A feeding apparatus for envelopes and other discrete pieces of sheet material includes a magazine (20) having an outlet slot (32) at the bottom of a side wall (16) to provide for dispensing said pieces seriatim by means of conveyor rollers (34) disposed in the bottom of the magazine (20). A pair of resilient depending cantilever beams (48) are disposed across the slot (32) and are operable to be deflected by the leading edges of one or more pieces of sheet material being urged through said slot (32) by the conveyor rollers (34) while permitting only the bottom piece engaged with the rollers (34) to be dispensed from the magazine (20).
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SEPARATOR MECHANISM FOR ENVELOPE OR SHEET FEEDING APPARATUS

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention pertains to apparatus for feeding discrete pieces of sheet material and, in particular, mechanism for separating individual pieces to be dispensed from a magazine one at a time.

Description of the Prior Art

In many types of paper handling apparatus, such as envelope feeders and sheet feeders which are operated in conjunction with printing and word processing equipment, mechanism is provided for separating discrete pieces of sheet material so that the pieces may be dispensed from a magazine or stack one at a time and fed to the associated printing apparatus. The separation of discrete pieces of sheet material to assure that the pieces are fed seriatim to the printing apparatus has been a longstanding problem in the art of paper handling equipment. For example, in many types of sheet feeding apparatus it is desired that the apparatus be adapted to feed discrete pieces of different thickness such as single sheets of stationery as well as envelopes or folded pieces. One well known concept for sheet material feeding mechanisms provides for a slot of predetermined thickness formed in the bottom wall of a hopper or magazine, which slot is adjacent to a conveyor mechanism such as an endless belt or a set of feed rollers. Because of the small thickness
of most sheet material the thickness of the slot must be carefully controlled so that only one piece of material is dispensed through the slot when engaged by the dispensing conveyor mechanism.

Apparatus is also known wherein adjustable stops are provided to in effect control the thickness or height of the dispensing slot. However, when different thicknesses of sheet material are to be fed, the position of the stops must be changed which is a time consuming operation and is difficult to control to provide satisfactory performance. Although the aforesaid type of mechanism is relatively reliable it requires precise settings and is limited to one particular material thickness or weight at a particular setting of the slot thickness.

Another known concept for so-called bottom dispensing feed mechanisms includes a magazine with a slot formed in a bottom side wall thereof below which is disposed a conveyor mechanism. Separation of discrete pieces of material which are engaged by the conveyor is accomplished by a spring biased retard member disposed adjacent to the slot outside of the magazine in the direction of feed of the material. In this type of arrangement the retard member is biased against a conveyor belt which requires an unreasonable amount of power to drive the mechanism and causes rapid wear on the conveyor belt as well as the retard member. Furthermore, this arrangement usually requires a one way clutch to allow the conveyor belt to be run in the opposite direction for clearing a jammed condition of the separator mechanism. The resiliently biased retard member is also difficult to control with respect to the biasing force so that suitable feeding or dispensing can be obtained without jamming or crinkling the sheet material.

Prior art mechanisms are also known which utilize vacuum or compressed air jets for separating discrete pieces of sheet material. Such apparatus, of course, requires additional equipment in the form of pumps or compressors which add to the cost of the material feeding equipment or require a central source of compressed air or vacuum. A wide variety of automatic printing equipment is currently in development and in use for applications in business offices where sources of compressed air and/or vacuum are not available. Ac-
Accordingly, sheet material feeding mechanisms which require pressure fluid or vacuum are not readily adaptable for many installations.

It has been determined in pursuing the present invention that it is desired to provide a separating mechanism for sheet material feeding equipment which is uncomplicated, reliable, adapted to separate discrete pieces of different thicknesses and surface finish and which may provide for easy clearing of a jammed condition of the feed mechanism if such should occur. Prior to the development of the present invention at least one or more of the problems and disadvantages discussed herein were associated with prior art separator mechanisms.

SUMMARY OF THE INVENTION

The present invention provides for an improved separator mechanism for use in sheet material feeding apparatus such as envelope and stationery feeders, which separator mechanism is adapted to reliably provide for separation of the piece of material to be fed from adjacent pieces of material retained in stacked relationship in a magazine or the like.

