Aug. 6, 1963 R. H. EICHORN 3,100,109

PAPER GRIPPER MECHANISM

Filed Dec. 23, 1960 2 Sheets-Sheet 1

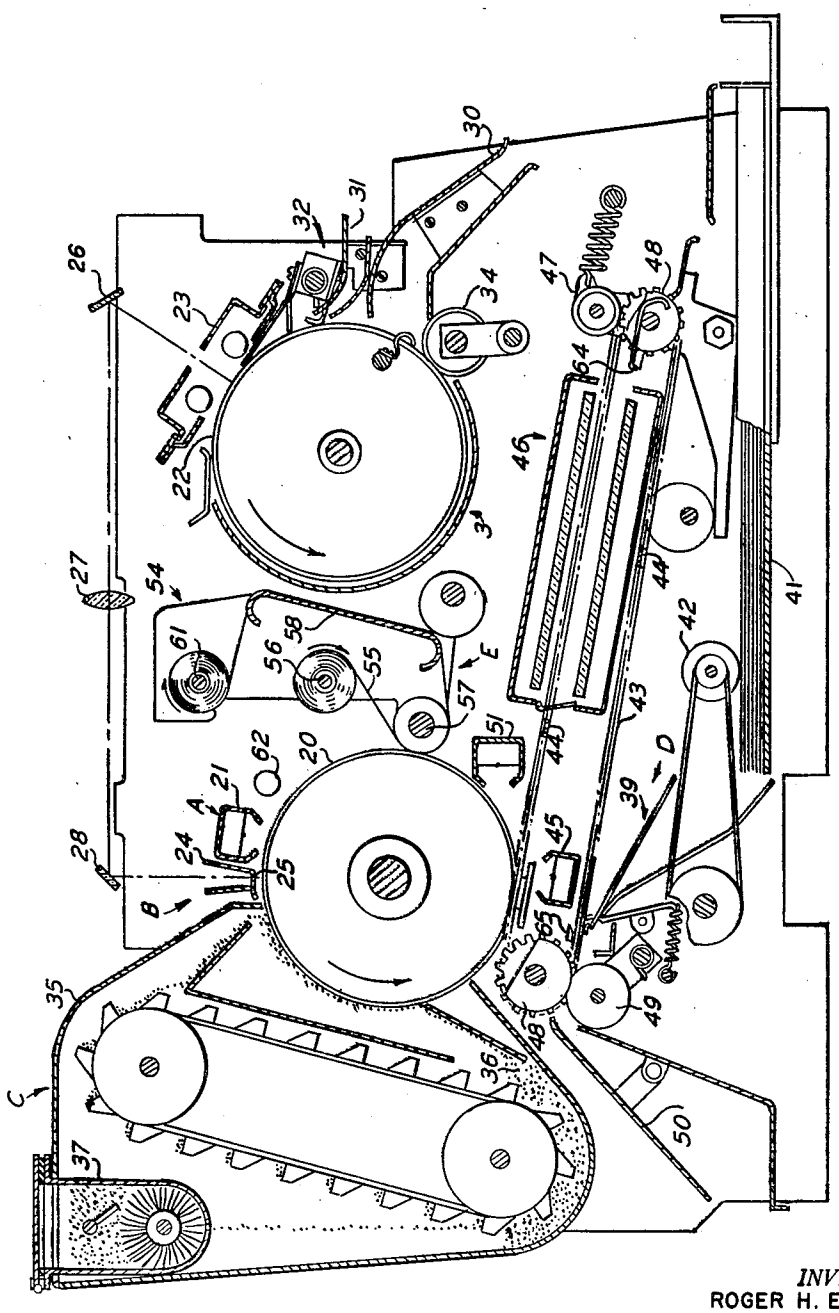



FIG. 1

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Aug. 6, 1963 R. H. EICHORN 3,100,109

