

[54] **OPEN TYPE STACKING DEVICE**

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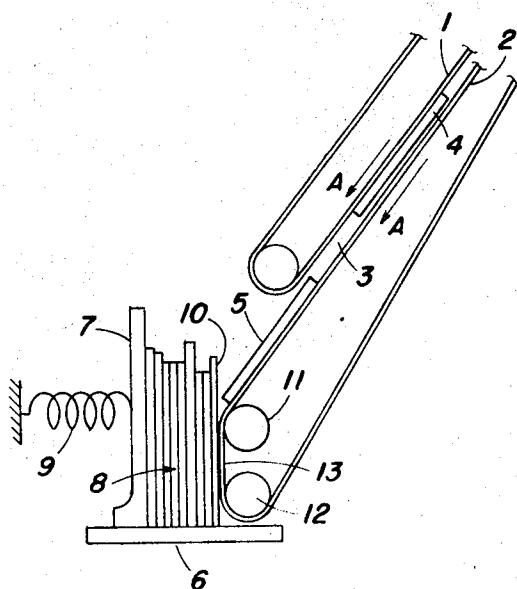
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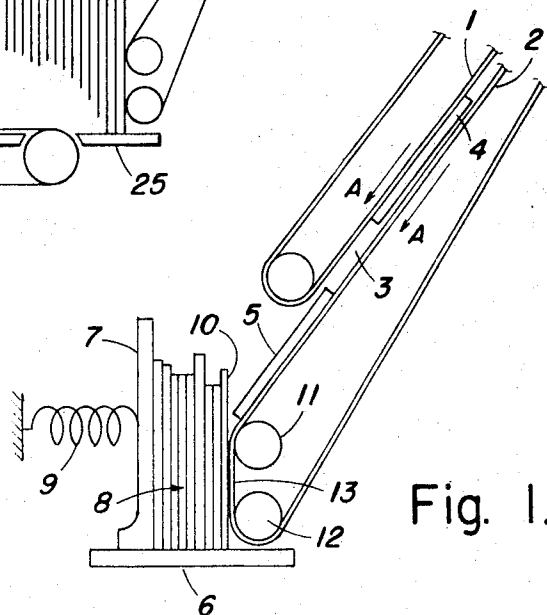
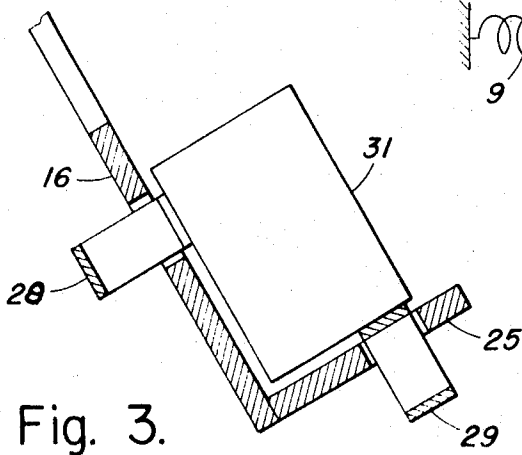
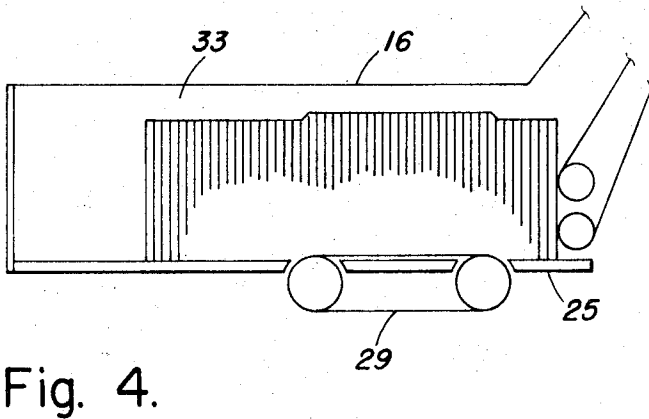
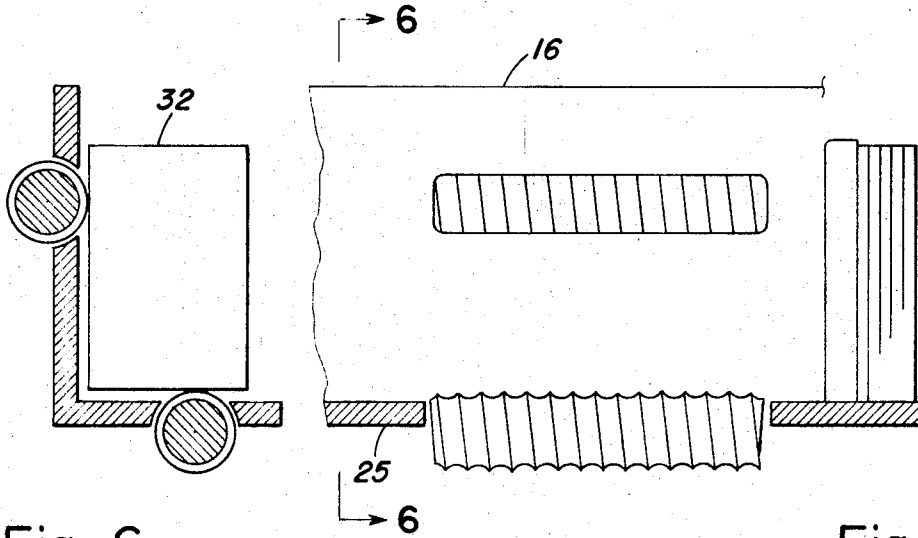
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[57] **ABSTRACT**

