# United States Patent

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[54] DOCUMENT FEED APPARATUS
1 Claim, 3 Drawing Figs.


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[51] Int. Cl. ..... B65h 9/04
[50] Field of Search ..... 271/53, 60



[56] References Cited
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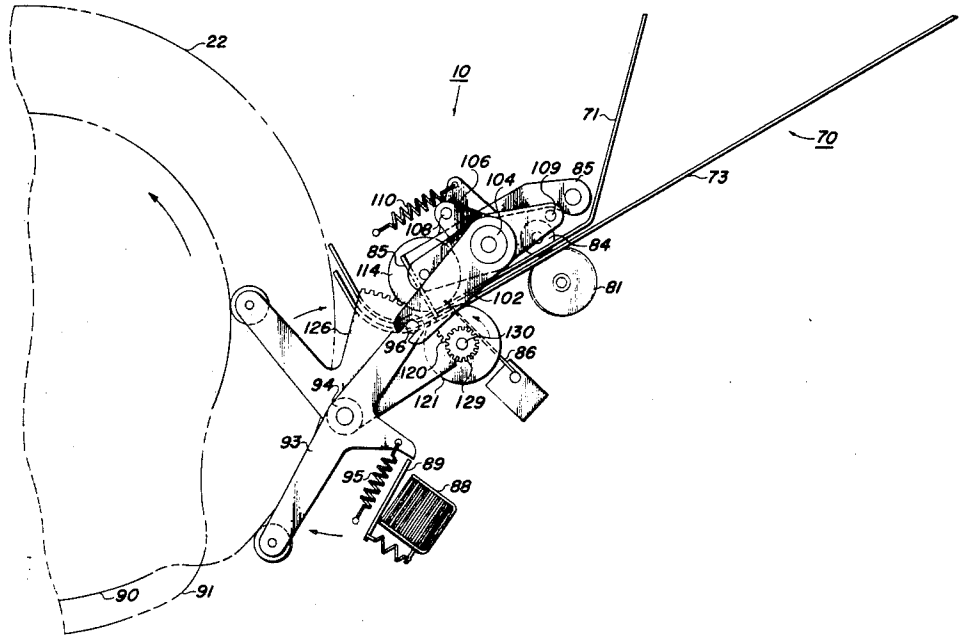
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**ABSTRACT:** Document feed apparatus for feeding documents onto a moving copy drum in proper registration and at a proper interval to enable the document to be secured on the copy drum. The documents are fed into a chute which advances them to a gate where they are held until ready to be received by the copy drum. At this time the gate is lifted and document advanced by feed rolls in response to cam-actuated devices timed with the movement of the copy drum.

