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Wieloch

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[54] **SHEET CONTAINER**

[75] Inventor: **Francis J. Wieloch,** Penfield, N.Y.

[73] Assignee: **Xerox Corporation,** Stamford, Conn.

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[52] **U.S. Cl.** **271/121,** 271/167, 271/208

[51] **Int. Cl.** **B65h 3/06,** B65h 1/04

[58] **Field of Search** ..... 271/145–171, 271/121–125, 22, 208; 206/57 R

[56] **References Cited**

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Primary Examiner—James B. Marbert

Assistant Examiner—James W. Miller

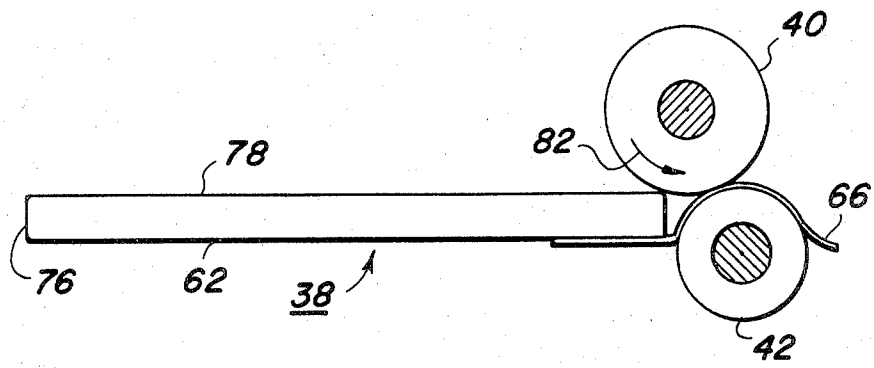
Attorney, Agent, or Firm—H. Fleisher; C. A. Green; J. J. Ralabate

[57] **ABSTRACT**

A container in which a stack of sheet material is stored for the subsequent advancement therefrom. The container includes a base plate having a flexible sheet with a portion of the upper surface thereof adapted to engage the under surface of the advancing sheet.

The foregoing abstract is neither intended to define the invention disclosed in the specification, nor is it intended to be limiting as to the scope of the invention in any way.

