giving the group of envelopes time to travel toward the banding machine at station C by means of the conveyor chain 67. Just as the cam carried by shaft 61 is about to open the microswitch 47, breaking the circuit to relay 46, the cam closes normally open microswitch 48, holding the relay 46 closed another cycle and giving the envelopes more traveling time. At the same time that the microswitch 48 is closed, holding the relay 46 closed, relay 49 is also energized, thus completing the electrical circuit to solenoid 50. The solenoid 50 pulls an arm 51 forward when the envelope pusher 52 at the banding machine is in its forward position, shown in broken lines, at station C.

As the arm 51 is pulled forward, cam arm 53 opens the normally closed microswitch 54, which breaks the electrical circuit and opens relay 49. At the same time, a lug 55 on the linkage 69, which operates the pusher 52 by the cam 56, pushes against the arm 51 to hold it there until the cam 56 revolves enough to release the arm 51 to normal position, the cam 56 being revolved by the machine and in synchrony therewith. Inasmuch as envelope pusher 52 cannot return to its normal back position when the lug 55 holds the arm 51, the group of envelopes at that point having one or more under the required number, in this case, seven in number, will pass behind the pusher 52 and will not be banded at station C.

When a group of envelopes being calipered has one or more envelopes in excess of the amount required, such as seven in this case, the normally open microswitch 57 starts the same sequence of operation on microswitches 47 and 48, relay 49, solenoid 50 and microswitch 54 by using the toggle switch 58, detector light bulb 59, and relay 60. The result of either too many or not enough envelopes in a group being delivered to station C will be the discharge of that group behind the envelope pusher 52 rather than in front of the envelope pusher 52 where the standard sized groups are delivered. If the number of envelopes delivered is correct, then the calipering roller 41 has no effect on the envelopes delivered to the banding position at station C and are there banded by the banding machine.

Groups of envelopes having different numbers of envelopes therein may be obtained as desired. Replacement of the ratchet wheel 2 and the round counting plate 3 with substitute ratchet wheels and counting plates of appropriate design, will provide for other multiples of envelopes to be grouped. Other flat articles may be similarly grouped, although an important use of the invention is obtained in the grouping of envelopes into collections of required numbers for the purpose of banding or other packing operation.

The present disclosure includes that contained in the appended claims, as well as that of the foregoing description.

Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combinations and arrangement of parts may be resorted to without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. Apparatus for grouping envelopes delivered in sequence from an envelope-making machine into groups of a predetermined plurality of envelopes arranged side-by-side and delivery to a packing mechanism in such groups, comprising the combination of first suction means at a first station for partially withdrawing from said sequence of envelopes to protrude from the sequence of envelopes the final envelope of each said plurality of envelopes, first advancing means for advancing said envelopes in a column and in side-by-side sequence with a portion of each of said final envelopes protruding from the advancing column of envelopes, and separating means at a second station spaced along said column from said first station for separating said column of envelopes into successive of said groups of envelopes, said separating means including second suction means for deflecting the protruding portion of each said final envelope arriving at said second station, dividing means for entering said column between said final envelope and the initial envelope of the next succeeding group while the protruded portion of the final envelope is deflected to divide the column into successive groups divided from the other envelopes, and second advancing means successively engaging each group divided at said second station and advancing the divided group laterally of the column to said packing mechanism.

2. Apparatus for grouping envelopes delivered in sequence from an envelope-making machine into groups of a predetermined plurality of envelopes arranged side-by-side and delivery to packing mechanism in such groups, comprising the combination of first means for partially withdrawing from said sequence of envelopes to protrude from the sequence of envelopes an envelope that is a terminal envelope of each said plurality of envelopes, second means for sequentially advancing envelopes in a column and arranged side-by-side with said terminal envelopes protruding from the column, third means for sequentially flexing and holding the protruding terminal envelope in a direction longitudinal of the column, fourth means for extending between the flexed terminal envelope of one group and the adjacent terminal envelope of the next succeeding group to separate the said one group from the column, and fifth means for moving the separated one group laterally out from the column of envelopes.