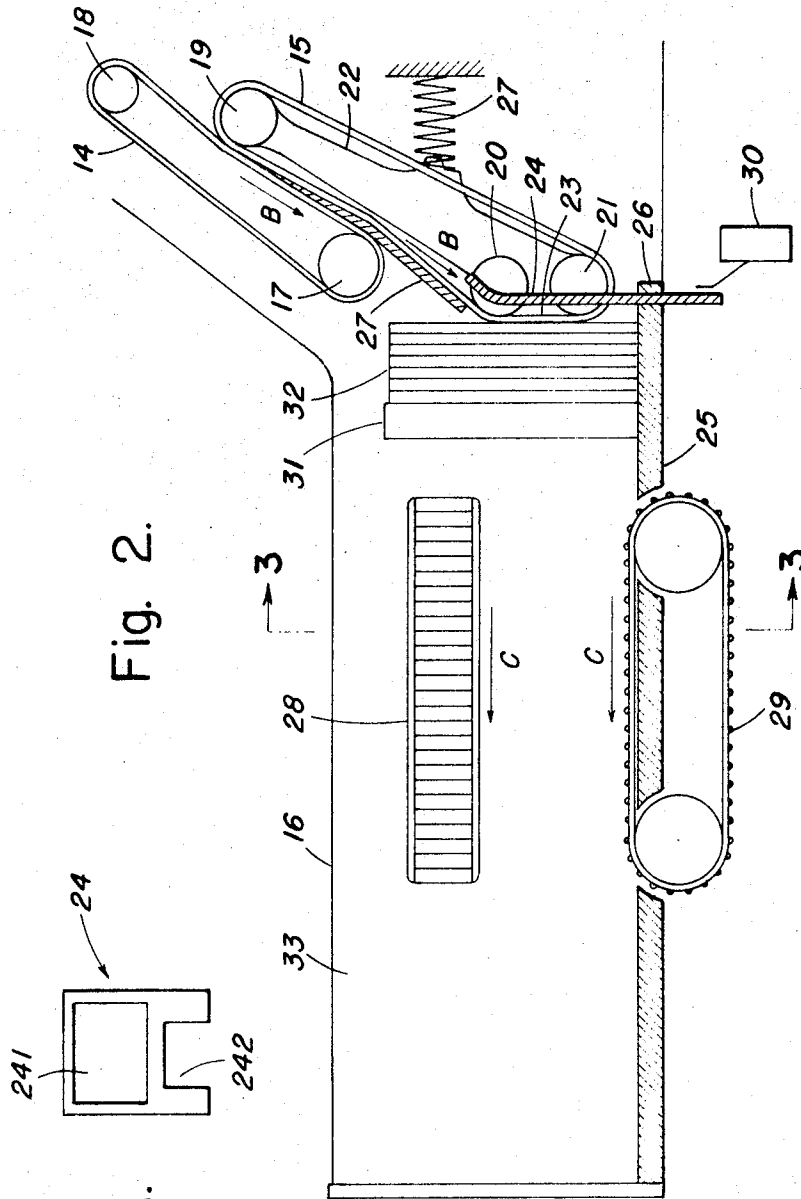
A stacking device, which automatically stacks letters, postcards or the like sequentially transported thereto, includes first and second channels for accomodating the letters and conveyor means interposed between said first and second channels for conveying stacked letters from said first channel to said second channel. The respective first and second channels are formed into a V-shape and the conveyor means are arranged in two adjacent planes which are formed into a corresponding V-shape, whereby the adjacent two sides of each of the stacked letters are supported within said channels and on said channels and on said adjacent two planes such that each letter is positioned to be in and maintain its correct orientation. The stacking operation of the sequentially transported letters is executed at the first channel and a removal operation of stacked letters may be performed at the second channel such that both operations may be performed independently of each other.