PAPER GRIPPER MECHANISM

Filed Dec. 23, 1960 2 Sheets-Sheet 2

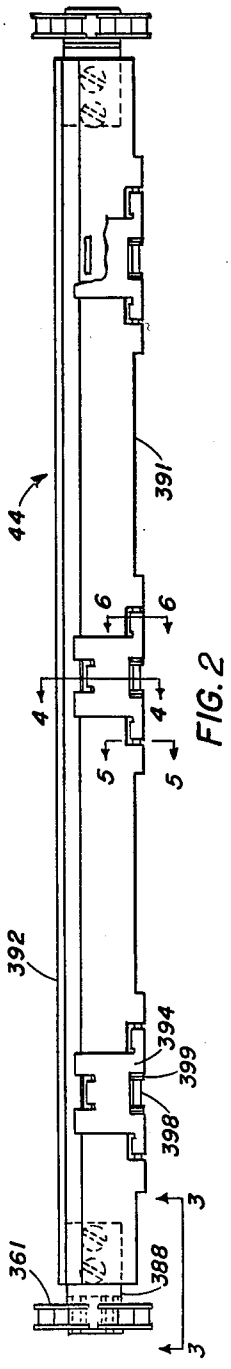



FIG. 2

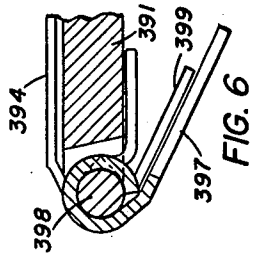



FIG. 6

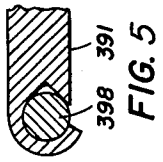



FIG. 5

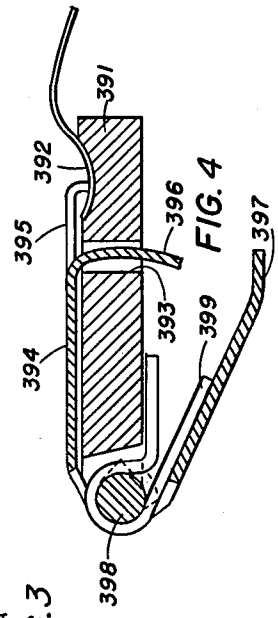



FIG. 4

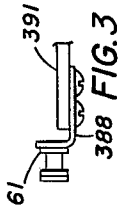



FIG. 3

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United States Patent Office 3,100,109 Patented Aug. 6, 1963



3,100,109

# PAPER GRIPPER MECHANISM

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

Filed Dec. 23, 1960, Ser. No. 77,956
8 Claims. (Cl. 270—79)

This invention relates in general to xerographic reproducing apparatus and, in particular, to a sheet gripper mechanism for a sheet conveyor to permit seriatim feeding of sheets of transfer material to a xerographic drum.

Specifically, the invention relates to an improved sheet gripper mechanism for a sheet conveyor that is particularly adapted for use in a xerographic reproducing machine, and which is also suitable for use with comparable types of devices.

In prior sheet feeding devices of the type having conveyor chains adapted for the transport of a sheet gripper device for feeding sheets of paper, or the like, to a cylinder, such as an offset cylinder in a printing press, it has been customary to provide a recess in the cylinder adapted to receive the sheet gripper so that a sheet carried thereby may be brought into contact with the cylinder.

In a xerographic reproducing apparatus of the type in which the xerographic plate is formed in the shape of a drum, it is necessary in the transfer process, when using sheet material, to bring the sheet material into contact with the peripheral surface of the xerographic plate without parts of the conveyor mechanism transporting this sheet coming into contact with the photoconductive insulating surface of the xerographic plate. Since it is desirable, for reasons which need not be described in detail herein, to have a continuous layer of photoconductive insulating material on the xerographic drum, it is apparent that a recess cannot be formed in the xerographic drum to receive the sheet gripper of a conveyor mechanism.

It is, therefore, the principal object of this invention to improve a sheet gripping device for use in the sheet feeding apparatus of a xerographic machine, the sheet gripping device being adapted for seriatim feeding of sheets to a rotating drum without the sheet gripper device contacting the xerographic drum.

Another object of this invention is to improve sheet gripping devices for use in a sheet conveyor whereby various sized sheets of paper, or like material, are conveyed into proper registered contact with a xerographic drum, or like device.

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 apparatus incorporating a sheet feed mechanism having paper gripper mechanisms constructed in accordance with the invention;

FIG. 2 is an enlarged top view of a preferred embodiment of a paper mechanism constructed in accordance with the invention;

FIG. 3 is a view of the paper gripper taken along line 3—3 of FIG. 2;

FIG. 4 is an enlarged sectional view taken along line 4—4 of FIG. 2;

FIG. 5 is an enlarged sectional view taken along line 5—5 of FIG. 2; and,

FIG. 6 is an enlarged sectional view taken along line 6—6 of FIG. 2.

Referring now to the drawings, there is shown in FIG. 1 a xerographic reproducing apparatus used for producing xerographic reproductions from a moving original.

The xerographic reproducing apparatus is adapted for installation within a suitable light-tight housing or cabinet of a size so that the entire unit may be mounted on an office desk or table.