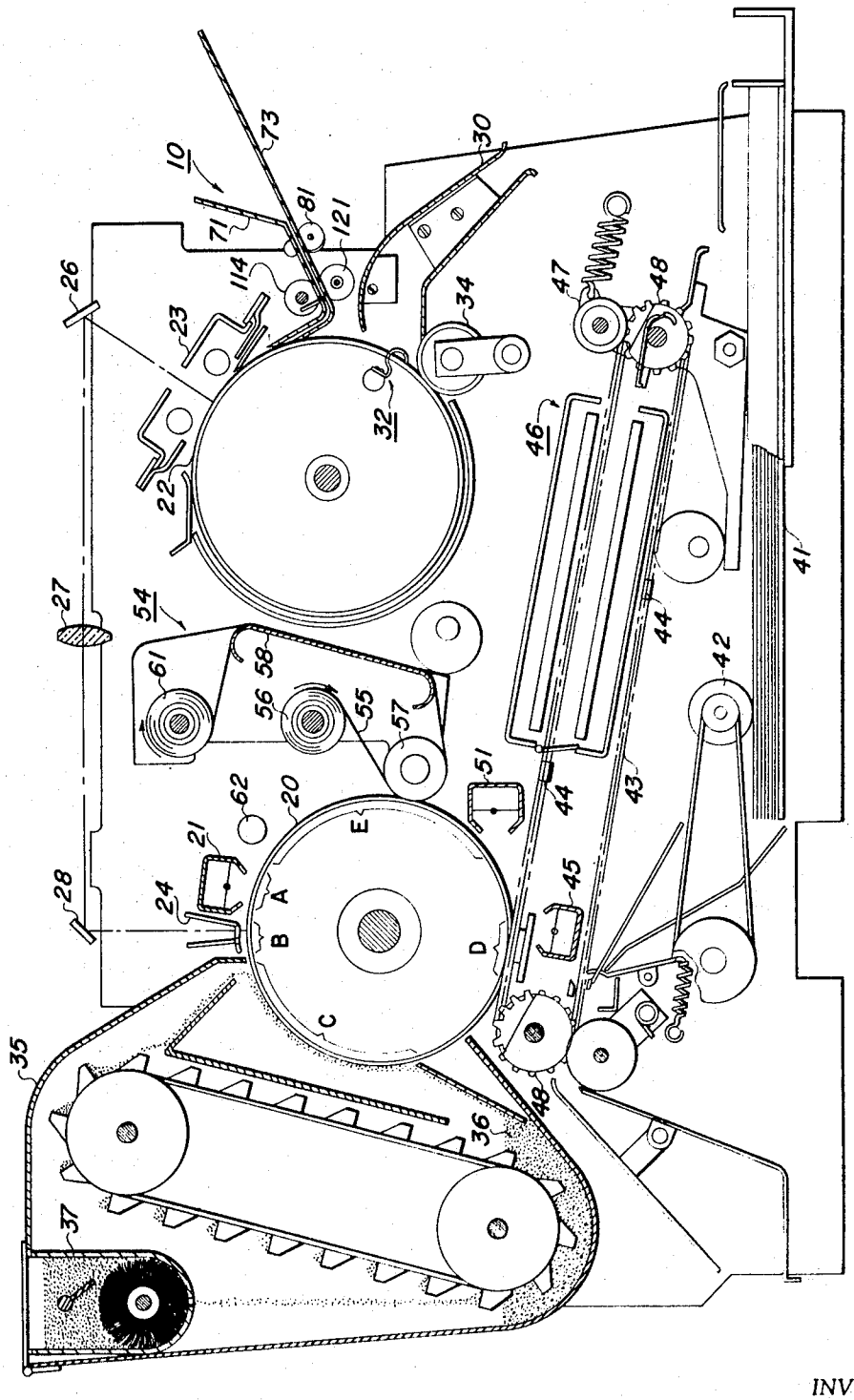



FIG. 1

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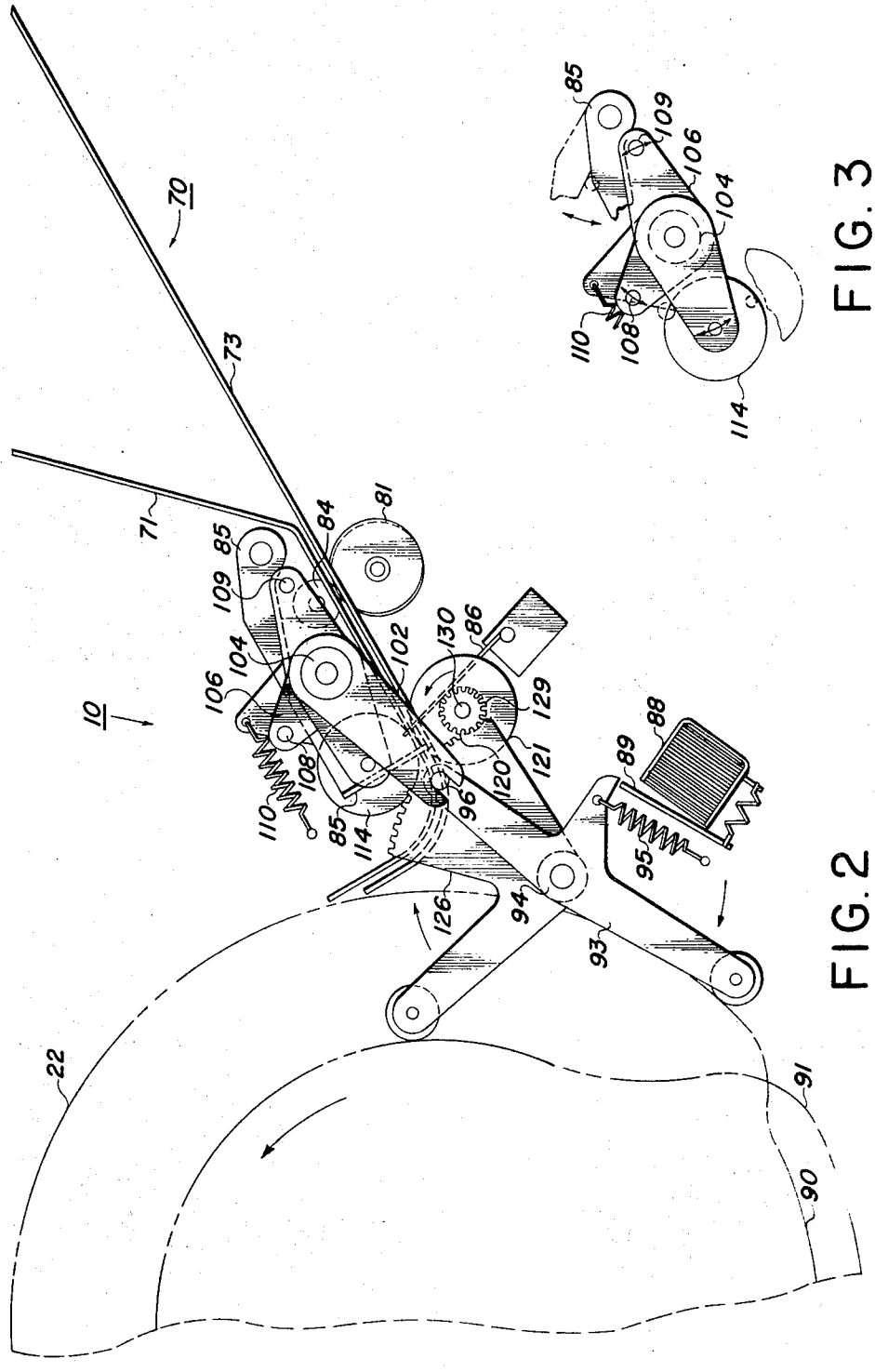

70
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71
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109
106
104
108
110
114
84
81
102
130
86
129
121
120
96
88
89
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94
93
126
22
91
90

FIG. 2


85
109
106
104
110
108
114

FIG. 3

# DOCUMENT FEED APPARATUS

This invention relates to a document feed apparatus for transporting a document or original to be reproduced, as for example, by a xerographic reproducing machine.

More specifically, the invention relates to an improved document feed apparatus enabling placement of the document onto a copy drum having clamping means or grippers by which a document may be releasably secured on the copy drum so as to be carried around thereby and so as to be released from the copy drum when desired, and a document registration and holding device adapted to facilitate the registration and loading of documents onto the copy drum.

Both in the printing art and in the document reproducing art, various devices have been designed and constructed by means of which thin flexible sheets, such as documents or sheets of paper, are carried in a circular path by means of a blanket cylinder, or copy drum. Also in these machines, various devices have been used to permit the releasable securing of a flexible sheet onto the drum or cylinder and to permit the release of these sheets from the drum or cylinder when desired.

In these prior art devices, wherein a document or other sheet material is carried by a copy drum or cylinder, the document, which is usually presented manually to the machine had to be held in a loading position until the very instant that it is picked up by the grippers on the copy drum. However, since the copy drum is usually positioned within the machine, out of sight of the operator, it is difficult for the operator to judge when to release the document to the copy drum. If the operator releases the document too soon it may not be gripped in proper registration on the copy drum, whereas if the operator holds onto the document too long, the document may be pulled from the copy drum and torn in the process.