The present invention also provides for a separator mechanism for sheet material which provides for separation of discrete pieces of different thicknesses or weights without requiring any adjustments of the separator mechanism itself.

The present invention further provides a separator mechanism for use with sheet material feeding apparatus of the so called bottom feed type whereby stacked material may be dispensed in the same order that it has been stacked.

In accordance with the present invention there is provided apparatus for feeding discrete pieces of sheet material having a magazine with a longitudinal opening formed at the bottom of a side wall thereof. A conveyor mechanism is disposed adjacent to the opening and is engageable with the discrete pieces of material seriatim for dispensing said pieces through the opening. In accordance with the present invention one or more resilient depending members are disposed across the opening and are adapted to be deflected by the edges of the pieces of sheet material whereby only
the piece engaged with the conveyor is allowed to pass out of the opening onto the feed path of the feeder apparatus. The resilient members are preferably formed of a flexible material such as natural or synthetic rubber. The resilient member is arranged as a cantilever beam in such a way that the greatest deflection is imposed on the beam by the piece of material which is desired to be dispensed from the material holding magazine. The resilient members also frictionally engage the piece of sheet material being dispensed to hold the same in firm engagement with the conveyor mechanism so that no slippage between the material and the surface of the conveyor mechanism is experienced which might result in damage to the material as it is being dispensed.

In accordance with the present invention an arrangement of a bottom feed type dispensing mechanism for discrete pieces of sheet material is advantageously used in combination with a conveyor mechanism comprises a plurality of cylindrical rollers having interposed therebetween fixed support members. Accordingly, the sheet material dispensing mechanism is relatively simple in construction and reliable in operation. Moreover, in the event that jamming of the feed path of the material should occur the path may be easily cleared due to the relatively simple structural arrangement which provides for dispensing and separation of the pieces of sheet material.

The present invention is particularly adapted to be used in conjunction with an envelope feeding apparatus of the type disclosed in co-pending U.S. Patent Application Serial No. 182,590 filed June 24, 1980 and assigned to the assignee of the present invention. Those skilled in the art will recognize that the present invention may, however, be readily adapted to other types of sheet material feeding apparatus including those types which dispense discrete pieces off of the top of a stack of sheet material.

The abovedescribed as well as other superior features of the present invention will be further appreciated upon reading the detailed description which follows together with the appended claims.
BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a transverse section view of an envelope feeding apparatus of the type disclosed in the above-identified U.S. Patent Application and incorporating the improved separator mechanism of the present invention;

Figure 2 is a fragmentary perspective view of the envelope feeding apparatus illustrated in Figure 1 and showing the improved separator mechanism;

Figure 3 is a detail section view taken in the same plane as the section view of Figure 1 and showing the relative positions of the separator member and pieces of sheet material at the onset of feeding a piece of material from a stack; and

Figure 4 is a view similar to Figure 3 illustrating the manner in which only one piece of material is permitted to be dispensed from the stack.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings and in particular Figure 1 an envelope feeding apparatus of the type disclosed in U.S. Patent Application Serial No. 162,590 is shown in transverse cross section and generally designated by the numeral 10. The apparatus 10 is particularly adapted to mount on a printer, not shown, having a rotatable cylindrical platen 12 for receiving an envelope or other piece of sheet material. The feeding apparatus 10 includes a frame generally designated by the numeral 14 comprised of suitable plate members including a member forming a front wall 16 and a member 18 forming a bottom wall of an envelope hopper or magazine generally designated by the numeral 20. The magazine 20 includes a removable plate 22 which is vertically moveable within the magazine and is operable to separate a stack of envelopes to be dispensed from the feeding apparatus to the aforementioned printer from envelopes received back to the magazine from the printer.

The apparatus 10 further includes a pair of spaced apart feed belts 24, one shown in Figure 1, which are trained over spaced apart pulleys 26 and 28 which are suitably rotatably mounted on the frame 14. The belts 24 are adapted to be driven by drive mechanism, not
shown, driveably engaged with the pulleys 28. The belts 24 are driven in timed relation with the rotation of the platen 12 for feeding envelopes into and out of the aforementioned printer. As shown in Figure 1 the feeding apparatus 10 is adapted to have a feed path, indicated by the arrows 30, which begins at an opening 32 formed between the bottom edge of the wall 16 and a plurality of spaced apart cylindrical rollers 34, also shown in Figure 2. Discrete pieces of sheet material such as envelopes 36 may be dispensed from the magazine 20 through the opening 32 and along the feed path 30 to a holding plate 38 which is provided with a yieldably biased holding member 40. Envelopes are serially dispensed from the magazine 20 to the holding plate 38 whereupon they are engaged by spaced apart lugs 25 formed on the belt 24 and further fed along the feed path 30 into the platen 12. Further details of the structure and operation of the feeding apparatus 10 will not be discussed herein as they form no part of the present invention.

Referring also to Figure 2 the rollers 34 are mounted on a shaft 42 which may be driven by suitable mechanism, not shown, in conjunction with the mechanism which drives the belt 24 as described in U.S. Patent Application Serial No. 162,590. Disposed between the rollers 34 are extensions of the bottom plate 18 comprising spaced apart fingers 44. As shown in Figure 1 also, the fingers 44 are curved somewhat to conform to the peripheral surface of the rollers 34 and are positioned slightly below the surface of the rollers 44 adjacent to the opening 32. Accordingly, the fingers 44 are adapted to function as support members intermediate the rollers 34 for providing some support for a piece of sheet material being dispensed from the magazine 20. Although the fingers 44 are disposed slightly below the peripheral surface of the rollers 34 in the vicinity of the opening 32 the weight of a stack of envelopes 36 will cause the envelope adjacent to the rollers 34 to deflect slightly in the span between the rollers and engage the fingers 44.

The improved means for separating discrete pieces of sheet material being dispensed from the magazine 20, in accordance with the present invention, includes a resilient member, generally designated by the numeral 46, which is characterized by a pair of
depending beam portions 48, as shown in Figure 2. The member 46 is suitably secured to the wall 16 by threaded fasteners 50 whereby the beam portions 48 are fixed to the wall 16 in cantilever fashion. The beams 48 depend across the opening 32 and extend between the spaced apart pairs of fingers 44 as shown in Figure 2. The member 46 is preferably formed of resilient material such as natural or synthetic rubber. In one embodiment of the present invention, used in conjunction with the apparatus 10 for feeding standard business letter size envelopes, the member 46 is formed of an elastomer having a hardness in the range of 40 to 50 durometer and having a thickness in the range of 2.25 to 3.20mm. In the aforementioned embodiment the width of the beam members 48 is preferably about 12.5mm. As illustrated in the drawing figures the beam members 48 extend downwardly between the respective pairs of fingers 44, as shown, and have their distal ends adjacent to the bottom surface of the fingers 44. Although the length of the beam members by itself is not critical, a proper relationship between length and thickness is desirable to provide the proper wiping or separating function described hereinbelow.

In operation, the dispensing rollers 34 are adapted to engage a piece of sheet material such as an envelope 36 which is at the bottom of the stack of envelopes, as shown in Figure 1. When the rollers 34 are rotated the frictional engagement between the rollers and the bottom envelope is sufficient to move the envelope towards and through the opening 32 as shown in Figure 3. However, the frictional forces between the bottom envelope and the envelope adjacent to it are such that as the envelope to be dispensed is moved through the opening 32 the next envelope as well as any additional envelopes which are not engaged with the wall 16 will tend to move through the opening with the envelope directly engaged with the rollers 34 until the edges of the envelopes engage the members 48 as shown. As the envelopes which are permitted to move through the opening 32 engage the members 48, the members are deflected in the direction of the feed path 30, the deflection being the greatest at the distal end 52 of the members 48.
Accordingly, as the bottom envelope 36 is dispensed from the magazine 20 the beam members 48 are deflected to engage and wipe across the surface of the envelope allowing the bottom envelope to be dispensed but retaining the remaining envelopes substantially within the magazine 20. The frictional retarding force applied to an envelope 36 by the members 48 is less than the frictional force between the bottom side of the envelope and the rollers 34. However, the envelope adjacent to the bottom envelope engages the members 48 at a position closer to their point of attachment to the wall 16 and accordingly the resistance to deflection of the members 48 is greater at the point of engagement with the next-to-be-dispensed envelope and so on for any envelope that has moved through the opening 32 to engage the members 48. Accordingly, the provision of the cantilever beam members 48 disposed across the opening 32 provides a progressively greater resistance to deflection at the points where the beam members are engaged by those pieces of material which are desired to be retained in the magazine.