13 Claims, 7 Drawing Figures





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OPEN TYPE STACKING DEVICE

BACKGROUND OF THE INVENTION:

This invention relates to an automated mail machine, more generally to a business machine for automatically conveying and stacking letters and postcards, and more specifically to a device for continuously and automatically stacking pieces of mail such as letters, postcards and the like, which are transported thereto. The objective pieces of mail such as letters and postcards to be handled in this device are hereinafter referred to as pieces of mail and, at times are denoted as "letters" or "letter-like". The conveying path in a typical prior art machine or device wherein the letters are faced, cancelled, or automatically sorted is, in most of the cases, made in such manner that the letters are interposed between confronting belts and conveyed to further operating means disposed at the terminating end of the conveying path. There are various types of automatic stacking devices that have heretofore been provided at the terminating end of the conveying path, and a typical example has a construction as shown in FIG. 1 of the accompanying drawing.

Before the detailed description of the present invention is presented, the operation of a conventional prior art stacking device and its attendant disadvantages will be briefly explained. The desirable features of the present invention will become readily apparent once the prior art is understood. Accordingly, to facilitate such an understanding, reference is made at this point to FIG. 1 which is a representative diagram of a conventional stacking device.

Referring to FIG. 1, conveyor belts 1 and 2 are driven in an obliquely downward direction as indicated by the arrows A and form a conveying path 3 therebetween. The letter-like materials 4 and 5 are guided through the conveying path 3 between the belts 1 and 2, and conveyed in the arrowed direction A.

The stacking portion of the device comprises a blocking plate 6, a supporting plate 7 freely movable in the lateral direction, a spring 9 disposed for applying a suitable supporting force or a depressing force to the stacked letters 8 through the supporting plate 7, and rollers 11, 12 located at the terminating end of the conveying belt 2. A letter 5 conveyed by the conveyor belts 1 and 2 arrives at the stacking portion to obliquely abut a previously arrived letter 10 near the roller 11 and then is pulled into the space between the previously stacked letter 10 and a portion 13 of the belt 2 running between the rollers 11 and 12 in a manner that opposes the pressure exerted by the spring 9. The letter 5 is then further pulled by the frictional force caused by the belt portion 13 to its final position wherein the letter 5 abuts the blocking plate 6.

Thus, the letters are stacked consecutively and the supporting plate 7 is pushed leftward by a distance corresponding to the thickness of the stack. The supporting plate 7 is provided for supporting a stack of letters so that they do not fall, but are placed and filed in a direction parallel to the supporting plate 7. The last stacked letter 10 acts as a guide for the next arriving letter 5 conveyed by conveyor belts 1 and 2. The supporting plate 7 directly acts as a guide for stacking the first letter conveyed to the stacking portion.

When the letters are stacked consecutively until the capacity of the stacking portion is reached, the stacked

letters must be manually removed and transported to further means by an operator, and the supporting plate 7 must be returned to its initial position.

However, if another letter to be stacked arrives during the removal operation of the stacked letters and the transporting thereof to further means, the letter will not be properly placed or filed because the arrived letter is not guided by the supporting plate 7 or by last stacked letter 10. In order to avoid this undesirable consequence, the operation of the machine must be interrupted during each manual removal, with a resulting impairment in the efficiency and automatic operation of the mailing machine.