5 Claims, 3 Drawing Figures



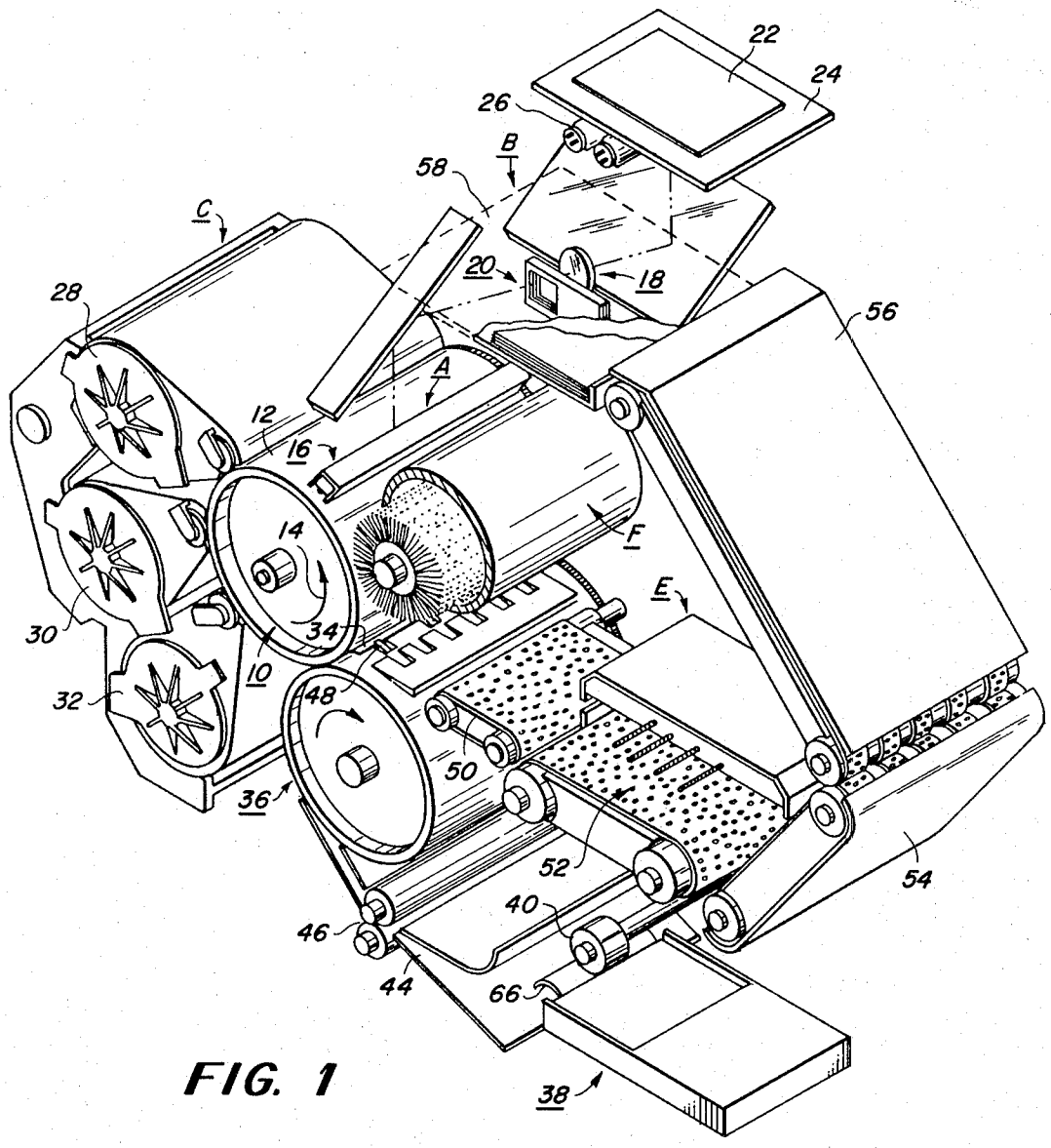

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FIG. 1

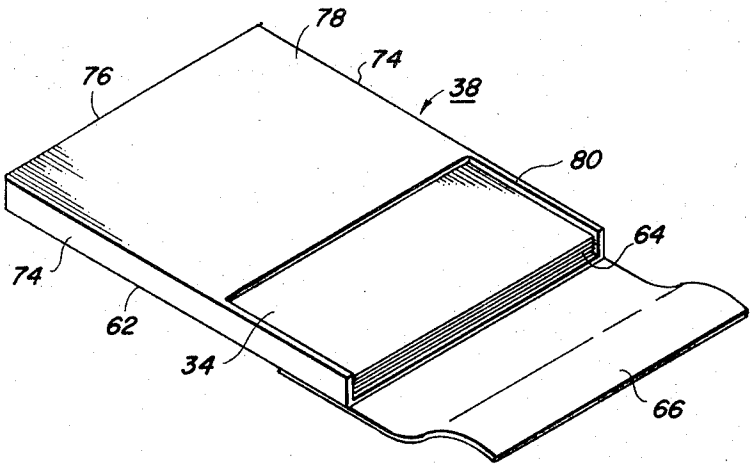

FIG. 2

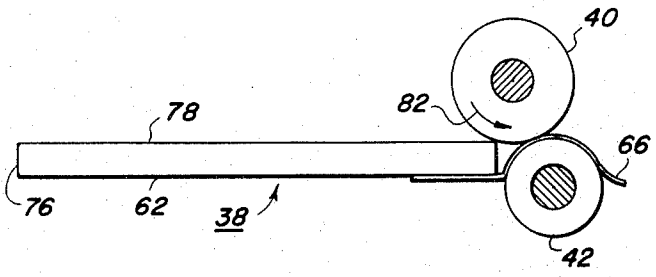

FIG. 3

SHEET CONTAINER

BACKGROUND OF THE INVENTION

This invention relates generally to a container for supporting a stack of sheet material which is to be dispensed therefrom, and more particularly, to a container adapted to facilitate seriatim feeding of successive uppermost sheets from the stack of sheet material disposed therein.