When the bottom envelope 36 is dispensed from the magazine 20 the next envelope, of course, becomes the bottom envelope and if the rotation of the rollers 34 is continuous another piece of material is serially dispensed from the magazine 20. The provision of the resiliently deflectable members 48 does not require any precise control of the width of the opening 32 which is delimited by the bottom edge of the wall 16 and the peripheral surface of the rollers 34. In fact, the width of the opening 32 may be substantial to permit easier clearing of a jammed condition of the pieces of sheet material in the magazine 20 even though it is unlikely that such an event would occur with the arrangement according to the present invention. Furthermore, it will be appreciated from the foregoing description that the separating mechanism of the present invention does not require any precise assembly or alignment of parts of the feeding apparatus or adjustment thereof during its use.

It will further be appreciated that the arrangement according to the present invention permits the use of discrete pieces of sheet material of various thicknesses such as sheets of stationery, or relatively thick pieces of material such as folded brochures or
pamphlets. Although the present invention works particularly well with so called bottom feed magazines and associated conveyor mechanisms it is contemplated that the resiliently deflectable cantilever beam members 48 may be adapted to work with feeding apparatus where discrete pieces of material are separated at the top of a stack.

Those skilled in the art will recognize that detailed modifications may be made in the present invention without departing from the scope or spirit of the invention which is recited in the appended claims.
CLAIMS

1. In an apparatus for feeding discrete pieces of sheet material:
   means forming a magazine for holding a plurality of discrete pieces of sheet material in stacked relationship;
   an opening in said magazine through which said discrete pieces may be dispensed seriatim;
   conveyor means engageable with each of said pieces successively to dispense said pieces through said opening; and
   a resilient member disposed across said opening and yieldably biased into engagement with at least one of said pieces for retaining said pieces and to permit the dispensing from said magazine of only the piece engaged with said conveyor means.

2. The invention set forth in Claim 1 wherein:
   said apparatus includes means for securing a portion of said member substantially fixed and said member includes a distal end portion disposed across said opening and adapted to be resiliently deflected by one or more of said pieces while permitting only the piece closest to said distal end to be dispensed from said magazine.

3. The invention set forth in Claim 2 wherein:
   said member comprises a cantilever beam disposed across said opening and being formed of a resilient material.

4. The invention set forth in Claim 3 wherein:
   said material comprises an elastomer.

5. The invention set forth in Claim 4 wherein:
   said elastomer has a hardness in the range of from 40 to 50 durometer.
6. The invention set forth in Claim 3 wherein:
said member includes two spaced apart cantilever beams each
disposed across said opening in said magazine and engageable with
said piece being dispensed from said magazine to prevent said piece
from being skewed with respect to the intended feed path of said
piece as said piece is dispensed from said magazine by said conveyor
means.

7. The invention set forth in Claim 2 wherein:
said magazine includes a front wall having a bottom edge
delimiting an elongated slot forming said opening, said conveyor
means being disposed adjacent and substantially below said edge, and
said member is disposed across said opening such that said distal end
of said member is below said edge.

8. The invention set forth in Claim 7 wherein:
said conveyor means comprises a plurality of spaced apart
cylindrical rollers disposed adjacent the bottom of said magazine.

9. The invention set forth in Claim 8 wherein:
said magazine includes a plurality of spaced apart support
members disposed below said edge and extending in the direction of
dispensing of said pieces from said magazine to a point at least
adjacent to the distal end of said member.

10. The invention set forth in Claim 9 wherein:
said spaced apart support members are disposed slightly below
the peripheral surface of said cylindrical rollers to provide for
engagement of said pieces by said rollers.
11. The invention set forth in Claim 10 wherein:
said spaced apart support members comprise a plurality of fingers extending past said opening in the direction of feeding of said pieces from said magazine.

12. The invention set forth in Claim 10 wherein:
said support members are formed integral with a bottom wall of said magazine.
AMENDED CLAIMS

(received by the International Bureau on 28 January 1982 (28.01.82))

1. In an apparatus for feeding discrete pieces of sheet material:
   means forming a magazine for holding a plurality of discrete pieces of sheet material in stacked relationship;
   an opening in said magazine through which said pieces may be dispensed seriatim;
   conveyor means engageable with each of said pieces successively to dispense said pieces through said opening;
   a resilient member comprising at least two spaced apart cantilever beams each disposed across said opening in said magazine and having respective distal end portions engageable with said piece being dispensed from said magazine to prevent said piece from being skewed with respect to the intended feed path of said piece as said piece is dispensed from said magazine by said conveyor means;
   a portion of said member being secured on said apparatus to permit the distal end portions of each of said beams to be resiliently deflected by one or more of said pieces while permitting only the piece closest to said distal end portions to be dispensed from said magazine.

2. The invention set forth in Claim 1 wherein:
   said member is formed of a resilient material comprising an elastomer.

3. The invention set forth in Claim 2 wherein:
   said elastomer has a hardness in the range of from 40 to 50 durometer.

4. The invention set forth in Claim 1 wherein:
   said magazine includes a front wall having a bottom edge delimiting an elongated slot forming said opening, said conveyor means being disposed adjacent and substantially below said edge, and said member is disposed across said opening such that said distal end portions of said beams are below said edge.

5. The invention set forth in Claim 4 wherein:
   said conveyor means comprises a plurality of spaced apart cylindrical rollers disposed adjacent the bottom of said magazine.
6. The invention set forth in Claim 8 wherein:
said magazine includes a plurality of spaced apart support members disposed below said edge and extending in the direction of dispensing of said pieces from said magazine to a point at least 5 adjacent to the distal end portions of said beams.

7. The invention set forth in Claim 9 wherein:
said spaced apart support members are disposed slightly below the peripheral surface of said rollers to provide for engagement of said pieces by said rollers.

8. The invention set forth in Claim 7 wherein:
said spaced apart support members comprise a plurality of fingers extending past said opening in the direction of feeding of said pieces from said magazine.

9. The invention set forth in Claim 7 wherein:
said support members are formed integral with a bottom wall of said magazine.
EDITORIAL NOTE

The applicant failed to renumber the amended claims in accordance with Section 205 of the Administrative Instructions.

In the absence of any specific indication from the applicant as to the correspondence between original and amended claims, these claims are published as filed and as amended.
# INTERNATIONAL SEARCH REPORT

**International Application No.:** (If not yet assigned, leave blank.)

**I. CLASSIFICATION OF SUBJECT MATTER**

According to International Patent Classification (IPC) and/or to other National Classification and IPC

INT. CL. 358: 3/06, 3/52
U.S. CL. 271/121, 165

**II. FIELDS SEARCHED**

Minimum Documentation Searched

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Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched

**III. DOCUMENTS CONSIDERED TO BE RELEVANT**

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<td>US, A, 1,976,778 Published 16 October 1934, Korth.</td>
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<td>US, A, 3,038,851 Published 01 October 1974, Kolibas.</td>
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<td>US, A, 4,015,839 Published 05 April 1977, McKe.</td>
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* Special categories of cited documents:

- "A" document defining the general state of the art
- "E" earlier document but published on or after the international filing date
- "L" document cited for special reason other than those referred to in the other categories
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but not on or after the priority date claimed
- "T" later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance

**IV. CERTIFICATION**

Date of the Actual Completion of the International Search: 09 November 1977

Date of Mailing of this International Search Report: 02 DEC 1981

International Searching Authority: ICA/US

Signature of Authorized Officer: Bruce R. Stoner, Jr.