April 2, 1963

R. H. EICHORN

SHEET STRIPPER

3,083,962

Filed Dec. 28, 1961

5 Sheets-Sheet 1

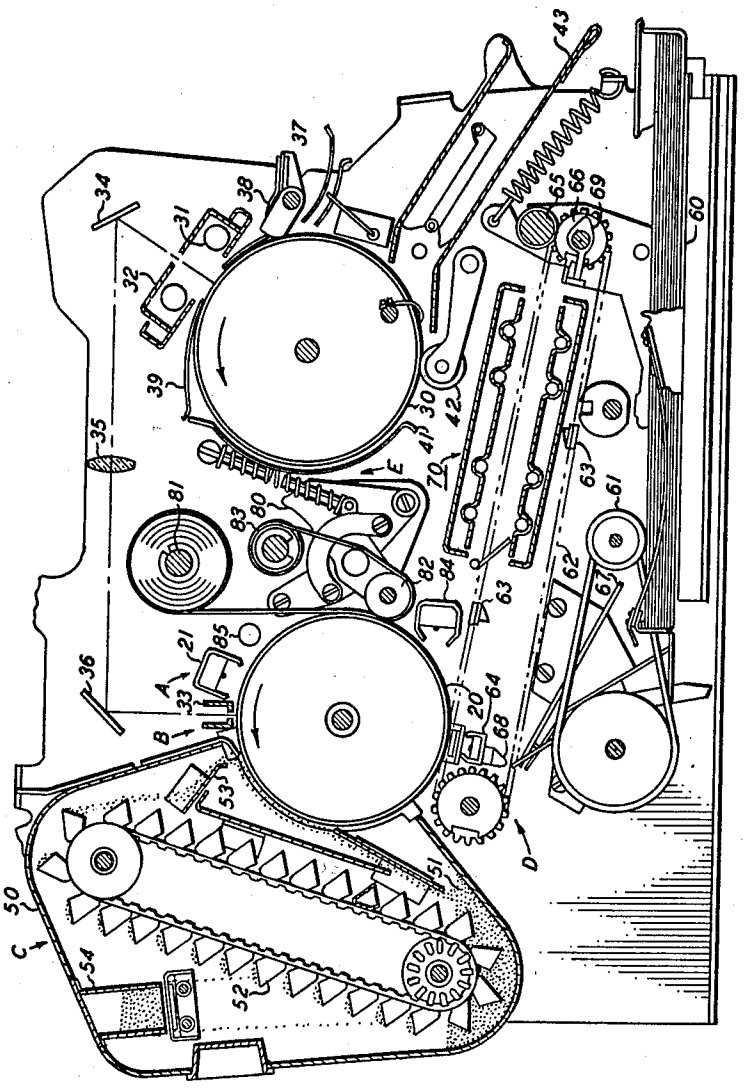


FIG. 1

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SHEET STRIPPER