3. Apparatus for separating into groups of predetermined number each, flat flexible articles presented side-by-side in sequence, comprising first means for partially laterally withdrawing from the sequence a terminal article of each group to be separated, second means for advancing the articles in a column with said partially withdrawn articles protruding from the column, third means for moving longitudinally of the column successive of the respective protruding portion of the partially withdrawn articles to provide a space intervening between the pulled article and the adjoining article of the adjacent group, fourth means for entering the said intervening space to press forwardly the group of envelopes preceding the fourth means, and fifth means moving the forwardly pressed group laterally outward of the column.

4. Apparatus for separating into groups of predetermined number each, a plurality of flat flexible articles presented side-by-side in a sequence, comprising withdrawing means for partially withdrawing outwardly from the said sequence of articles to protrude therefrom a terminal article of the group of predetermined number to be separated, advancing means for advancing said sequence of articles having said terminal articles protruding therefrom, flexing means for flexing the successively protruding articles in a direction away from the neighboring article of an adjacent group to provide a space therebetween, and feeding means for laterally feeding the group in advance of said space laterally away from said sequence of articles.

5. Apparatus for separating into groups of predeter-

mined number each of a plurality of flat flexible articles presented side-by-side in a sequence, comprising withdrawing means for partially withdrawing outwardly from the said sequence of articles to protrude therefrom a final article of the group of predetermined number to be separated as said final article is presented to the apparatus, advancing means for advancing the sequence of articles forwardly in a column with said final articles successively protruding from said column, flexing means for flexing in a direction forwardly of said column the successive protruding articles to provide a space between the flexed article and the initial article of the next succeeding group of articles, intervening means for extending into said provided space and separating the articles in advance of the final article being flexed from succeeding articles in said column, and revolving feed means for feeding in a group the separated articles laterally away from said column of articles.

6. Mechanism for supplying envelopes from a first machine presenting the envelopes in succession of envelopes in side-by-side and column arrangement to a second machine for packing of the envelopes in groups of a predetermined plurality of envelopes, comprising a first reciprocal sucker for engaging by vacuum certain of said envelopes presented by the first machine and moving the same partially laterally outward from said column, means synchronizing the movement of the reciprocal sucker with the rate of presentation of envelopes by said first machine to provide that the certain said envelopes moved by the reciprocal sucker are the final envelopes of the successive groups of a predetermined plurality, advancing means for advancing forwardly the column of envelopes with said final envelopes protruding laterally outward from the column, a second reciprocal sucker for successively engaging by vacuum the protruding portion of the said final envelopes and moving the same forward to flex the moved envelopes forwardly away from the succeeding envelopes in said column, a rotating roller in advance of said column, a separating arm movable at intervals to between the forwardly moved final envelope and the next succeeding envelope in said column and arranged to press the envelopes in the group in advance of the separating arm against said rotating roller whereby the said group is moved laterally outward from said column, and feed means for moving the envelopes in said groups from said roller to said second machine.

7. Mechanism for supplying envelopes from a first machine presenting the envelopes in succession of envelopes in side-by-side and column arrangement to a second machine for packing of the envelopes in groups of a predetermined plurality of envelopes, comprising a first reciprocal sucker for engaging by vacuum certain of said envelopes presented by the first machine and moving the same partially laterally outward from said column, means synchronizing the movement of the reciprocal sucker with the rate of presentation of envelopes by said first machine to provide that the certain said envelopes moved by the reciprocal sucker are the final envelopes of the successive groups of a predetermined plurality, advancing means for advancing forwardly the column of envelopes with said final envelopes protruding laterally outward from the column, a second reciprocal sucker for successively engaging by vacuum the protruding portion of the said final envelopes and moving the same forward to flex the moved envelopes forwardly away from the succeeding envelopes in said column, a rotating roller in advance of said column, a separating arm movable at intervals to between the forwardly moved final envelope and the next succeeding envelope in said column and arranged to press the envelopes in the group in advance of the separating arm against said rotating roller whereby the said group is moved laterally outward from said column, feed means for moving the envelopes in said groups from said roller to said second machine, and calipering means for determining the number of envelopes in each group moved by

the feed means and for by-passing therefrom collections of envelopes not corresponding in number to the said predetermined plurality.