An object of the present invention is to overcome the above described drawbacks of the conventional device.

Another object of this invention is to provide a stacking device for letters wherein stacked letters can be freely removed therefrom even while the device is operating.

Further objects and features of the present invention will be fully understood from the following detailed description with respect to preferred embodiments of the present invention in conjunction with the accompanying drawings, in which;

FIG. 1 is a representative diagram of a conventional stacking device;

FIG. 2 is a plan view of an embodiment of the present invention;

FIG. 2A is a front view of a guide plate utilized in the apparatus of FIG. 1;

FIG. 3 is a cross sectional view taken along line 3—3 of the embodiment shown in FIG. 2;

FIG. 4 is a plan view showing a stack of letters formed by the apparatus of the present invention;

FIG. 5 is a partial plan view of a portion of another embodiment of the present invention; and

FIG. 6 is a cross sectional view taken along line 6—6 of FIG. 5.

DETAILED DESCRIPTION OF THE INVENTION:

Referring now to FIG. 2, a conveying belt 14 is extended between and around rollers 17, 18, which are mounted on a base plate 16. This belt 14 is driven in the direction indicated by the arrow B due to the rotation imparted to the rollers by a suitable driving source (not shown). Another conveying belt 15 is extended between and around rollers 19, 20 and 21. This belt 15 is, also, driven in the direction indicated by the arrow B due to the rotation imparted to rollers 19, 20, 21 by a suitable driving source (not shown). Belts 14 and 15 comprise a conventional transporting means. One roller 19 is mounted on the base plate 16, and the other rollers 20 and 21 are mounted on a triangular auxiliary plate 22 which in turn is mounted on the base plate 16. The base plate 16 is swingable around the shaft of the roller 19 in a plane parallel to the base plate 16. The rollers 20 and 21 perform a function similar to that performed by the rollers 11 and 12 of the prior art device shown in FIG. 1, and the terminal portion 23 of the belt 15 acts to pull a sequentially transported letter into the stack in a manner similar to the portion 13 in the device of FIG. 1.

A guide plate 24 is perpendicularly fixed to the auxiliary plate 22. As shown in FIG. 2A the guide plate 24 has an aperture 241, through which the rollers 20 and

21 extend. Thus, the belt 15 passes through the aperture 241. The lower portion 242 of the guide plate 24 is bifurcated so as to straddle an extended portion 26 of blocking plate 25 and to be extended in a downward direction as shown in the drawing. The auxiliary plate 22, rollers 20, 21, belt portion 23, and guide plate 24 are all urged leftwardly in the drawing by means of a force exerted on the auxiliary plate 22 by spring 27. Normally these members assume an extreme leftmost position wherein the lower portion of the guide plate 24 contacts an end of the blocking plate 25.

The base plate 16 (and also the auxiliary plate 22 mounted thereon) is angularly disposed about the horizontal plane to form an angle of about 60° therewith, and the blocking plate 25 is perpendicularly fixed to the base plate 16. Thus the blocking plate 25 is also angularly disposed with respect to the horizontal plane. As a result, a horizontally disposed channel having a V-shaped cross section as clearly shown in FIG. 3 is formed. It is understood therefore, that FIG. 2 is a plan view that is normal to the plane of the base plate 16. Along the surfaces of the base plate 16 and the blocking plate 25, both of which constitute the interacting walls of the V-shaped channel, flat belts 28, 29 are provided, each of which belts are deployed, respectively, about two rollers. The flat belts 28, 29 are disposed in apertures in the intersecting walls. One surface of each belt 28, 29 is slightly projected from the surface of its respective plate 16, 25 and is movable in a plane parallel to the surface of each plate. The belts 28, 29 are driven in the direction indicated by the arrow C in synchronism with each other by a separate driving source other than that used for driving the conveyor belts 14 and 15.

A micro-switch 30, having closeable contacts, is connected in series relationship with the power supply for the driving source for the belts 28, 29. When the auxiliary plate 22 is in its normal position, the micro-switch, which is disposed in proximate relation therewith, is kept in the opened state, whereby the belts 28, 29 are maintained in a standstill condition.