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5 Sheets-Sheet 2

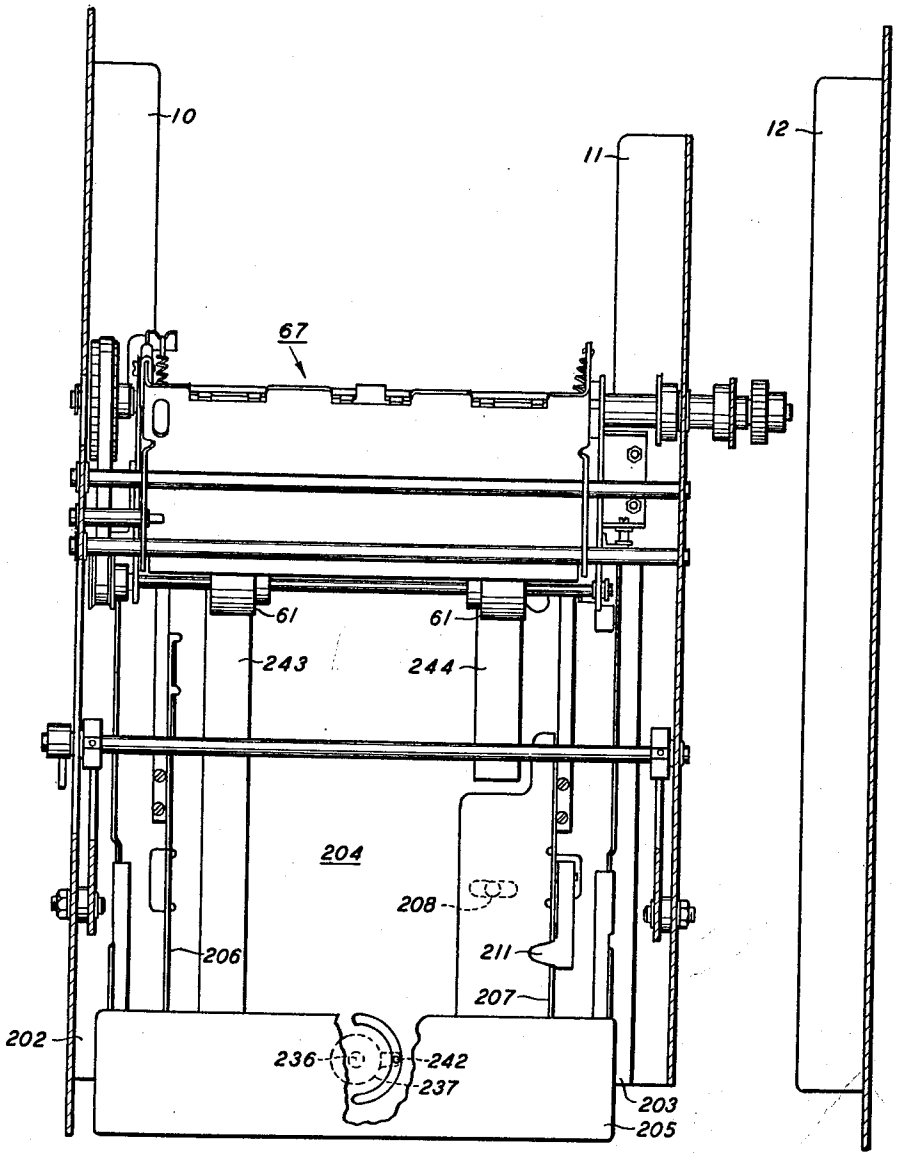


FIG. 2

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SHEET STRIPPER

Filed Dec. 28, 1961 5 Sheets-Sheet 3