*General*

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 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 **22**, 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 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 **26** 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 through paper guides **31** 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 by means of guides **32** and **33**, 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 accumulating 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 paritcles 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**, of the type disclosed in copending application Serial No. 77,955, filed concurrently herewith on December 23, 1960, in the name of Roger H. Eichorn and William G. Lewis, 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 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 the rotating xerographic drum in coordination with the appearance of a developer 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 or at 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 in 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 take-up 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 show the general operation of a xerographic reproducing apparatus. For further details concerning the specific construction of the xerographic apparatus shown, reference is made to copending application, Serial No. 77,954, filed concurrently herewith on December 23, 1960, in the name of Roger H. Eichorn and William G. Lewis.

Referring now to the subject matter of the invention, the paper grippers carried by the chains of the sheet conveyor are used to transport a sheet of support material into contact with the peripheral surface of the xerographic drum. Since the peripheral surface of the xerographic drum is continuous, that is, no slots are formed therein to receive the sheet grippers, the sheet grippers must be capable of advancing a sheet of support material into contact with the peripheral surface of the xerographic drum without the gripper itself coming into contact therewith. Since both of the paper grippers used in the machine are of like construction, for simplicity, only one will be described herein.

As shown in detail in FIGS. 2 to 6, inclusive, a preferred embodiment of a paper gripper **44**, constructed in accordance with the invention, consists of a gripper bar **391** of a length to extend substantially between the two roller chains **361** to be connected thereto by means of clips **388** forming part of the chains when connected thereto, as is well known in the art. The clips **388** are formed to support the gripper bar so that the top sur-

face of the gripper bar is positioned slightly below the pitch line of the chains, whereby the gripper bar as it passes beneath the xerographic drum will not contact the peripheral surface of the xerographic drum.

A concave sheet gripper jaw **392**, which may be a separate element fixed to the gripper bar or as shown formed integral therewith, extends across the rear of the gripper bar (in terms of the direction of travel of the gripper bar). The concave sheet gripper jaw is positioned to have surface contact with the leading edge of a sheet of support material as it is advanced from the paper guide **39**. The concave sheet gripper jaw cooperates with the tang portions or jaws **395** of the grippers **394** to grip a sheet of support material inserted therebetween.

Each of the grippers is mounted, by means of pins **398** suitably secured to the leading edge of the gripper bar, for movement in two directions relative to the fixed concave sheet gripper jaw **392**; that is, for movement from a first position in which the tangs or jaws of the gripper are in spaced-apart relation to the concave sheet gripper jaw to receive a sheet of support material therebetween, and for movement to a second position in which the tangs or jaws of the gripper are in engagement with the concave sheet gripper jaw or with a sheet of support material sandwiched therebetween. Springs **399** encircling the pins **398** are positioned with one end of the springs abutting the underside of the gripper bar and the other end of the springs abutting the cam follower portion **397** of the gripper to normally bias the tangs or jaws of the gripper into contact with the concave sheet gripper jaw or with a sheet of support material inserted therebetween. To prevent cocking of the grippers, each gripper is provided with a depending curved guide portion or tang **396** which is slidably received in a suitable slot **393** formed in the gripper bar **391**, the tang also serving as a guide or stop for the leading edge of the support material.

A sheet of support material gripped between the concave sheet gripper jaw and the tangs or jaws of the grippers is arched upward into contact with the drum as it passes therebeneath because of the shape of the concave sheet gripper jaw which tends to slightly bend the leading edge of a sheet as shown in FIG. 18.

Referring now to FIG. 14, a sheet of support material, such as paper, forwarded into the paper guide **39** by the action of separator roller **42** is slightly wrinkled as the separator roller continues to advance the sheet after its forward motion has been arrested by the gate **355**. Thus, as a paper gripper advances over the guide, the gate **355** will be forced open as the paper gripper strikes it and at the same time the cam followers **397** of the grippers will strike the cam **65**, fastened to cam supports **387** adjustably secured to frame plates **10** and **11**, to open the jaws of the paper gripper to receive the sheet from the paper guide **39**. Because of the slight buckle in the sheet and because at this time the separating roller is still attempting to advance the sheet, the sheet as it unbuckles will be forced between the jaws of the paper gripper so that as the cam followers of the grippers slide off the cams the jaws will close by the biasing action of the springs **399** to grip the sheet and forward it to the delivery station of the machine.

At the delivery station, the paper gripper passes between the delivery rollers **47** and **48** and as it does so, the grippers are again actuated by means of their cam followers riding over the cam **64** secured to the shoulder portions of the left-hand and right-hand conveyor supports, thereby releasing the sheet from the paper gripper for discharge from the machine.