Typical electrophotographic printing machines utilized in business offices are provided with cut sheets of support material. The sheets are used as an imaging receiving member in the printing machine. Although paper is the most commonly used sheet material, certain non-fibrous plastic sheets characterized generally by having a high surface gloss and a smooth surface are increasingly employed. These non-fibrous sheets are frequently more durable than paper and, when transparent, have great utility as transparencies, i.e., a conventional projector may project images therefrom onto a screen.

Generally, the sheet material is of a preselected size and advances through the printing machine, one sheet at a time, for suitable processing therein. Inasmuch as copies may be made at high speeds, it is advantageous to stack a pile of sheets in the printing machine feeding mechanism which advances automatically one sheet at a time therefrom. The sheets are advanced until the stack thereof is depleted, whereupon the operator refills the machine with a new stack of sheets. However, when non-fibrous sheet material is substituted for paper operational difficulties frequently occur. For example, in feeding successive non-fibrous sheets, it is found that the top sheet often causes creep or advancement of the sheets immediately therebelow. This results in misfeeds and jams within the machine, thereby greatly increasing the amount of wasted sheets and the ensuing cost of the operation. In addition thereto machine downtime, i.e., the time necessary to clear the machine of sheet jams, is substantially greater than if misfeeds or jams did not occur. It appears that jams and misfeeds are caused by the relatively high sliding friction between successive non-fibrous sheets and, also, by the electrically insulating nature of the nonfibrous sheets which permits an accumulation of electrostatic charges thereon. Electrostatically charged sheets attract one another making separation thereof more difficult.

The utilization of non-fibrous sheets as transparencies in electrophotographic printing machines becomes more significant with the advent of multi-color machines. In a multi-color electrophotographic printing machine, it is highly desirable to have the capability of creating multicolor transparencies. Transparencies of this type are frequently required for display purposes, i.e., via projection onto screens for seminars or business meetings. Hence, there is continuing need for more trouble free feeding and processing of non-fibrous material, particularly for multi-color electrophotographic printing machines.

Moreover, it is desirable to pre-package the stack of transparent sheets for shipping to minimize handling maintaining the sheets substantially free from dirt and finger prints. In addition thereto, a pre-packaged stack of transparencies is automatically keyed to the proper orientation for use in the printing machine, i.e., the preferred sheet side has the toner powder images deposited thereon and coalesced thereto.

Accordingly, it is a primary object of the present invention to improve the container storing a stack of sheet material therein so that successive feeding of sheets therefrom is facilitated.

SUMMARY OF THE INVENTION

Briefly stated, and in accordance with the present invention there is provided a container in which a stack of support material is stored for being dispensed therefrom. In accordance with a preferred aspect of the present invention, the container includes a base plate, and a flexible sheet having one marginal edge portion thereof secured to the leading edge portion of the base plate. The base plate has a generally planar surface for supporting the stack. As the uppermost sheet advances from the stack, a portion of the upper surface of the flexible sheet engages the undersurface thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of the present invention will become apparent upon reading the following detailed description and upon reference to the drawings, in which:

FIG. **1** is a schematic view of an electrophotographic printing machine incorporating the present invention therein;

FIG. **2** is a perspective view of a container used in the FIG. **1** printing machine for storing sheet material therein; and

FIG. **3** is an elevational view of the FIG. **2** container cooperating with the FIG. **1** printing machine feeding mechanism for the advancement of sheet material therefrom.

While the present invention will be described in connection with a preferred embodiment thereof, it will be understood that it is not intended to limit the invention to that embodiment. On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

DETAILED DESCRIPTION OF THE INVENTION

For a general understanding of the disclosed electrophotographic printing machine in which the present invention may be incorporated, continued reference is had to the drawings wherein like reference numerals have been used throughout to designate like elements. FIG. **1** schematically illustrates the various components of a printing machine for producing multi-color copies from a colored original. Although the container of the present invention is particularly well adapted for use in an electrophotographic printing machine, it should become evident from the following discussion that it is equally well suited for use in a wide variety of printing machines and is not necessarily limited in its application to the particular embodiment shown herein.