It is, therefore, the principal object of this invention to improve document feed apparatus to position a document on a rotating copy drum without the necessity of stopping the copy drum.

Another object of this invention is to improve registration and holding devices to provide accurate and safe feeding of documents or other sheet material to a copy drum or cylinder conveyor.

A still further object of the invention is to enable the locating and holding of a document in a loading position for attachment to a copy drum or other cylindrical conveyor.

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 is a schematic illustration of a xerographic machine utilizing the document feed apparatus of the present invention;

FIG. 2 is a side-sectional view of the document feed apparatus according to the present invention; and

FIG. 3 is an enlarged view illustrating details of the gate left mechanism.

There is shown in FIG. 1 a xerographic reproducing apparatus used for producing xerographic reproductions from a moving original fed by feed apparatus according to the present invention generally designated 10.

The xerographic reproducing apparatus is adapted for installation within a suitable lighttight housing or cabinet of a size so that the entire unit may be mounted on an office desk or table. As shown, the xerographic apparatus comprises a xerographic plate including a photoconductive layer or light-receiving surface on a conductive backing and formed in the shape of a drum, generally designated by numeral 20, which is journaled in a frame to rotate 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 deposited 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 and discharge station, at which the drum surface is first charged and then brushed 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 chematic 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 22, which is adapted to support copy fed by feed apparatus 10 as will be described 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 attached to a slotted light reflector 23 mounted adjacent to the copy drum.

A light shield 24 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 therebeneath.

To enable the optical system to be enclosed within a relatively small cabinet a folded optical system including an object mirror 26, a lens 27, and an image mirror 28 is used in the preferred embodiment of the apparatus.

Copy fed by feed apparatus 10 to the copy drum is removably secured thereon by a suitable gripper mechanism 32 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 by means of guides, the latter also preventing the trailing edge of the copy from contacting the web cleaner 54. After the copy is scanned it can be released from the copy drum to be transported out of the machine by copy feed out roller 34 coacting with the peripheral surface of the copy drum to forward the copy through copy guide 30.

Adjacent to the exposure station is a developing station C in which there is positioned a developer apparatus 35 including a developer housing having a lower or sump portion for accu-

mulating developer material 36. Mounted within the developer housing is a motor-driven bucket-type conveyor 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 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 37.

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 tray 41 for a plurality of sheets of a suitable support material, that is, sheets of paper or the like, a separator roller 42 adapted to feed the top sheet of the stack of support material to a sheet conveyor mechanism 43 having paper grippers 44 thereon which carry the sheet support material into contact with 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 45 that is located at or immediately after the point of contact between the support material and the rotating xerographic drum. The corona transfer device 45 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 46, 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 47 and 48 by means of which the copy is delivered to a copy holder after it is released by the gripper mechanism. Suitable cam means are provided at the receiving and delivery stations of the conveyor mechanism 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 the removal of any residual powder remaining on the xerographic drum there is provided a corona precleaning device 51 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 54 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 56 and transported around a cleaning roll 57, preferably made of rubber, around a guide plate 58 to be wound on a takeup or rewind roll 61.

Any residual electrical charge remaining on the xerographic drum is dissipated by light from a fluorescent lamp 62 mounted in a suitable bracket above the xerographic drum, a suitable starter 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 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 purposes of this application to the general operation of a xerographic reproducing apparatus. For further details concerning the specific construction of the xerographic apparatus shown, reference is made to Eichorn et al. U.S. Pat. No. 3,099,943 issued Aug. 6, 1963.

Referring now to FIGS. 2 and 3, there is shown the feed apparatus 10 for feeding documents one at a time onto the copy drum 22 at the proper interval and in registration therewith as will become more apparent. Feed apparatus 10 comprises a feed in chute generally designated 70 which is made up of a pair of guide members 71 and 73 arranged at an angle to feed a document downwardly toward feed rollers 81 which are adapted to be constantly rotated by a suitable driving mechanism (not shown). Feed rollers 81 are canted such that when a document is dropped into the chute throat, the document is urged forwardly and to one side for side registration with the chute by the feed rollers which are contacted by pressure roll balls 84 until the document contacts a gate 85.

Positioned in the document path is a switch 86 which is coupled to the machine programmer so that when a document is moved therepast, this condition is signified to machine control to indicate that a document is ready to be fed onto the copy drum. When switch 86 is actuated and machine control has a condition calling for a document to be fed, a solenoid 88 receives a signal to actuate a clapper member 89 for the purpose to be described.

Mounted on the drum shaft are a pair of cam elements 90 and 91 which are rotated with the copy drum. The cam elements are adjustable to achieve the desired relationship of the cam surfaces with the drum rotation. A cam follower 93 follows the movement of cam element 90 and is moved clockwise on a pivot 94 by a spring member 95 connected thereto when clapper 89 is actuated. Cam follower 93 has a drive pin 96 which engages bifurcated member 102 which in turn causes a shaft 104 to rotate counterclockwise. Shaft 104 carries a pair of arm members 106 which also supports a shaft 108 and a pin 109. When shaft 104 rotates in a counterclockwise direction a pressure roll 114 is caused to be lowered against the action of a spring member 110 pinching and holding the document against a lower roll 121. Secondly, arm members 106 carrying pin member 109 cause gate 85 to be raised.

The document is now ready to be fed onto the copy drum. At this time, cam element 91 is timed with the drum rotation to cause a cam follower 126 having a segment gear portion 128 which in turn meshes with a pinion gear 129 which in turn is drivingly connected to a shaft 130 causes lower feed roller 121 to rotate thereby feeding out the document to the copy drum surface. It will be appreciated that cam element 91 is so designed that it accelerates the document movement without jerking it and that it will continue the feeding of a document at a speed slightly greater than the copy drum whereby the document is caused to buckle slightly into the gripper mechanism 32. When the document reaches the copy drum surface, the gripper mechanism will close and hold the leading edge of the

document. As soon as the document is under gripper control, the pressure roll **114** lifts due to the action of shaft **108**, and feed roller **121** is deaccelerated, and the gate **85** is lowered. At this time the feed document apparatus is ready for feeding another document which may be advanced into the chute by any suitable mechanism either automatically or by hand. A suitable control is used to open the gripper mechanism to strip the document from the copy drum as previously mentioned.

By the above invention, a feed apparatus is described which is capable of feeding document material onto a copy drum in registration and at the proper time without the necessity of stopping the copy drum. Also there is provided an improved mechanism for safely feeding the documents or other sheet material in automatic fashion into loading position and advancing these documents automatically at the proper time for being received onto the copy drum. It will be appreciated that a feed apparatus as described is greatly desirable for use with copying machines of the type described.

While the invention has been described with reference to the structure disclosed herein it is not confined to the details set forth but it is intended to cover such modifications or changes as may come within the scope of the following claims.

What is claimed is:

1. A document feed apparatus for advancing documents one at a time onto a moving rotary cylinder having a sheet gripper device adapted to cooperate with the peripheral surface of said cylinder to engage the leading edge of a document advanced thereto, the improvement comprising

a chute for receiving a document to be fed,

first roll means arranged to advance a document along a predetermined path,

gate means positioned in said path to hold the document until ready to be fed onto the moving cylinder,

second roll means positioned in document path,

cam means associated with said cylinder for movement therewith,

first cam follower means associated with said cam means for raising said gate means,

second cam follower means associated with said cam means for driving said second roll means thereby advancing the document to a position into operative relationship with the aforementioned gripper device,

switch means located in the document path before said gate means to emit signals to a control to indicate if a document is ready to be fed, and

a solenoid having a clapper member positioned in the path of said second cam follower means, said solenoid being operative when energized for moving said clapper member out of the path of said second cam follower means thereby enabling a document to be advanced.

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