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



What is claimed is:

1. In a sheet feeding apparatus having conveyor chains adapted to transport a sheet gripping device from a sheet receiving station to a sheet delivery station, wherein the sheet gripping device includes a gripper bar secured to said conveyor chains transversely therebetween, a sheet gripper jaw portion on said gripper bar serving as a common lower gripper jaw, a plurality of grippers pivotably secured on said gripper bar, each of said grippers being pivotally mounted on said gripper bar, each of said grippers having jaw portions thereon adapted to cooperate with said sheet gripper jaw portion to grip a sheet therebetween, and cam follower portions on each of said grippers adapted to be actuated by cams located adjacent and between said conveyor chains at said sheet receiving station and said sheet delivery station, and springs operatively connected to said gripper bar and to each of said cam follower portions of said grippers to normally bias said jaw portions of said grippers into cooperative engagement with said sheet gripper jaw.

2. In a sheet feeding apparatus having conveyor chains adapted to transport a sheet gripping device from a sheet receiving station to a sheet delivery station, wherein the sheet gripping device includes a gripper bar secured to said conveyor chains transversely therebetween, said gripper bar, having a common lower concave sheet gripper jaw, a plurality of grippers pivotably secured to said gripper bar, each of said grippers having jaw portions thereon adapted to cooperate with said concave sheet gripper jaw to grip the leading edge of a sheet therebetween and to buckle a sheet so gripped to force a portion thereof to extend above said gripper bar, and cam follower portions on each of said grippers adapted to be actuated by cams located adjacent and between said conveyor chains at said sheet receiving station and said sheet delivery station, and springs operatively connected to said gripper bar and to each of said cam follower portions of said grippers to normally bias said jaw portions of said grippers into cooperative engagement with said concave sheet gripper jaw.

3. In a sheet feeding apparatus having conveyor chains adapted to transport a sheet gripper device from a sheet receiving station to a sheet delivery station, wherein the sheet gripping device includes a gripper bar secured to said conveyor chains transversely therebetween, a concave sheet gripper jaw portion on said gripper bar serving as a common lower gripper jaw, a plurality of pins secured to the leading edge of said gripper bar, a plurality of grippers pivotably secured to said pins on said gripper bar, each of said grippers having jaw portions thereon adapted to cooperate with said concave sheet gripper jaw portion to grip the leading edge of a sheet therebetween and to buckle a sheet so gripped to force a portion thereof to extend above said gripper bar, and cam follower portions on each of said grippers adapted to be actuated by cams located adjacent and between said conveyor chains at said sheet receiving station and said sheet delivery station, and springs operatively connected to said pins, one end of said springs being in contact with each of said cam follower portions of said grippers and its opposite end in contact with said gripper bar to normally bias said jaw portions of said grippers into cooperative engagement with said concave sheet gripper jaw.

4. In a sheet feeding apparatus having a pair of conveyor chains adapted to transport a sheet gripping device from a sheet receiving station to a sheet delivery station, wherein the sheet gripping device includes a gripper bar secured to said conveyor chains transversely therebetween, said gripper bar having a concave depressed portion at its trailing edge with respect to its direction of travel as carried by said conveyor chains, a plurality of grippers pivotably secured to said gripper bar, each of

said grippers having jaw portions thereon adapted to cooperate with said concave depressed portion of said gripper bar to grip the leading edge of a sheet therebetween and to buckle the sheet while engaged therebetween to force a portion of the sheet to extend above said gripper bar and said grippers, and cam follower portions thereon adapted to be actuated by cams located adjacent and between said conveyor chains at said sheet receiving station and said sheet delivery station, and springs operatively connected to said gripper bar and to said grippers to normally bias said jaw portions of said grippers into cooperative engagement with said concave depressed portion of said gripper jaw.

5. In a sheet feeding apparatus having a pair of conveyor chains adapted to transport a sheet gripping device from a sheet receiving station to a sheet delivery station, wherein the sheet gripping device includes a gripper bar secured to said conveyor chains transversely therebetween, said gripper bar having a common concave sheet gripper jaw portion thereon at its trailing edge with respect to its direction of travel, and apertures therein positioned between said sheet gripper jaw portion and the leading edge of said gripper bar; a plurality of grippers pivotably secured to said gripper bar, each of said grippers having jaw portions thereon adapted to cooperate with said concave sheet gripper jaw to grip the leading edge of a sheet therebetween and to buckle a sheet so gripped to force a portion thereof to extend above said gripper bar, cam follower portions on each of said grippers adapted to be actuated by cams located adjacent and between said conveyor chains at said sheet receiving station and said sheet delivery station, and a depending tang on each of said grippers positioned to extend through one of said apertures adapted to guide the leading edge of a sheet; and springs operatively connected to said gripper bar and to said each of said cam follower portions of said grippers to normally bias said jaw portions of said grippers into cooperative engagement with said concave sheet gripper jaw portion of said gripper bar.