The printing machine illustrated in FIG. **1** employs a photoconductive member having a rotatably mounted drum **10** with a photoconductive surface **12** thereon. Basically, drum **10** is rotated in the direction of arrow **14** to pass sequentially through a series of processing stations A through E, inclusive. Drum **10** and other machine operating mechanisms are driven at a predetermined speed relative to each other from a common drive motor (not shown). The various machine opera-

tions are coordinated to produce the proper sequence of events at the processing stations.

Drum **10** initially moves photoconductive surface **12** through charging station A. Charging station A has positioned thereat a corona generating device indicated generally at **16.** Corona generating device **16** extends in a generally transverse direction across photoconductive surface **12.** In this manner, corona generator device **16** is adapted to charge photoconductive surface **12** to a relative high substantially uniform potential. Preferably, corona generator device **16** is of a type described in U.S. Pat. No. 2,778,946 issued to Mayo in **1957.**

Drum **10** is next rotated to exposure station B where photoconductive surface **12** is exposed to a color filtered light image of the original document. Exposure station B includes a moving lens system, generally designated by the reference numeral **18,** and a color filter mechanism, shown generally at **20.** A suitable moving lens system is disclosed in U. S. Pat. No. 3,062,108 issued to Mayo in **1962.** As shown in FIG. **1,** an original document **22,** such as a sheet of paper, book or the like, is placed face down upon transparent viewing platen **24.** Lamp assembly **26** and lens system **18** are moved in a timed relation with drum **10** to scan successive incremental areas of original document **22** disposed upon platen **24.** This produces a flowing light image of original document **22** on photoconductive surface **12.** During exposure, filter mechanism **20** interposes selected color filters into the optical light path of lens **18.** The color filter operations on the light rays passing through the lens to record an electrostatic latent image on photoconductive surface **12** corresponding to preselected special region of the electromagnetic spectrum, hereinafter referred to as a single color electrostatic latent image.

The single electrostatic latent image recorded on photoconductive surface **12,** is next transported to development station C. Development station C includes thereat three individual developer units, generally indicated by the reference numerals **28, 30** and **32,** respectively. A suitable development station employing a plurality of developer units is disclosed in copending application Ser. No. 255,259 filed in 1972. Preferably, the developer units are all of the type generally referred to in the art as "magnetic brush developer units." Typical magnetic brush systems utilize a magnetizable developer mix which includes carrier granules and toner particles. The developer mix is continually brought through a directional flux field to form a brush thereof. The electrostatic latent image recorded on photoconductive surface **12** is developed by bringing the brush of developer mix into contact therewith. Each of the respective developer units contain discretely colored toner pqrticles corresponding to the complement of the spectral region of the wavelength of light transmitted through filter **20,** e.g., a green filtered electrostatic latent image is made visible by depositing green absorbing magenta toner particles therein, blue and red latent images are developed with yellow and cyan toner particles, respectively.

Drum **10** is next rotated to transfer station D where the toner powder image adhering electrostatically to photoconductive surface **12** is transferred to a sheet of final support material **34.** Final support material **34** may be, amongst others, plain paper. However, the container of the present invention is particularly adapted for use with a non-fibrous sheet of support material.

A preferred polymeric non-fibrous sheet of support material is polysulfone thermoplastic available in sheets of approximately **4** mils thickness under the trademark Rowlex from Rowland Products, Inc., Kensington, Conn. This material, in sheet form, is very transparent and may be processed satisfactorily to receive thereon a high quality colored image corresponding to the original document to be reproduced. Another polymeric non-fibrous material for use herein is polyethylene terephthalate polyester transparent sheet material available under the trademark Mylar from the E. I. DuPont De Nemours Co., and may be obtained in a wide range of thicknesses. Many transparent, as well as opaque polymeric materials are available in the art which may be formed into films to receive multicolor images thereon. Any suitable high temperature coated film formable polymeric material may be used.

Bias transfer roll, shown generally at **36,** recirculates support material **34** and is electrically biased to a potential of sufficient magnitude and polarity to attract electrostatically toner particles from the latent image recorded on photoconductive surface **12** to support material **34.** A suitable electrically biased transfer roll is described in U.S. Pat. No. 3,612,677 issued to Langdon in 1971. Transfer roll **36** rotates in synchronism with photoconductive surface **12.** Inasmuch as support material **34** is secured releasably thereon for movement in a recirculating path therewith, successive toner powder images may be transferred thereto in superimposed registration. Support material **34** is advanced from a stack thereof disposed in a container, indicated generally at **38.** Feed roll **40** in operative communication with retard roll **42** (FIG. **3**) advances and separates the uppermost sheet from the stack disposed within container **38.** Container **38** will be described hereinafter in detail in association with FIG. **2.** The cooperative relationship between feed roll **40,** retard roll **42** and the stack of sheet material disposed within container **38** will be discussed hereinafter, in detail, with reference to FIG. **3.** The advancing sheet moves into chute **44** which directs the sheet into the nip of register rolls **46.** Thereafter, gripper fingers **48** mounted on transfer roll **36** secure releasably thereon support material **34** for movement in a recirculating path. With continued reference to FIG. **1,** sheet **34** is stripped from transfer roll **36** and advanced with the thermoplastic coated side down, on endless belt conveyor **50** to fixing station E where a fuser, indicated generally at **52,** coalesces the transferred powder image to sheet **34.** One type of a suitable fuser is described in U.S. Pat. No. 3,498,592 issued to Moser et al. in **1970.** After the fixing process, sheet **34** is advanced by endless belt conveyors **54** and **56** to catch tray **58** for subsequent removal therefrom by an operator.

Although a preponderance of the toner material is transferred to the support material, invariably some residual toner particles are left behind on photoconductive surface **12** after the transfer of the powder image to support material **34.** This residual toner is removed from the drum as it moves through cleaning station F. Here the residual toner is first brought under the influence of a cleaning corona generating device (not shown) adapted to neutralize the electrostatic charge remaining on the material. The neutralized toner is then mechanically cleaned from photoconductive sur-

face 12 by a rotatably mounted fibrous brush 58. A suitable brush cleaning device is described in U.S. Pat. No. 3,590,412 issued to Gerbasi in 1971. Rotatably mounted brush 58 is positioned at cleaning station F and maintained in contact with photoconductive surface 12. In this manner, residual toner particles remaining on photoconductive surface 12 after each transfer operation are removed therefrom.

It is believed that the foregoing description is sufficient for purposes of the present application to show the general operation of an electrophotographic printing machine embodying the teachings of the present invention.

Referring now to the specific subject matter of the present invention illustrated more clearly in FIGS. 2 and 3, container 38 storing a stack of support material therein will be discussed hereinafter, in detail. Turning now to FIG. 2, container 38 includes a base plate 62 having a generally planar surface for supporting thereon a stack 64 of sheet material 34. A flexible sheet 66 has one marginal edge portion 68 secured to the leading edge portion 70 of base plate 62. Flexible sheet 66 is adapted to have a portion of the upper surface thereof in engagement with the undersurface of the uppermost sheet 34 advancing from stack 64. A registration member, indicated generally at 72 includes a pair of opposed side members 74 and a rear member 76. Each side member 74 is affixed to one of the side edge portions of base plate 62 by suitable means, e.g. adhesive. In this way, side members 74 define a pair of opposed spaced generally planar surfaces extending substantially in a direction normal to base plate 62. Stack 64 is disposed on base plate 62 such that at least one of the side edge portions thereof engage side members 74. This aligns the side edges of each sheet of support material 34 in registration with one another. Similarly, rear member 76 is attached to base plate 62 by suitable means, e.g., an adhesive, defining a generally planar surface extending substantially in a direction normal to side members 74 and base plate 62. Rear member 76 is adapted to engage the trailing edge of stack 64 so as to align each sheet of support material 34 in registration with one another. Thus, it is evident that the combination of side member 74 and rear member 76, cooperating with one another, insures that both the side edges and leading and trailing edges of stack 64 are aligned such that each sheet of support material 34 is in registration with one another. A top plate 78 is attached to the upper edge portions of side members 74 and rear member 76. Top plate 78 in conjunction with base plate 62 defines a cavity for storing stack 64. As depicted in FIG. 2, top plate 78 has a notch 80 in the region of the leading marginal edge portion thereof affording access to the uppermost sheet of stack 64. This enables successive uppermost sheets 34 to be withdrawn from the cavity defined by top plate 78 and base plate 62. Flexible sheet 66 is, preferably, made from a fibrous material which may be conductive to ground static charge thereon. One suitable flexible sheet material is plain paper amongst others. Flexible sheets 66 is adapted to cooperate with non-fibrous support material 34 to provide sequential feeding of single sheets preventing machine jams and insuring proper operation of the electrophotographic printing machine depicted in FIG. 1.

While the invention has been described in connection with a container having a separate base plate with the side and rear members attached thereto, one skilled in the art will appreciate that the invention is not necessarily so limited and that the container may be made from sheet metal or plastic in which the base plate side members and rear member are formed from a single sheet wherein the side and rear member are bent in an upwardly direction from the base plate.

Referring now to FIG. 3, container 38 is depicted therein in cooperation with feed roll 40 and retard roll 42. Notched portion 80 of top plate 78 enables feed roll 40 to have access to the upper surface of the uppermost sheet 34 of stack 64 disposed on base plate 62. Feed roll 40 is adapted to rotate in the direction of arrow 82. Flexible sheet 66 is bent into an arcuate configuration and interposed between retard roll 42 and feed roll 40. As feed roll 40 rotates in the direction of arrow 82, it advances the uppermost sheet into the nip between retard roll 42 and feed roll 40 over flexible sheet 66. The utilization of fibrous flexible sheet 66 prevents multiple sheet feeding and permits only a single sheet to pass over flexible sheet 66 between feed roll 40 and retard roll 42.

From the foregoing, it is apparent that the container of the present invention cooperates with the feeding mechanism of an electrophotographic printing machine to insure seriatim feeding of successive uppermost sheets from a stack of sheet material disposed in the container. In particular, the container is adapted to feed successive non-fibrous sheets. Hence, the apparatus of the present invention facilitates the automatic sheet feeding of successive non-fibrous sheets of support material adapted to be utilized in an electrophotographic printing machine for the formation of colored transparencies.

It is, therefore, evident that there as been provided in accordance with the present invention, a container cooperating with a sheet feeding mechanism for preventing multiple feeding of sheets from a stack that fully satisfies the objects, aims and advantages set forth above. While this invention has been described in conjunction with a specific embodiment thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, it is intended to embrace all alternatives, modifications and variations that fall within the spirit and broad scope of the appended claims.

What is claimed is:

1. An apparatus for separating and feeding successive single sheets from a stack of sheet material, including:

a rotary driven feed roll, said feed roll being adapted to engage the upper surface of successive uppermost sheets in the stack of sheet material;

a retard roll cooperating with said feed roll for seriatim feeding of successive uppermost sheets from the stack;

a base plate defining a generally planar surface for supporting the stack; and

a flexible sheet having one marginal edge portion thereof secured to the leading edge portion of said base plate, said flexible sheet extending in a substantially outwardly direction beyond said base plate and being interposed between said feed roll and said retard roll such that a portion of the upper surface thereof engages the undersurface of successive uppermost sheets advancing from the stack disposed on said base plate.

2. An apparatus as recited in claim 1, further including a registration member extending substantially in an upwardly direction from base plate, said registration member having a first portion defining a generally planar surface engaging one side edge portion of the stack and a second portion defining a generally planar surface extending substantially in a direction normal to the first portion thereof engaging the trailing edge portion of the stack to substantially align the sheets thereof in registration with one another.

3. An apparatus as recited in claim 2, wherein:

the first portion of said registration member includes a side member defining a generally planar surface extending substantially in a direction normal to said base plate and being affixed thereto in the region of one side marginal edge portion thereof; and

the second portion of said registration member includes a rear member defining a generally planar surface extending substantially in a direction normal to said side member and said base plate, said rear member being attached to said base plate in the region in the trailing marginal edge portion thereof.

4. An apparatus as recited in claim 2, further including a top plate attached to said registration member and having a generally planar surface extending substantially in a direction parallel to said base plate defining a cavity therebetween for storing the stack therein, said top plate having a notch in the region of the leading marginal portion thereof affording said feed roll access to the upper surface of the uppermost sheet of the stack permitting the advancement thereof from the cavity.

5. An apparatus for separating and feeding nonfibrous sheets, as recited in claim 1, wherein said flexible sheet is made from a fibrous material.

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