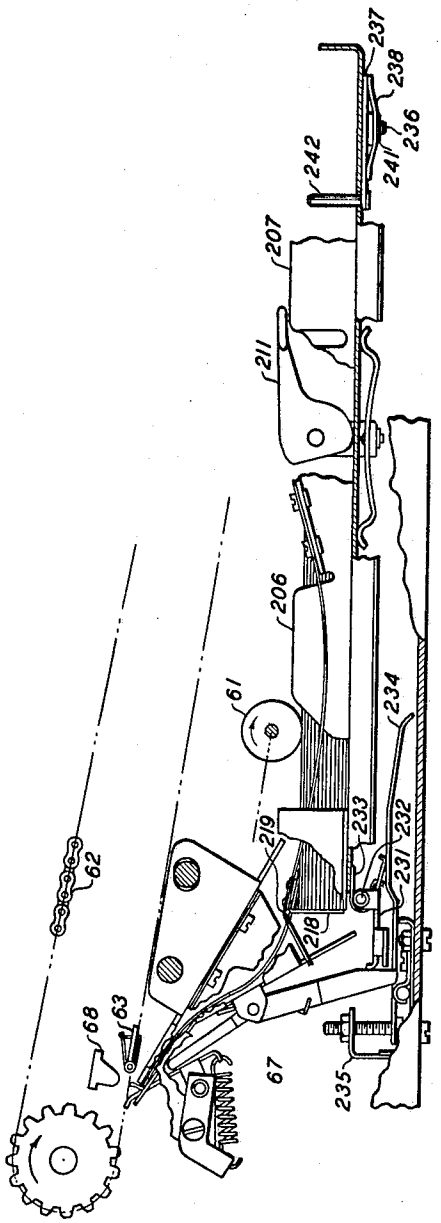


FIG. 3

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SHEET STRIPPER

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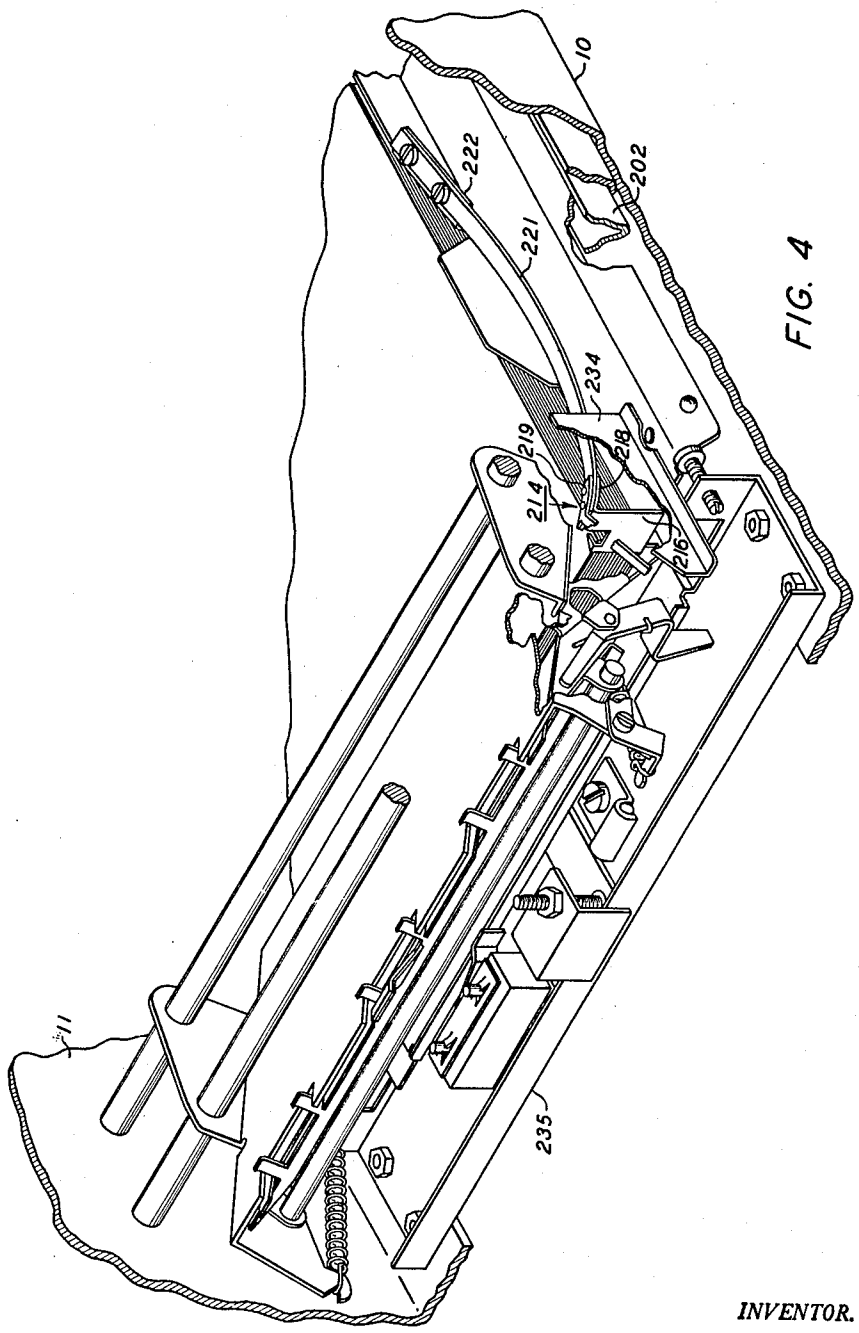


FIG. 4

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Filed Dec. 28, 1961

5 Sheets-Sheet 5

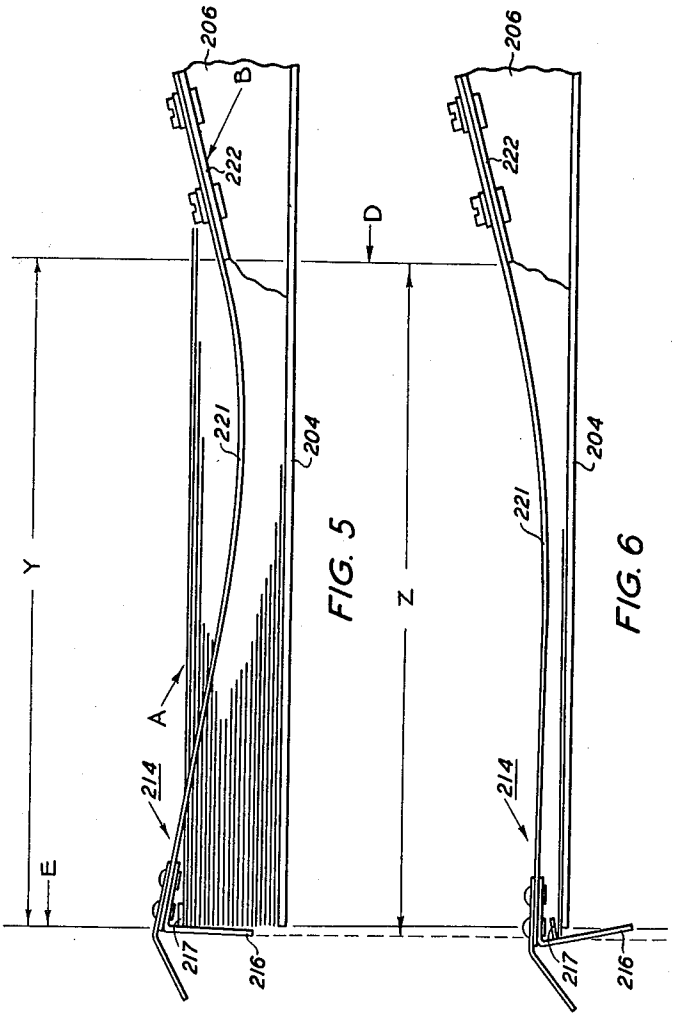


FIG. 5

FIG. 6

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United States Patent Office 3,083,962 Patented Apr. 2, 1963

3,083,962

SHEET STRIPPER

Roger H. Eichorn, Webster, N.Y., assignor to Xerox Corporation, Rochester, N.Y., a corporation of New York

Filed Dec. 28, 1961, Ser. No. 162,855
2 Claims. (Cl. 271—36)

This invention relates in general to a sheet feeding mechanism and, in particular, to a device for causing a single sheet to be separated and advanced from a stack or pile of sheets.

More specifically, the invention relates to a sheet separator or stripper pin for use in a sheet feeding device of the type in which sheets of a stack of pile of sheets are fed from the top one by one.

It is well known that the separation and feeding of sheets seriatim from a stack or pile of sheets presents many problems due to the difference in the size, weight, stiffness and the surface characteristics of the paper which must be conveyed by the sheet feeding mechanism in a particular machine. It is also well known that for a given type of sheets, the characteristics of the sheets will be effected by variations in humidity and electrostatic conditions in the area in which the sheets are stored.

It is therefore, the principal object of this invention to improve sheet separators for a sheet feeding mechanism whereby the topmost sheet is separated from the remaining sheets of a stack or pile of sheets.

Another object of this invention is to improve sheet separators adapted to separate sheets from a stack of sheets independently of the characteristics of the sheets or the height of the stack.

For a better understanding of the invention as well as other objects and further features thereof, reference is had to the following detailed description of the invention to be read in connection with the accompanying drawings, wherein:

FIG. 1 illustrates schematically an automatic xerographic reproducing apparatus having a sheet feeding mechanism using a preferred embodiment of the separator or stripper pin of the invention;

FIG. 2 is a top view of a portion of the sheet feeding mechanism of the xerographic apparatus and specifically a top view of the paper tray assembly including separator or stripper pins constructed in accordance with the invention;

FIG. 3 is a side view of the paper tray, separator or stripper pin and associated elements of the paper feed system partly in section;

FIG. 4 is a perspective view of the paper tray, the left hand separator or stripper pin associated elements; and,

FIGS. 5 and 6 are enlarged views of a sheet separator or stripper pin in position on a full stack of sheets, and in position on the last sheet of a stack, respectively.

General

As shown, the xerographic apparatus comprises a xerographic plate including a photoconductive layer of light-receiving surface on a conductive backing and formed in the shape of a drum, generally designated by numeral 20, which is journaled in the frame of the machine, formed by frame plates 10, 11 and 12 held in spaced relation to each other by tie rods, not shown. The xerographic plate is rotated in the direction indicated by the arrow to cause the drum surface sequentially to pass a plurality of xerographic processing stations.

For the purpose of the present disclosure, the several xerographic processing stations in the path of movement

of the drum surface may be described functionally, as follows:

A charging station, at which a uniform electrostatic charge is desposited on the photoconductive layer of the xerographic drum;

An exposure station, at which a light or radiation pattern of copy to be reproduced is projected onto the drum surface to dissipate the drum charge in the exposed areas thereof and thereby form a latent electrostatic image of the copy to be reproduced;

A developing station, at which a xerographic developing material including toner particles having an electrostatic charge opposite to that of the electrostatic latent image are cascaded over the drum surface, whereby the toner particles adhere to the electrostatic latent image to form a xerographic powder image in the configuration of the copy to be reproduced;

A transfer station, at which the xerographic powder image is electrostatically transferred from the drum surface to a transfer material or support surface; and,

A drum cleaning station, at which the drum surface is first charged and then brushed or wiped to remove residual toner particles remaining thereon after image transfer, and at which the drum surface is exposed to a relatively bright-light source to effect substantially complete discharge of any residual electrostatic charge remaining thereon.

The charging station is preferably located as indicated by reference character A in the schematic illustration of the apparatus. In general the charging apparatus or corona charging device 21 includes a corona discharge array of one or more discharge electrodes that extend transversely across the drum surface and are energized from a high potential source and are substantially enclosed within a shielding member.

Next subsequent thereto in the path of motion of the xerographic drum is an exposure station B. This exposure station may be one of a number of types of mechanisms or members such as desirably an optical scanning or projection system, or the like, designed to project a line copy image onto the surface of the photoconductive xerographic drum from a suitable original.

The optical scanning or projection assembly consists of a copyboard in the shape of a drum, hereinafter referred to as copy drum 30, which is adapted to support copy to be reproduced and arranged to rotate in light-projection relation to the moving light receiving surface of the xerographic plate. Uniform lighting is provided by suitable lamps 31 attached to a slotted light reflector 32 mounted adjacent to the copy drum.

A slotted light shield 33, adapted to protect the xerographic plate from extraneous light, is positioned adjacent to the surface of the xerographic plate. A slot aperture in the light shield extends transversely to the path of movement of the light-receiving surface of the xerographic drum 20 to permit reflected rays from the copy drum to be directed against a limited transverse area of the light receiving surface as it passes thereunder.

To enable the optical system to be enclosed within a relatively small cabinet, a folded optical system including an object mirror 34, a lens 35, and an image mirror 36, is used in the preferred embodiment of the apparatus.

A document fed through document guides 37 to the copy drum is removably secured thereon by a suitable gripper mechanism for movement therewith in timed relation to the movement of the xerographic drum whereby a flowing image of the copy is projected onto the xerographic drum. The copy is held against the surface of the copy drum until gripped by means of document retaining guides 38. Pressure guides 39 and document

guard 41 retain and guide the trailing edge of the document on the copy drum. After the copy is scanned it is released from the copy drum to be transported out of the machine by the copy drum and document feed out rollers 42 through document feed out guide 43.

Adjacent to the exposure station is a developing station C in which there is positioned a developer apparatus 50 including a developer housing having a lower or sump portion for accumulating developer material 51. Mounted within the developer housing is a driven bucket-type conveyor 52 used to carry the developer material previously supplied to the developer housing to the upper portion of the developer housing from where the developer material is cascaded over a hopper chute 53 onto the drum.

As the developer material cascades over the drum, toner particles of the developer material adhere electrostatically to the previously formed electrostatic latent image areas on the drum to form a visible xerographic powder image; the remaining developer material falling off the peripheral surface of the drum into the bottom of the developer housing. Toner particles consumed during the developing operation to form the xerographic powder images are replenished by a toner dispenser 54, of the type disclosed in copending application Serial No. 776,976 now U.S. Patent No. 3,013,703, filed November 28, 1958, in the name of Robert A. Hunt, mounted within the developer housing.

Positioned next adjacent to the developing station is the image transfer station D which includes suitable sheet feeding mechanism adapted to feed sheets of paper successively to the xerographic drum in coordination with the presentation of the developed image on the drum at the transfer station. The sheet feeding mechanism includes a sheet source such as paper tray 60 for a plurality of sheets of a suitable support material, that is, sheets of paper or the like, separator rollers 61 adapted to feed the top sheet of the stack of support material through a guide 67 to a sheet conveyor mechanism 62 having paper grippers 63 thereon which carry the sheet support material into contact with the rotating xerographic drum in coordination with the appearance of a developed image at the transfer station.

The transfer of the xerographic powder image from the drum surface to the support material is effected by means of a corona transfer device 64 that is located at or immediately after the point of contact between the support material and the rotating xerographic drum. The corona transfer device 64 is substantially similar to the corona discharge device that is employed at the charging station in that it also includes an array of one or more corona discharge electrodes that are energized from a suitable high potential source and extend transversely across the drum surface and are substantially enclosed with a shielding member. In operation, the electrostatic field created by the corona transfer device is effective to tack the transfer material electrostatically to the drum surface and simultaneously with the tacking action, the electrostatic field is effective to attract the toner particles comprising the xerographic powder image from the drum surface and cause them to adhere electrostatically to the surface of the support material.

As the paper gripper mechanism continues to move forward in its closed circuit, it will strip the support material from the xerographic drum and carry it to a fixing device, such as, for example, heat fuser 70, whereat the developed and transferred xerographic powder image on the support material is permanently fixed thereto.

After fusing, the finished copy is preferably discharged from the apparatus at a suitable point for collection externally of the apparatus. To accomplish this there is provided a pair of delivery rolls 65 and 66 by means of which the copy is delivered from the apparatus after it is released by the gripper mechanism. Suitable cam means 68 and 69 are provided at the receiving and delivery stations of the conveyor mechanism respectively, to actuate the paper gripper at these stations to receive or discharge a sheet of support material.

The next and final station in the device is a drum cleaning station E whereat any powder remaining on the xerographic drum after the transfer step is removed and whereat the xerographic drum is flooded with light to cause dissipation of any residual electrical charge remaining on the xerographic drum.

To aid in the removal of any residual powder remaining on the xerographic drum there is provided a corona precleaning device 84 that is substantially similar to the corona discharge device that is employed at charging station A. Removal of residual powder from the xerographic drum is effected by means of a web cleaner device 80 adapted to continuously feed a clean fibrous web material into wiping contact with the xerographic drum. As shown, the web material 55 is taken from a supply roll 81 and transported around a cleaning or pressure roll 82, preferably made of rubber, onto a take-up or rewind roll 83.

Any residual electrical charge remaining on the xerographic drum is dissipated by light from a fluorescent lamp 85 mounted in a suitable bracket above the xerographic drum, a suitable starter and ballast being provided for energizing the fluorescent lamp.

Suitable drive means drive the xerographic drum, the copy drum, the sheet conveyor mechanism at predetermined speeds relative to each other, and to effect operation of the paper separator roll, and the web cleaner mechanism, the latter being driven at a speed or speeds whereby relative movement between the xerographic drum and the web material is effected. Suitable drive means are also provided for effecting operation of the conveyor mechanism and toner dispenser of the developing apparatus assembly.

It is believed that the foregoing description is sufficient for the purpose of this application to show the general operation of a xerographic reproducing apparatus and the sheet feeding mechanism thereof. For further details concerning the specific construction of the xerographic apparatus shown, reference is made to copending application Serial No. 162,779, filed concurrently herewith on December 28, 1961, in the name of Roger H. Eichorn et al.

Paper Feed System

The sheet feeding mechanism is positioned at the transfer station of the xerographic apparatus for seriatim feeding of cut sheet support material, such as paper or the like, into contact with the xerographic drum so that the developed powder image on the surface of the drum can be transferred to the support material. The sheet feeding mechanism consists of a tray 60 for holding a supply of cut sheet support material, separator rollers 61 for separating a single sheet of support material from the tray and forwarding it to a guide having a receiving slot in the front thereof and a movable gate to block the receiving slot so that the sheet can be arrested and held for delivery by a sheet conveyor mechanism.

The sheet of support material forwarded into the guide by the separator rollers is advanced by a sheet conveyor mechanism into contact with the xerographic drum adjacent to the corona transfer device whereat the powder image previously formed on the drum is transferred from the drum to the sheet of support material, the sheet of support material then being forwarded by the conveyor mechanism to the heat fuser for fusing of the powder image onto the sheet, and then to a set of delivery rolls which deliver the sheet of support material from the machine.

A supply of cut sheet support material such as paper, to be fed one at a time to the sheet conveyor 62 is held in a paper tray 60 movably positioned at the front of the machine between the frame plates 10 and 11 by means of a pair of suitable slides 202 and 203, so that the paper tray

can be extended beyond the outer margin of the cabinet of the machine for loading.

The paper tray **60** includes a platform or support **204** for the paper. The platform is formed with a turned up portion at one end to support hinged cover plate **205**. Left-hand guide **206** and right-hand paper guide **207** are positioned to extend across the length of the platform to align the left-hand and right-hand side margins, respectively, of a stack placed on the platform.

In the embodiment shown, the left-hand paper guide **206** is secured, as by welding, to the platform. The right-hand paper guide **207** is provided with a lateral leg adapted to rest on the platform **204**. A depending pin **208**, secured to the lateral leg of this guide, extends through a suitable elongated slot in the platform to permit lateral movement of the guide to accommodate various width sheets. The right-hand paper guide is releasably locked in position on the platform by actuation of a cam lever **211**. The cam lever **211** is pivotably secured to one end of a cam bracket **212**. The cam bracket **212**, which extends through an aperture in the platform, has a leaf spring **213** secured to its opposite end. As the cam lever is rotated to lock the right-hand guide, the cam portion of the cam lever will strike the platform to cause the cam bracket to rise, thus forcing the leaf spring into contact with the underside of the platform.

In feeding sheets from a stack one at a time, as the topmost sheet is advanced forward, the movement of the topmost sheet will tend to advance the second sheet also. In order to ensure separation of the topmost sheet only from the stack, there is provided at opposite corners of the stack, separators of snaps **214** and **215**, sometimes referred to as stripper pins, which apply a restraining force on the topmost sheet and leading edge of the paper stack. The downward restraining force exerted by the separators or snaps must be small to permit the topmost sheet to be advanced from under the separators or snaps.

If the paper stack is forced too tightly against the stop portion of the snap, the snap may be prevented from following the stack as each sheet is fed because the downward force exerted by the snap is not sufficient to move the stack. When this occurs, the snap remains jammed against the stack and will eventually cease to function to prevent misfeeding or a double feeding of sheets from the stack.

Since the separators or snaps **214** and **215** are formed complementary to each other, it is believed necessary to describe only one of the separators or snaps in detail.

The separator or snap **214** includes a depending stop portion **216**, which in its normal operative position, as shown in FIG. 4, constitutes a stop for the leading edges of the sheets forming the stack, a rearwardly extending leg **217** extending from the stop portion to rest on the topmost sheet of the stack, and a support portion **218** used to fasten the snap to its support arm. These elements of the separator or snap are formed either as a unitary structure from sheet metal, as shown, or as separate elements secured together.

The separator or snap **214** and a finger **219**, described in detail hereinafter, are secured to the free end of a support arm **221**, which in the embodiment shown is a leaf spring. The opposite end of the leaf spring is fixed to a spring mount **222** which may be formed as an integral part of a paper guide, as shown, or as a separate element secured to the platform of the paper tray.

The spring mount **222** has a support surface thereon to which the leaf spring is secured, the support surface being inclined at an angle to intersect the plane of the platform behind its left-hand end, as seen in FIGS. 3, 5 and 6. The point of intersection of the plane of the support surface with the plane of the platform should be a short distance behind, in reference to the path of travel of a sheet as it is advanced from the paper tray, the leading edge of the bottommost sheet of a stack supported in the paper tray.

With this mounting arrangement, the leaf spring **221** will always be bent or deflected in a slight arc even when the paper tray is empty. The leaf spring will always bias the separator or snap downward. The difference in force applied to the snap when the leaf spring is bent to accommodate a full stack, as compared to the force applied to the snap when the leaf spring is bent to accommodate the last sheet of a stack, is within an acceptable limit for proper functioning of the snap.

The stationary part of the leaf spring is secured to its spring mount **222** on the paper guide, whereby the fixed portion of the leaf spring is positioned above the plane of the platform so that the point of deflection of the free end of the leaf spring is above the platform. By mounting the leaf spring at an angle to intersect the plane of a platform, the radius of the arc or effective path traveled by the snap from a full stack position to an empty stack position will continuously increase.

With this arrangement, the snap will travel in a path to increase the effective distance from the snap to the fixed end of the leaf spring. Thus, the snap will always move away from the front or leading edge of the stack by a small margin, as successive sheets are fed, to prevent the snap from binding against the leading edge of the stack.

In operation, as the topmost sheet is advanced by the separator rollers, the leading edge corners of the sheet engage the snaps whereupon the sheet will buckle. This buckling action of the topmost sheet insures its separation from the underlying sheets in the stack. The first two or three sheets beneath the uppermost sheet being advanced will also move forward to contact the snap, but the frictional force applied by these few sheets against the snap will not be sufficient to render the snap inoperative for those intended purposes.

Referring now to FIG. 5, which illustrates the leaf spring bent to accommodate a full stack of paper, and FIG. 6, which illustrates the position of the spring when the tray is empty, reference A represents the paper stack, reference **222** the spring mounting, and **214** the snap. Line D is a vertical line extending from the corner edge of the spring mount **222** controlling the spring deflection. The distance measured horizontally from line D to the line E extending vertically from the snap when positioned on a full stack is represented by Y. The distance from line D to the line extending vertically from the snap when in contact with the platform when the tray is empty is represented by Z. The distance Y is less than the distance Z because of the angle relationship between the spring mount and the platform, the spring mount being positioned above the platform, as shown.

This change in the path traveled by the snap away from the leading edge of the stack as represented in FIG. 5 to its position shown in FIG. 6, is expressed as distance F.

Inasmuch as it usually requires a bottom sheet of a stack to travel further to its point of delivery than the top-most sheet of a stack, the above-described action of the snap allows the lower sheets of the stack to advance slightly more than the uppermost sheets. This slight proportional movement of successive sheets in the stack tends to equalize the distance that the respective sheets must be advanced by the separator rollers.

Vertical guards **223**, only the left-hand one being shown, are secured to opposite sides of the platform to protect the separators or snaps when the paper tray is removed from the machine.

To align the leading edges of the sheets prior to the engagement of the snaps or separators thereon, there is provided a gate **231** pivotally mounted on rod **232** secured to depending legs on the left-hand end of the paper tray as seen in FIG. 3. Torsion springs **233** are mounted on the rod to normally bias the gate into a vertical position. A depending finger portion on the gate is postioned to engage a cam **234** secured to a bracket **235** extending between frame plates **10** and **11** so that when the paper tray is advanced to its operative position as shown in

FIG. 3 the gate is forced to swing downward, out of interference relationship with the sheets in the paper tray so that they may be advanced by the separator rollers **61** into the guide **67**.

The fingers **219**, on the separators or snaps **214** and **215**, are positioned to engage the gate **231**. Thus, as the gate is biased by the torsion springs **233** into an upright position, the fingers are cammed up by the gate, automatically lifting the separators or snaps higher than the predetermined height of the stack of paper to be loaded. As the paper tray is advanced to its operative position, the gate **231** is lowered thereby dropping the separators or snaps onto the stack. The leading edge of the stack is originally aligned by the gate **231**, but when the gate is lowered, the leading edge of the sheets will be held in alignment by the separators or snaps, as previously described.

A depending pin **236** is secured to the bottom front end of the platform, with respect to the machine, to pivotably support a disc **237**. The disc **237** is yielding biased against the platform by spring **238** secured to the pin **236** by retaining ring **241** positioned in a suitable groove formed in the pin.

A stop stud **242**, secured to the disc **237**, extends through an arcuate slot formed in the platform concentric with the axis of pin **236**. The stop stud is used as an adjustable stop against the trailing edge of the stack and as a compensating means for adjustment to various paper lengths.

Friction pads **243** and **244**, usually made of rubberized cork or similar material, are suitably secured to the platform to prevent the bottom sheet of a stack from sliding before it is ready to be fed by the separator rollers.

While the invention has been described herein with reference to a xerographic machine and a specific sheet feeding mechanism, it is not confined to the details set forth, since it is apparent that the sheet separator or stripper pin of the invention could be used in other types of reproducing machines and in connection with other forms of sheet feeding mechanism. Therefore, this application is intended to cover such modifications or changes as may come within the purpose of the improvements or the scope of the following claims.

What is claimed is:

1. In a sheet feeding device having a platform for a stack of sheets,

means for feeding the topmost sheet from the stack of sheets, and at least one substantially upright margin guide on the platform for aligning the side margin of a stack of sheets;

the improvement including a spring mount secured to said upright margin guide,

said spring mount having a support surface positioned above the plane of said platform,

a leaf spring secured at one end to said support surface and having its other end free,

a snap secured to the free end of said leaf spring,

said snap having a narrow depending front stack engaging stop portion thereon and a rearwardly extending lip portion adapted to rest on the top sheet of a stack,

said support surface of said spring mount being inclined at an angle to intersect the plane of said platform rearwardly of said stop portion of said snap.

2. In a sheet feeding device having a platform for a stack of sheets,

means for feeding the topmost sheet from the stack of sheets, and at least one substantially upright margin guide on the platform for aligning the side margin of a stack of sheets,

the improvement including a spring mount secured to said upright margin guide,

said spring mount having a support surface positioned above the plane of said platform,

a leaf spring having an end portion secured to said support surface and an unsecured portion,

a snap secured to the unsecured portion of said leaf spring,

said snap having a narrow depending front stack engaging stop portion thereon and a rearwardly extending lip portion adapted to rest on the top sheet of a stack,

said support surface of said spring mount being inclined at an angle to intersect the plane of said platform rearwardly of said stop portion of said snap whereby said leaf spring will always be deformed to bias said rearwardly extending lip portion of said snap against the topmost sheet of a stack of sheets.

No references cited.