8. Mechanism for supplying envelopes from a first machine presenting the envelopes in succession of envelopes in side-by-side and column arrangement to a second machine for packing of the envelopes in groups of a predetermined plurality of envelopes, comprising a first reciprocal sucker for engaging by vacuum certain of said envelopes presented by the first machine and moving the same partially laterally outward from said column, means synchronizing the movement of the reciprocal sucker with the rate of presentation of envelopes by said first machine to provide that the certain said envelopes moved by the reciprocal sucker are the final envelopes of the successive groups of a predetermined plurality, advancing means for advancing forwardly the column of envelopes with said final envelopes protruding laterally outward from the column, a second reciprocal sucker for successively engaging by vacuum the protruding portion of the said final envelopes and moving the same forward to flex the moved envelopes forwardly away from the succeeding envelopes in said column, a rotating roller in advance of said column, a separating arm movable at intervals to between the forwardly moved final envelope and the next succeeding envelope in said column and arranged to press the envelopes in the group in advance of the separating arm against said rotating roller whereby the said group is moved laterally outward from said column, feed means for moving the envelopes in said groups from said roller to said second machine, and evening means disposed along said feed means for evening the edges of the envelopes in each group being fed thereby to deliver to said second machine the group with the final envelope no longer protruding from the other envelopes of the same group.

9. Mechanism for supplying envelopes from a first machine presenting the envelopes in succession of envelopes in side-by-side and column arrangement to a second machine for packing of the envelopes in groups of a predetermined plurality of envelopes, comprising a first reciprocal sucker for engaging by vacuum certain of said envelopes presented by the first machine and moving the same partially laterally outward from said column, means synchronizing the movement of the reciprocal sucker with the rate of presentation of envelopes by said first machine to provide that the certain said envelopes moved by the reciprocal sucker are the final envelopes of the successive groups of a predetermined plurality, advancing means for advancing forwardly the column of envelopes with said final envelopes protruding laterally outward from the column, a second reciprocal sucker for successively engaging by vacuum the protruding portion of the said final envelopes and moving the same forward to flex the moved envelopes forwardly away from the succeeding envelopes in said column, a rotating roller in advance of said column, a separating arm movable at intervals to between the forwardly moved final envelope and the next succeeding envelope in said column and arranged to press the envelopes in the group in advance of the separating arm against said rotating roller whereby the said group is moved laterally outward from said column, feed means for moving the envelopes in said groups from said roller to said second machine, calipering means for determining the number of envelopes in each group moved by the feed means and for by-passing therefrom collections of envelopes not corresponding in number to the said predetermined plurality, and evening means disposed along said feed means for evening the edges of the envelopes in each group being fed thereby to deliver to said second machine the group with the final envelope no longer protruding from the other envelopes of the same group.

10. Apparatus comprising the combination of means for laterally shifting a terminal envelope of successive groups of predetermined plurality each, means for successively advancing said groups of envelopes in side-by-

side relationship, means for flexing the laterally shifted envelopes away from a next adjacent envelope to provide an intervening space between the ends of the laterally shifted envelope and said next adjacent envelope, means for entering said space and separating the envelopes in advance of the space from the next succeeding envelope, and means for laterally moving the said separated envelopes in a group away from the succeeding envelopes.

11. Apparatus comprising the combination of means for laterally shifting a terminal envelope of successive groups of predetermined plurality each, means for successively advancing said groups of envelopes in side-by-side relationship, means for flexing the laterally shifted envelopes away from a next adjacent envelope to provide an intervening space between the ends of the laterally shifted envelope and the next adjacent envelope, means for entering said space and separating the envelopes in advance of the space from the next succeeding envelope, means for laterally moving the said separated envelopes in a group away from the succeeding envelopes, and means for a calipering the said laterally moving envelopes to determine their correspondence in number with said predetermined plurality.

12. Apparatus comprising the combination of means for laterally shifting a terminal envelope of successive groups of predetermined plurality each, means for successively advancing said groups of envelopes in side-by-side relationship, means for flexing the laterally shifted envelopes away from a next adjacent envelope to provide an intervening space between the ends of the laterally shifted envelope and the next adjacent envelope, means for entering said space and separating the envelopes in advance of the space from the next succeeding envelope, means for laterally moving said separated envelopes in a group away from the succeeding envelopes, and means for synchronizing the means for the lateral shifting of terminal envelopes with the supplying of envelopes presented in sequence to the apparatus to predetermine the plurality of envelopes in the said groups.

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