6. In a sheet feeding apparatus having a pair of conveyor chains adapted to transport a sheet gripper device from a sheet receiving station to a sheet delivery station, wherein the sheet gripping device includes a gripper bar secured to said conveyor chains transversely therebetween, a concave sheet gripper jaw portion on said gripper bar serving as a common lower gripper jaw, and apertures therein positioned between said gripper jaw portion and the leading edge of said gripper bar; a plurality of pins secured to the leading edge of said gripper bar, a plurality of grippers pivotably secured to said pins on said gripper bar, each of said grippers having jaw portions thereon adapted to cooperate with said concave sheet gripper jaw to grip the leading edge of a sheet therebetween and to buckle a sheet so gripped to force a portion thereof to extend above said gripper bar, a depending tang positioned to extend through one of said apertures to guide the leading edge of a sheet, and cam follower portions thereon adapted to be actuated by cams located adjacent and between said conveyor chains at said sheet receiving station and said sheet delivery station; and coil springs encircling said pins, one end of said coil springs being in contact with each of said cam follower portions of said grippers and its opposite end in contact with said gripper bar to normally bias said jaw portions of said grippers into cooperative engagement with said concave sheet gripper jaw portion.

7. In a sheet feeding apparatus having a pair of conveyor chains adapted to transport a sheet gripping device from a sheet receiving station to a sheet delivery station, wherein the sheet gripper device includes a gripper bar secured to said conveyor chains transversely therebetween, said gripper bar having a common lower sheet gripper jaw portion thereon at its trailing edge with respect to its direction of travel, said gripper bar having apertures therein positioned between said sheet gripper jaw portion and the leading edge of said gripper bar; a plurality of grippers pivotably secured to said gripper, each of said grippers having jaw portions thereon adapted to cooperate with said sheet gripper jaw to grip the leading edge of a sheet therebetween, each of said grippers having cam follower portions thereon adapted to be actuated by cams located adjacent and between said conveyor chains at said sheet receiving station and said sheet delivery station, and each of said grippers having a depending tang portion positioned to extend through one of said apertures to guide the leading edge of a sheet, and springs operatively connected to said gripper bar and to said each of said cam follower portions of said grippers to normally bias said jaw portions of said grippers into cooperative engagement with said sheet gripper jaw portion of said gripper bar.

8. In a sheet feeding apparatus having a pair of conveyor chains adapted to transport a sheet gripper device from a sheet receiving station to a sheet delivery station, wherein the sheet gripping device includes a gripper bar secured to said conveyor chains transversely therebetween, a sheet gripper jaw portion on said gripper bar serving as a common lower gripper jaw, said gripper bar having apertures therein positioned between said gripper jaw portion and the leading edge of said gripper bar with respect to its direction of travel; a plurality of pins secured to the leading edge of said gripper bar, a plurality of grippers pivotably secured to said pins on said gripper bar, each of said grippers having jaw portions thereon adapted to cooperate with said sheet gripper jaw to grip the leading edge of a sheet therebetween, each of said grippers having a depending tang positioned to extend through one of said apertures to guide the leading edge of a sheet, each of said grippers having cam follower portions thereon adapted to be actuated by cams located adjacent and between said conveyor chains at said sheet receiving station and said sheet delivery station, and coil springs encircling said pins, said coil springs being in contact at one end with each of said cam follower portions of said grippers and at the opposite end in contact with said gripper bar to normally bias said jaw portions of said grippers into cooperative engagement with said sheet gripper jaw portion.

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UNITED STATES PATENT OFFICE

# CERTIFICATE OF CORRECTION

Patent No. 3,100,109 August 6, 1963

Roger H. Eichorn

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 3, line 28, for "paritcles" read -- particles --; line 53, for "developer" read -- developed --; same column 3, line 56, for "or at" read -- at or --; column 6, line 10, strike out "pivotably"; line 28, after "bar" strike out the comma; column 7, line 4, for "the sheet while engaged therebetween" read -- a sheet so gripped --; line 5, for "of the sheet" read -- thereof --; same column 7, line 6, for "thereon" read -- on each of said grippers --.

Signed and sealed this 4th day of August 1964.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents