

Feb. 7, 1961

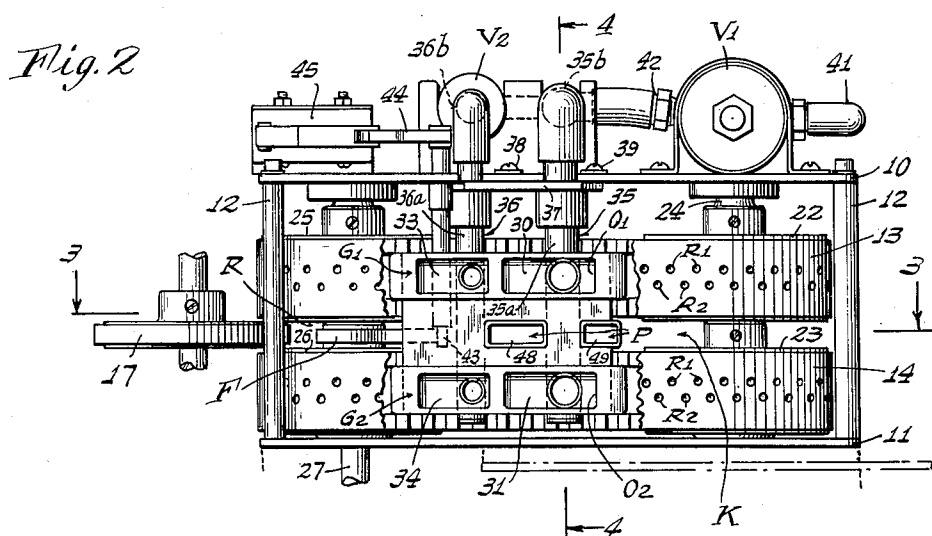
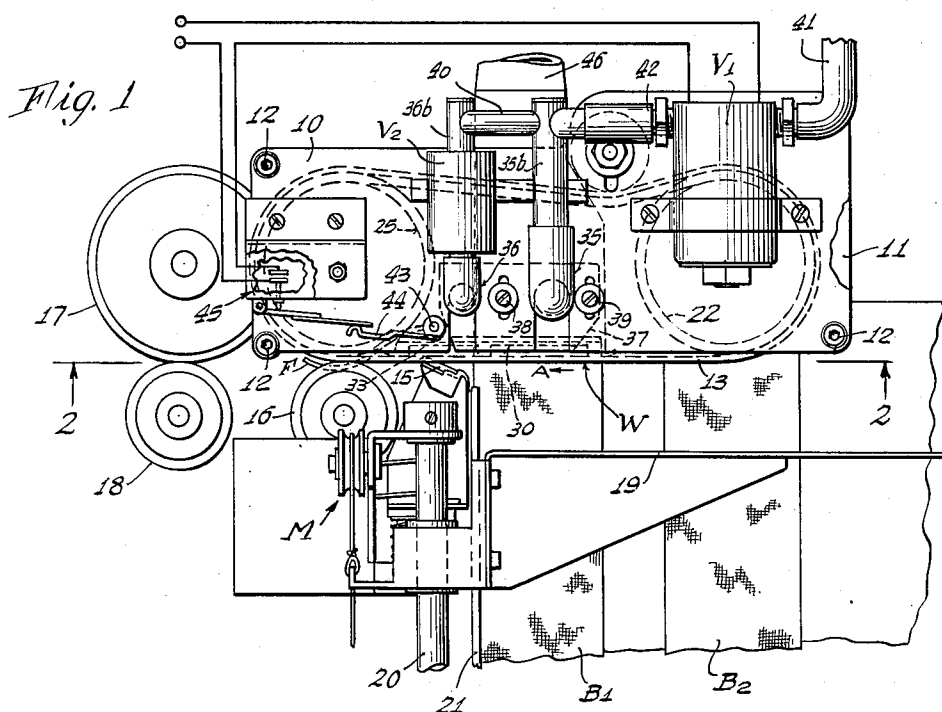
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2,970,834

LETTER FEEDING DEVICE

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4 Sheets-Sheet 1



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4 Sheets-Sheet 3

Fig. 5

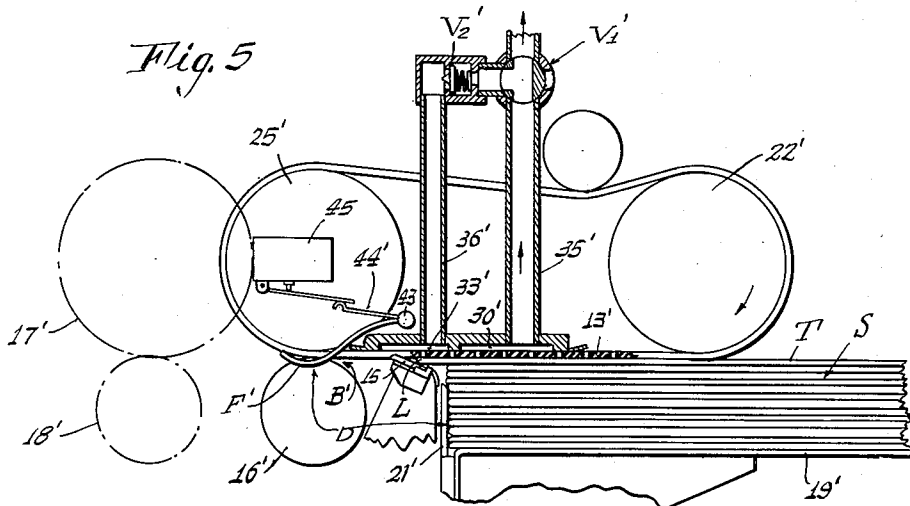


Fig. 6

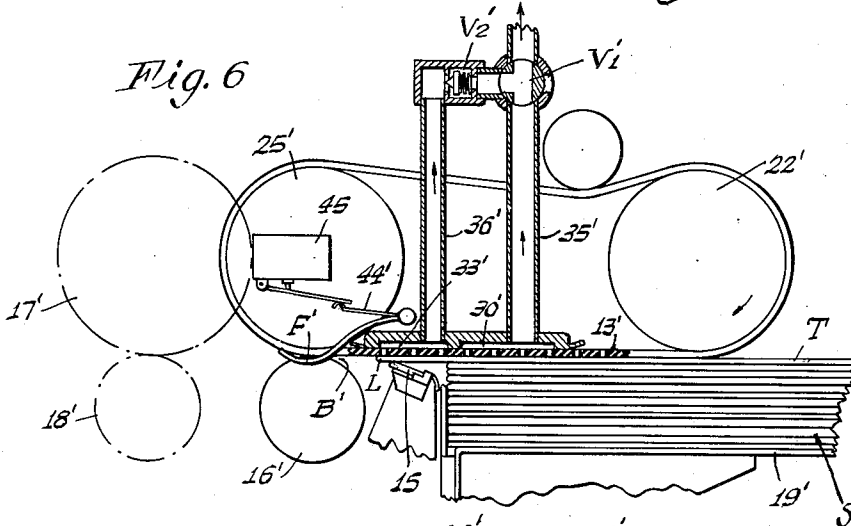
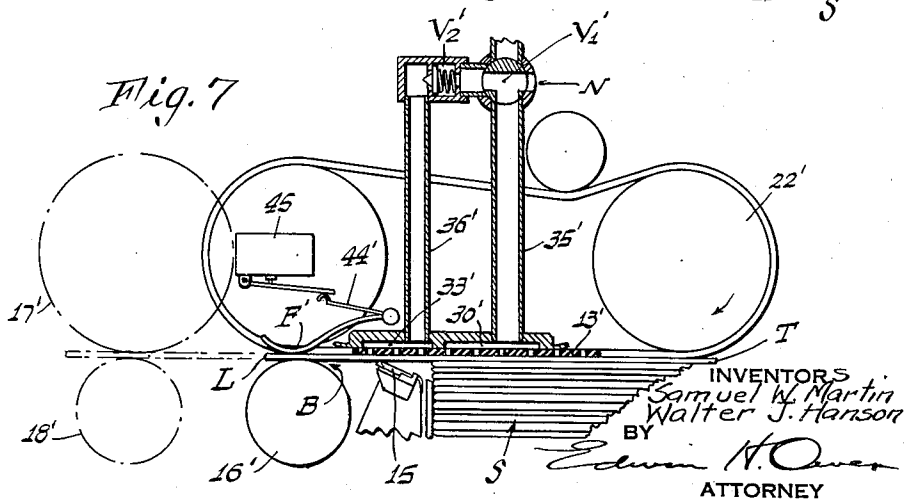


Fig. 7



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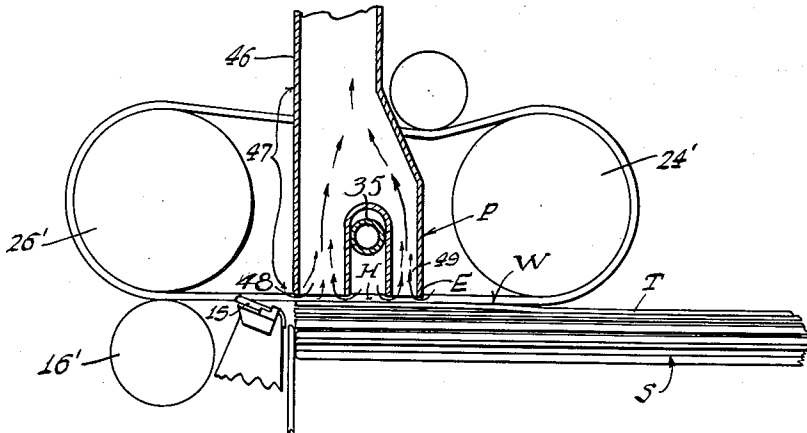
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4 Sheets-Sheet 4

Fig. 8



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LETTER FEEDING DEVICE

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4 Claims. (Cl. 271—26)

This invention relates to devices for feeding workpieces, such as letters, one at a time from a stack, and more particularly to the feeding of letters on which some operation is to be performed, such as by postage canceling mechanism.

An object of the present invention is to provide improved and simplified mechanism operable at high speed for feeding letters through a stack even though the letters in the stack have different lengths and different thicknesses and in such a way that the letters follow closely one after the other with substantially uniform spacing between them irrespective of their respective lengths.

Stated more particularly, the present invention provides means operative on the terminal letter of a stack of letters for causing the same to have feed engagement with a traveling belt means and to be carried thereby to and through a separating device and thence to feeding mechanism for advancing it to another mechanism for subsequent operations.

In common with prior devices for separating sheets and other similar articles, the device of the present invention removes one letter at a time from a stack and advances it to a stationary separator disposed near the delivery side of the stack and so arranged as to permit the advancing letter to pass beyond it while restraining the next adjacent letter from passing through.

According to the present invention, the arrangement is such that the traveling belt means maintains control on the leading portion of the letter being fed until it is past the separator and is in position to be engaged by subsequent letter handling or delivery devices. The letter is thus pulled through the separator which avoids the possibility of even a thin limp letter from crumpling when encountering the separator.

Since it is desired to advance one by one intermingled thick and thin letters, the separator is yieldingly mounted for more or less movement away from its normal position depending on the thickness of the particular letter which is to pass it. This being so, it is necessary that the means for feeding the letters off the stack should be effective on the terminal letter only.

Accordingly, the present invention provides improved feed mechanism for engaging and advancing only the terminal letter, the advancing means becoming inoperative with relation to the next letter until the first letter has passed through the separator.

In the form of the present invention disclosed herein as exemplary thereof, the mechanism for feeding the letters from a stack of letters comprises a pair of endless belts provided with one or more rows of apertures and arranged to become effective in providing a suction grip on the leading portion of the surface of the terminal letter during the initial advancement of a letter. The belts travel between the letter and vacuum chambers so that suction produced by the vacuum chambers causes the letter to be drawn to the belts to be advanced thereby at controlled intervals.

To assure that the terminal letter is maintained in close relation to the surfaces of the belts, an auxiliary vacuum chamber is provided between the belts. This auxiliary vacuum chamber is provided with a high velocity vacuum and produces suction over a wide area to draw the terminal letter close to the perforated belts.

In order to pull the leading portion of the letter past the separator, the feed belt is extended beyond the stack and beyond the separator and terminates close to the final feeding means. For the same reason, the vacuum means is extended beyond the stack and beyond the separator so that the leading portion of the letter is held to the belt until said leading portion has passed the separator. However, with this arrangement, the portion of the vacuum means which extends beyond the stack communicates with the atmosphere through the holes in the belt at the time it is desired to use the vacuum to attach the letter to the belt.

To avoid a bleed of the suction at the area exposed to the atmosphere, the vacuum chamber, according to the present invention, is divided into two sections, one section being located adjacent the stack and the other section being located forwardly of the stack. These two sections are so interconnected to the vacuum pump that vacuum is not applied to the leading section until the section adjacent the stack has caused the letter to adhere to the belt, thus covering or sealing off the apertures and causing pressure change in that chamber. As soon as this has occurred to a determinate extent, a pressure-responsive valve connecting that chamber with the forward chamber opens and permits air to be drawn from the forward chamber, thus causing the leading end of the letter which has passed beyond the stack to continue to adhere to the belt and be pulled forward and past the separator by the belt.

Provision is made for cutting off the vacuum as soon as the leading end of the letter reaches the bite of a pressure roller at the forward end of the belt. This is accomplished by providing a feeler in the path of the letter which operates a switch which in turn controls an electromagnetic valve for cutting off the vacuum to the vacuum chambers.

As soon as the trailing end of the letter has passed the switch-operating feeler, the electromagnetic valve is operated to make the vacuum effective again in the vacuum chamber which is adjacent the letter stack. This will cause the next letter to be taken from the stack, attached to the belts and fed forwardly.

It is the principal object of the invention therefore to provide vacuum belt operated letter feed means for advancing the terminal letter from a stack of letters and through a separator by an improved mechanism which will maintain a pulling action on the leading portion of the letter.

It is another object to provide a supplementary suction of high velocity vacuum which is operative over a broad area of the face of the terminal letter to draw the letter to the belt to thereby enhance the work of the vacuum belt in advancing the letter.

It is a further object to provide a primary suction chamber behind belt apertures adjacent the stack of letters to effect the initial advancement of a letter by drawing the forward end portion thereof to the belt and advancing same, and to provide a secondary suction chamber forward of the primary chamber to continue to draw the forward end of the letter to the belt and advance same past a separator element.

Another object is to provide a pressure control structure to cause the secondary suction chamber to become operative after the terminal letter is drawn to the belt by the primary suction chamber in a sealing off position.

Other features and advantages will hereinafter appear.

3

For purposes of illustration and explanation, the invention is shown in detail in its preferred form in the accompanying drawings, wherein:

Fig. 1 is a plan view of the letter feeding device embodying the improved suction means for the letter feeding belt, as well as improved control means therefor;

Fig. 2 is a vertical view of the device taken on line 2—2 of Fig. 1 showing more clearly the twin belt arrangement of this invention with parts of the belt broken away to expose the improved suction box arrangement associated with the belts, also showing the mouth end view of a novel interposed auxiliary letter suction device exerting a high velocity vacuum effective upon the workpiece;

Fig. 3 is a longitudinal section view of the device taken substantially along the line 3—3 of Fig. 2, showing the auxiliary high velocity vacuum device for initially drawing the terminal letter to the belt;

Fig. 4 is a cross section of the letter feeding device shown in Fig. 2, the section being taken substantially on line 4—4 of Fig. 2;

Figs. 5, 6 and 7 are diagrammatic renditions of the device as shown in Figs. 1 and 3, illustrating sequential phases of the letter feeding operation of the improved letter feeding device; and

Fig. 8 is a diagrammatic rendition of the structure of Fig. 3, illustrating the high velocity vacuum suction effect of the auxiliary suction device of this invention upon the terminal letter about to be advanced.

Referring to the accompanying drawings, the description involving Figs. 1 to 4 presents the structural details of a preferred embodiment of the improved letter feeding mechanism of this invention, and the description involving Figs. 5 to 8 presents the operation and function of this mechanism.

The letter feeding device as shown in Figs. 1 to 4, includes a frame structure comprising a pair of plates appearing in the top view of Fig. 1 as the top plate 10 and as the bottom plate 11 respectively, the plates being rigidly spaced and parallel with respect to one another by means of corner stay bolts 12. Between these plates operate a pair of endless suction belts 13 and 14 here shown to be identical, traveling synchronously and parallel to one another in a letter feeding direction indicated by an arrow A, the belts being effective to sequentially carry letters or other workpieces from a stack S past a separator 15 and to a pressure roller 16. The pressure roller 16 is cooperative with the suction belts at a position forwardly of the separator and in turn is effective to feed the letters into the grip of further advancing devices indicated by a pair of feed rollers 17 and 18. The larger feed roller 17 is the driving roller having a diameter such as to provide a peripheral speed equal to or greater than that of the suction belts. The stack of letters S is urged gently and in a rather loose formation toward the working face W of the suction belts by means of a pusher plate or bracket 19, aided by a pair of auxiliary feeder belts B₁ and B₂ with their working faces supporting the letters running toward and transversely of the working face W of the suction belts. The pusher plate 19 is guided by a rail structure 20 as well as by a wall 21 carrying the rail structure and in turn forming part of the frame structure of the device by being connected to the plates 10 and 11.

Conventional weighted mechanism indicated at M urges the pusher bracket 19 against the last letter in the stack, the coaction of the pusher bracket and auxiliary feeder belts B₁ and B₂ being effective to maintain the letters in a loosely stacked order while moving toward the working face W of the suction belts.

The suction belts 13 and 14 run over a rearward pair of sprockets 22 and 23 fixed upon an idler shaft 24 journaled in the frame plates 10 and 11. The forward end portion of the belt runs over a forward pair of

4

sprockets 25 and 26 fixed upon a driving shaft 27 equally journaled in the plates 10 and 11 of the frame.

The letter feeding suction belts which may be in the form of flexible rubber or the like have teeth 28 formed along their inner peripheries which interengage with corresponding sprocket teeth 29, so that both suction belts are thus driven synchronously and are free from slippage relative to one another and relative to the driving means. In the present embodiment each of the two suction belts is shown to have an identical arrangement of suction perforations, namely two rows R₁ and R₂ of suction holes through which suction is exerted upon the terminal letter T of the stack by means of the improved suction control means provided for by this invention and described below.

A longitudinal space K provided between the two parallel suction belts accommodates, according to the invention, not only an auxiliary high velocity vacuum letter suction device P, but in addition accommodates a feeler or monitor member F coextensive with the longitudinal direction of space K. The feeler member F is rockable to control, through mechanism described below, a vacuum connection to the belt suction means. The space K further accommodates, as in a recess R, a peripheral portion of the driving feed roller 17 aforementioned.

Improved belt suction means, effective through the perforations R₁ and R₂ of the suction belts, are provided at the inner face of the suction belts back of the working face W thereof. The suction means comprise a pair of primary suction boxes 30 and 31 for the respective suction belts, with their respective suction openings O₁ and O₂ facing the stack of letters in a location fairly close to the delivery side thereof.

According to the invention, there are additionally provided a pair of secondary suction boxes 33 and 34 structurally unitary with the respective primary suction boxes 30 and 31 in that the primary suction box 30 forms with the secondary suction box 33, a stationary suction glide shoe G₁, while the primary suction box 31 forms with the secondary suction box 34, a stationary suction glide shoe G₂. Both glide shoes G₁ and G₂ are in turn structurally interconnected to constitute a relatively rigid unit by means of a transverse primary suction header 35 and a secondary transverse suction header 36. Both transverse suction headers 35 and 36 in turn are rigidly interconnected by a bracket plate 37 fastened adjustably into the frame plate 10, as indicated by a pair of fastening screws 38 and 39. The primary suction header 35 consists of an inner vertical portion 35^a interconnecting the primary suction boxes 30 and 31, and an outer horizontal end portion 35^b extending at right angles from the inner end portion 35^a and outwardly of and parallel to the plate 10 of the frame. Similarly the secondary suction header 36, extending generally parallel to the primary suction header 35, comprises an inner vertical end portion 36^a interconnecting the secondary suction boxes 33 and 34, and an outer horizontal end portion 36^b disposed outwardly of and parallel to the plate 10 of the frame. The outer ends of the two parallel suction headers have between them a cross connection 40 whereby vacuum effect is applicable to both suction headers from a vacuum source or vacuum supply connection 41 via a solenoid-controlled valve V₁ connected to the suction headers as by a nipple 42 or other suitable connection. In addition, the outer end portion 36^b of the secondary suction header has interposed in it a pressure responsive spring-loaded valve unit V₂, both valve units V₁ and V₂ being functionally and diagrammatically illustrated in Figs. 5, 6, 7.

The solenoid-controlled valve unit V₁ is a three-way valve positionable as diagrammatically illustrated in Figs. 5, 6 and 7. In the Fig. 5 position the valve V₁ has the vacuum connected to the suction header 35, whereas in Fig. 7 the vacuum is shut off although communication is established between the header 35 and the atmosphere.

5

The function of the pressure responsive valve unit V_1 also appears from Figs. 5, 6, 7 showing the valve closed due to the spring loading in Fig. 5. When the terminal letter T is drawn to the belt 13 increased suction is effected in the header 35 to overcome the spring load and thereby open the valve V_2 sufficiently to effect suction in the secondary suction header 36 as in Fig. 6. This yielding of the spring of valve V_2 occurs as soon as the terminal letter seals off the suction holes in the area of the primary suction boxes 30 and 31. Hence, the suction in the header 36 will cause the lead end of the advancing letter to continue to be drawn to the belt surface after leaving the area of the primary suction boxes 30-31. This provides for the continued pulling action on the end of the letter while moving past the separator 15 and to the pressure roller 16.

The improved devices for controlling the suction for the belt according to this invention further comprise the feeler member or rockable finger F disposed in the path of the terminal letter T and actuated by the advancing movement of each letter. Each letter engages the finger F in a manner to interrupt the suction in the suction boxes as soon as the leading edge of the letter is gripped by the pressure roller 16. The vacuum supply remains disconnected until the trailing edge of each respective letter releases the feeler finger F, thereby allowing the suction to be restored on the belt at the area of the suction boxes 30, 31. In this way the spacing between the sequential letters is maintained constant.

In this suction control device, the feeler finger F is fixed upon the inner end of a rocker shaft 43 which extends transversely of one of the suction belts to penetrate and to protrude outwardly from the plate 10 of the frame. Fixed upon the outer end of this rocker shaft is an actuator arm 44 operating a switch 45 mounted accessibly upon the outside of plate 10 of the frame. The rocking of the feeler member F from the position of Fig. 5 to that of Fig. 7 will close the normally open switch 45 so as to energize the solenoid-controlled valve unit V_1 causing the valve to be moved from the active vacuum providing position of Fig. 5 to the inactive position of Fig. 7, which interrupts the vacuum connection of Fig. 5 while establishing communication with the atmosphere for the suction header 35.

The high velocity vacuum pick-up device P consists mainly of a separate vacuum duct 46 having a terminal portion 47 of flattened configuration such as to be accommodated within the longitudinal space K intervening the two suction belts 13 and 14. See Figs. 2, 3, 4 and 8. The flat terminal portion 47 in turn is formed with a pair of mouth portions 48 and 49 straddling the suction header 35, as is clearly shown in Fig. 3. In the operation of this pick-up device P (see Fig. 8) air is drawn into the mouth portions across the terminal edges E thereof at such a high velocity as to exert a continuous pulling effect upon the terminal letter T, sufficient to cause each terminal letter to be drawn individually and instantaneously from the loosely formed stack into operating contact with the working face W of the suction belts. In this way the working suction in the suction boxes becomes effective instantaneously and positively to draw the respective terminal letter of the stack tightly against the belt surface to advance the letter with the belt past the restraining separator 15 and into a driving relation with the subsequent advancing device. It will be understood that this high velocity vacuum pick-up effect is attained and maintainable continuously in the manner stated due to a narrow passage H effective between the terminal edges of the suction mouth portions 48, 49 and the face of the terminal letter T.

The letter feeding operation of this invention comprises a sequence of operating phases illustrated in the diagrammatic Figs. 5 to 8 in which parts corresponding to those of the structural Figs. 1 to 4 are designated by identical numerals but with the prime sign added for distinction.

6

In considering the operating phases of Figs. 5 to 7 it will be understood that the high velocity vacuum lift effect illustrated in Fig. 8 is exerted and maintained continuously throughout the feeding operation for the purpose of insuring prompt and instantaneous engagement of the respective terminal letters T with the suction belts, whereas the belt suction itself is maintained only periodically during the letter feeding operation, the period being only long enough to advance the terminal letter from the stack past the separator and into the grip of the pressure roller 16.

In the initial letter feeding phase of Fig. 5 the feeler finger F' is at rest allowing the switch 45 to be normally open thus keeping the solenoid-controlled valve unit V_1 de-energized and in position to provide vacuum connection to the suction header 35' and its suction box 30'. This condition causes the leading surface of the terminal letter T to be drawn tightly to and carried forward by the suction belts.

When the terminal letter is drawn to the belt, the suction holes of the belt in the area of the primary suction box 30' become sealed off thus rendering the vacuum in the header 35' effective to exert control over the spring valve V_2 to open said valve and effect suction in the header 36'. In this way the leading end portion of the letter is drawn to and pulled by the belt past the separator.

Accordingly, the letter feeding phase of Fig. 6 shows the leading edge L safely past the separator and headed toward and into the bite B' formed by the pressure roller 16' and the associated suction belts. In that phase the belt area opposite the secondary suction boxes 33', as well as that of the primary suction boxes 30' are sealed off by the advancing letter and continue so until the leading end of the letter engages and rocks the finger F' to the switch closing position of Fig. 7. The solenoid operated valve V_1 is thus energized to effect movement of the valve to the position of Fig. 7 where the vacuum supply is shut off and the headers 35' and 36' are open to the atmosphere.

The terminal letter is thus released from the suction grip of the belts and continues to be advanced by the coaction of the pressure roller 16' with the delivery end portion of the belts, and into the grip of the subsequent feed rollers 17' and 18', that position of the letter being indicated in dot and dash lines in Fig. 7. Thereupon, the trailing end of the letter in passing from the grip of the pressure roller 16' releases the feeler finger F' to the position shown in Fig. 5, thereby automatically effecting the opening of the switch 45' and thus again establishing the vacuum suction in the primary suction box 30'.

While in order to comply with the statute the invention is described in language which is rather specific as to structural features and arrangements, it is to be understood that the invention is not limited to the specific details shown, but that the means and method herein disclosed comprises the preferred of several modes of putting the invention into effect, and the invention is therefore claimed in any of its forms or modifications within the scope of the language employed in the appended claims.

What is claimed is:

1. A device for separating and feeding letters sequentially from a stack thereof with the terminal letter of the stack adapted to be engaged by the face of endless traveling perforated suction belt means to be carried thereby sideways from the stack past a separator cooperative with the belt at the delivery side of the stack with stationary suction means for the belt means provided at the inner face of the belt operable to cause suction engagement of the letters from the stack by the belt, and control means for said suction means to provide substantially constant distance between trailing and leading edges of adjacent letters of the sequence, said suction means comprising a primary suction box facing the stack

and operable to adhere the terminal letters to the belt by suction, a secondary suction box cooperative with the primary suction box and with the belt and disposed forwardly beyond the stack; additional suction control means operable to maintain suction effective in said primary suction box to engage the terminal letter at the beginning of a letter feeding operation then render suction effective in the secondary suction box coincident with the leading end portion of the letter being carried forward towards the separator whereby the leading end portion is held under the control of the belt until past the separator.

2. The device according to claim 1, in which the suction control means for the belt comprises a conduit connection between said suction boxes, and a spring-loaded valve interposed in said connection with the spring loading balanced to yield to a pressure differential between the said suction boxes to allow air to be drawn through the valve from the secondary suction box causing the letter to also adhere to the belt in the area associated with the separator.

3. The device according to claim 1, with the addition of a pressure roller cooperative with the belt forwardly of the separator and presenting with the belt a bite adapted to grip and advance the leading end portion of the letter emerging from the separator, with monitor means provided for controlling the suction to the suction boxes comprising a feeler member mounted in the path of and controlled by the advancing workpiece, an electric switch actuated by the feeler member, a three-way valve movable to positions rendering the suction boxes effective and ineffective respectively as to suction, solenoid means operable to move the valve to said respective positions, and electric circuit means operatively connecting said switch with said solenoid means whereby the feeler member is effective to disconnect the vacuum substantially when said leading edge is gripped in said bite and to reconnect the vacuum substantially when the trailing edge portion of the workpiece releases the feeler member.

4. A device for separating and feeding workpieces sequentially from a stack, which comprises a pair of endless traveling perforated suction belts disposed side by side and laterally spaced from one another jointly to engage and carry letters sequentially off the stack, a separator cooperative with the belts at the delivery side of the stack in a manner restraining the advancement of the belt of all but the terminal piece, stationary belt suction means provided at the inner face of the belt operable to cause suction engagement of the pieces from the stack by the belt, a pressure roller cooperative with the belt forwardly of the separator and presenting with the belt a bite adapted to grip and advance the leading end portion of the workpiece emerging from the separator, monitor means for controlling the vacuum connection to the belt suction means comprising a feeler member rockably mounted in the path of the workpiece and disposed substantially within the space between the belts and longitudinally co-extensive therewith, a rocker shaft carrying said feeler member and extending transversely of one of said suction belts to the outer side thereof, an electric switch, an actuator carried by the outer end of the rocker shaft effective to operate the switch by said feeler member rocking the shaft, electrically controlled valve means operated by the switch to disconnect the suction means coincident with said leading portion rocking the feeler member and the shaft and to reconnect the suction responsive to the trailing end portion of the workpiece releasing the feeler member.

References Cited in the file of this patent

UNITED STATES PATENTS

604,892	Blaisdell	May 31, 1898
1,136,960	Ielfield	Apr. 27, 1915
1,744,814	Swart et al.	Jan. 28, 1930
2,005,079	Ehlig	June 18, 1935
2,837,333	Sindzinski	June 3, 1958
2,856,187	Burckhardt et al.	Oct. 14, 1958