A slideable guide block 31, corresponding to the supporting plate 7 of the prior art device illustrated in FIG. 1, may be constructed to be approximately the same size as the letters. It is, of course, understood that guide block 31 may assume any convenient size suitable for its purpose, to be described. At the initial stage of the stacking operation, the guide block 31 is placed in the receiving portion of the V-shaped channel adjacent of and facing close to the terminal belt portion 23 of the transporting means including conveying belt 15 in the V-shaped channel and receives an initially conveyed letter. As the stacking operation proceeds, the amount of stacked letters increases, and the guide block 31 is gradually slid leftwardly (on the drawing) in the V-shaped channel by the force exerted thereon by the stacked letters until the guide block 31 is stopped by abutting with the forward ends of the flat belts 28, 29.

If the amount of stacked letters contained between the stopped guide block 31 and belt portion 23, i.e., the receiving portion of the V-shaped channel is now exceeded, the spring 27 is depressed and the members comprising the auxiliary plate 22, rollers 20, 21, and the belt 15 are pushed rightwardly and rotated around the shaft of the roller 19 in the counterclockwise

direction by the expansive force of the increasing stack of letters.

At this time, the size of the stack is sensed by micro-switch 30 which is operated by the movement of the guide plate 24 fixed to auxiliary plate 22 to close the power supply circuit to the driving source for the flat belts 28, 29 whereby the flat belts 28, 29 are driven in a synchronized manner in the leftward direction C. The initiation of the leftward movement of the flat belts 28, 29 causes the guide block 31 to ride on the flat belts 28, 29 and to be shifted leftward on the flat belts. Thus, the stacked letters disposed in the receiving portion between the guide block 31 and belt portion 23 are also carried on the flat belts 28, 29 and shifted to the leftward direction together with the guide block.

The shifting speed of the flat belts 28, 29 is set to a value substantially faster than that of conveying belts 14, 15, whereby the depression force applied to the auxiliary plate 22 by the overstacked letters is decreased, and the micro-switch 30 contacts are thereby opened to interrupt the power supplied to the driving source for driving the flat belts 28, 29. Accordingly, while the letters are continuously stacked on the blocking plate 25 and the base plate 16, because of the continuous motion of conveying belts 14, 15, the flat belts 28, 29 are operated intermittently as the micro-switch 30 contacts open and close, whereby the guide block 31 and letters following the guide block 31 are shifted leftwardly in a manner to counterbalance the stacking speed of the letters.

A portion 33 of the V-shaped channel at the left side (on the drawing) of the flat belts 28, 29 constitutes an auxiliary accommodating space for increasing the stacking capacity of the letters accommodated by the present device. That is, the letters that exceed the stacking capacity of the receiving portion to the right of the flat belts 28, 29 are transported by the flat belts and stored in the portion 33 as shown more clearly in FIG. 4. Portion 33 is designated the removal portion for a purpose soon to become apparent.

Within the intermediate portion of the V-shaped channel provided with flat belts 28, 29, the stacked letters are supported in a manner that the letters extend beyond the two belts within the channel as shown in FIG. 3. The belts 28, 29 are understood to be substantially perpendicular to each other to support each of the letters at two adjacent edges thereof, and the weight of each letter is proportionally distributed thereon. Furthermore, since the flat belts are disposed to be spaced apart from the intersection of base plate 16 and blocking plate 25 at a sufficient distance, a letter is supported by these flat belts at its edges near opposite corners thereof, whereby the center of gravity of the stacked letters, as measured from the points of support, is substantially lowered in comparison with prior art devices where the letters are merely elevated on a horizontal plane. For this reason, the letters are supported in an extremely stable configuration and resist the tendency to fall even if a stacked letter is subject to a reacting force attributed to the stacking operation performed at the receiving portion of the V-shaped channel.

Furthermore, the surfaces of the flat belts 28, 29 may be coated with a rubber-like material having a comparatively high frictional coefficient, and also may be

provided with a multitude of fine grooves or teeth extending in the direction of movement C for preventing slippage of the letters transported thereby, and thus increasing the stability of the stacked letters.

With the provision of the above described coating and/or fine grooves or teeth, a far stronger shifting force can be exerted on the letters by the flat belts 28, 29 through the grooves or teeth or by the resulting friction force whereby a greater amount of letters can be transported to and stored in that portion 33 of the V-shaped channel forming an auxiliary accommodating space for the stacked letters.

In the auxiliary accommodating space 33 and also in the receiving portion of the V-shaped channel wherein the flat belts are not provided, the weight of the stacked letters is supported by the walls of the channel. The adjacent two sides of each letter lie directly on the surfaces of the walls of the V-shaped channel, whereby the stacked letters are highly stable, and a portion of the stacked letters may be transported by the flat belts 28, 29 into the portion 33 whereat the letters are stored while retaining their properly aligned condition.

In the above described stacking device, when it is desired to remove stacked letters during the continuous stacking operation, there is no need to rearrange the position of the guide block 31 or to interrupt the operation of the device. That portion of the stacked letters contained in the receiving portion of the V-shaped channel between the rightward end portion of the flat belts 28, 29 and the rightward end of the V-shaped channel should remain therein while the letters in portion 33 or the letters supported by flat belts 28, 29 can be freely removed from the channel at any time without disturbing the remaining letters or the stacking operation performed on subsequently received letters. This occurs because the remaining stack of letters retains its upright position due to the aforedescribed inherent nature of the V-shaped channel and the flat belts. The remaining letters thus serve as a guide for properly stacking the subsequently received letters and perform the function previously performed by guide block 31.

Thus, it is apparent that, in this embodiment of the present invention, the stability of the stacked letters is obtained by the inherently stable characteristics afforded by the V-shaped channel which is made of two plates perpendicularly joined together and two flat belt conveyors arranged in apertures in the respective plates. When the letters are stacked in the V-shaped channel so as to be substantially perpendicular to the walls thereof, they readily retain their upright positions because the points at which each letter is supported are comparatively high with respect to the center of gravity of the stacked letters. Also in this embodiment, use of the guide block 31, which corresponds to the supporting plate 7 in FIG. 1, is required only during the initial operation of the stacking device, but is not required during the ordinary operation of the device. Moreover, undesirable interruptions in the operation of the device are not necessary for removal of stacked letters therefrom.

As is apparent from the above description, the important feature of the present invention is the V-shaped channel and the conveyor belts 28, 29 provided in the walls thereof, and particularly in the fact that the weight of the stacked letters is proportionally dis-

tributed along the two walls. For this purpose each wall of the V-shaped channel should be arranged to be angularly disposed to the horizontal plane with an angle of more than 20° therebetween. Furthermore, because the letter-like materials are generally formed into rectangular configurations, it is preferable that the walls of the V-shaped channel be joined together so that the walls are disposed in a substantially perpendicular relation.

Although the fundamental design of the present device has been described above, it will be apparent to those skilled in the art that various modifications can be carried out on the above disclosed construction, within the scope of this invention. For instance, the number of the flat conveyor belts provided in each side wall of the V-shaped channel may be increased to more than one, or the width of each flat belt may be enlarged so as to be coextensive with the adjacent edges of the letters. The flat belts may also be replaced with rotatable spiral shafts each having a helical groove therein as shown in FIGS. 5 and 6.

Further, the detailed construction of the stacking portion of the disclosed device may be modified in such manner that the roller 21 and the belt portion 23 shown in FIG. 2 may be omitted whereby the aforedescribed function performed thereby may now be performed by the rollers 19 and 20. In addition, the shaft of the roller 21 may be provided with a frictional ring made of rubber-like material and having a diameter greater than the diameter of the roller to accelerate received letters into the stacking position.

We claim:

1. A stacking device, which automatically stacks materials such as letters, postcards or the like sequentially transported thereto by transporting means, comprising:

transporting means having a terminal portion;

a V-shape channel formed of two walls arranged so that the weight of the stacked materials therein is proportionally distributed on said two walls, said V-shape channel including a first portion disposed opposite to said terminal portion of said transporting means so as to receive and stack materials transported thereto by said transporting means and a second portion from which stacked materials may be removed;

a plurality of conveyor means provided between said first and second portions to intermittently convey the stacked materials from said first portion to said second portion, said plurality of conveyor means being positioned in the respective planes of said two walls forming said V-shape channel;

and means for guiding material initially received from said terminal portion of said transporting means into said first portion of said V-shape channel so that the opposite surfaces of the received material are positioned perpendicular to the planes of said two walls of said V-shape channel.

2. The stacking device of claim 1, in which each of said plurality of conveyor means is a conveyor belt driven intermittently.

3. The stacking device of claim 1, in which each of said plurality of conveyor means is a rotatable spiral shaft driven intermittently.

4. The stacking device of claim 1, in which said two walls of said V-shape channel intersect each other at an angle of approximately 90°, and said plurality of conveyor means are arranged in intersecting planes having an angle of intersection of 90°.

5. The stacking device of claim 1, in which said transporting means comprises:

two conveyor belts for transporting materials and for delivering said transported materials into said first portion of said V-shape channel, said two conveyor belts being arranged in substantially parallel relation so that said transported materials are interposed therebetween;

a plurality of roller means provided for each of said two conveyor belts for driving said conveyor belts, one of said plurality of roller means being disposed in said first portion and in parallel relation with one of said two walls of said V-shape channel so that material initially received from said two conveyor belts is delivered to obliquely abut said guide means and material subsequently received from said two conveyor belts is delivered to obliquely abut already stacked material thereby being guided into said first portion of said V-shape channel.

6. The stacking device of claim 1, in which said means for guiding is composed of one block plate which is slidable through said first portion of said V-shape channel, said plurality of conveyor means and said second portion of said V-shape channel.

7. The stacking device of claim 1, in which said first and second portions are formed of unitary construction having a communicating portion therebetween, said communicating portion including said conveyor means therein.

8. A stacking device for automatically stacking pieces of mail such as letters, postcards and the like sequentially transported thereto, comprising:

displaceable transporting means for delivering pieces of mail;

first and second angularly disposed walls forming a channel for the passage of stacked pieces of mail therethrough; said channel being substantially V-shaped and having a receiving portion positioned proximately of said displaceable transporting means for receiving delivered pieces of mail, a removal portion from which stacked pieces of mail are removed and an intermediate portion for transmitting stacked pieces of mail from said receiving portion to said removal portion;

conveyor means disposed in said intermediate portion of said channel;

slidable guide means positioned in said receiving portion of said channel for guiding initially received pieces of mail into a predetermined disposition in said receiving portion, such that a stack of pieces

of mail is formed in said receiving portion wherein each piece of mail in said stack includes adjacent edges in abutting relationship with said first and second angularly disposed walls and each piece of mail is substantially perpendicular to each of said first and second walls; said slidable guide means being adapted to slide through said receiving and removal portions of said channel;

and actuating means for sensing when the stack of pieces of mail in said receiving portion exceeds a predetermined size and for actuating said conveyor means to transmit stacked pieces of mail from said receiving portion to said removal portion such that said actuating means deactuates said conveyor means when said stack of pieces of mail in said receiving portion is reduced below said predetermined size.

9. The stacking device of claim 8 wherein said displaceable transporting means comprises conveyor belt means supported by a displaceable support member, said displaceable support member being subject to a first force exerted thereon in a manner tending to align said displaceable support member in a first normal position and to a second force exerted thereon in a manner tending to oppose said first force and to cause a displacement of said displaceable support member; said second force being derived from said stack of pieces of mail formed in said receiving portion of said channel such that said displaceable member is displaced when said receiving portion is substantially occupied by said stack of pieces of mail.

10. The stacking device of claim 9 wherein said actuating means comprises switch means disposed in proximate relation to said displaceable support member and adapted to close when said displaceable support member is displaced into contacting relationship therewith; said switch means having closeable contacts electrically connected in series with means for driving said conveyor means.

11. The stacking device of claim 10 wherein said conveyor means comprises first and second conveyor belts disposed in apertures in said first and second angularly disposed walls, respectively; said first and second conveyor belts being driven by driving means when said closeable contacts of said switch means are closed.

12. The stacking device of claim 10 wherein said conveyor means comprises first and second rotatable shafts disposed in apertures in said first and second angularly disposed walls, respectively; said first and second rotatable shafts being rotated by driving means when said closeable contacts of said switch means are closed.

13. The stacking device of claim 10 wherein said first and second angularly disposed walls define an angle of approximately 90° therebetween.

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