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Borostyan et al.

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[54] **VACUUM STRIPPING ROLL WITH STATIONARY PICKUP SLOTS**

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[52] **U.S. Cl.**..... **271/174,** 271/197, 271/DIG. 2

[51] **Int. Cl.**..... **B65h 29/56**

[58] **Field of Search** ..... 271/172, 74, DIG. 2, 80, 271/94–96, 12, 34, 99, 100, 51, 197; 355/3

[56] **References Cited**

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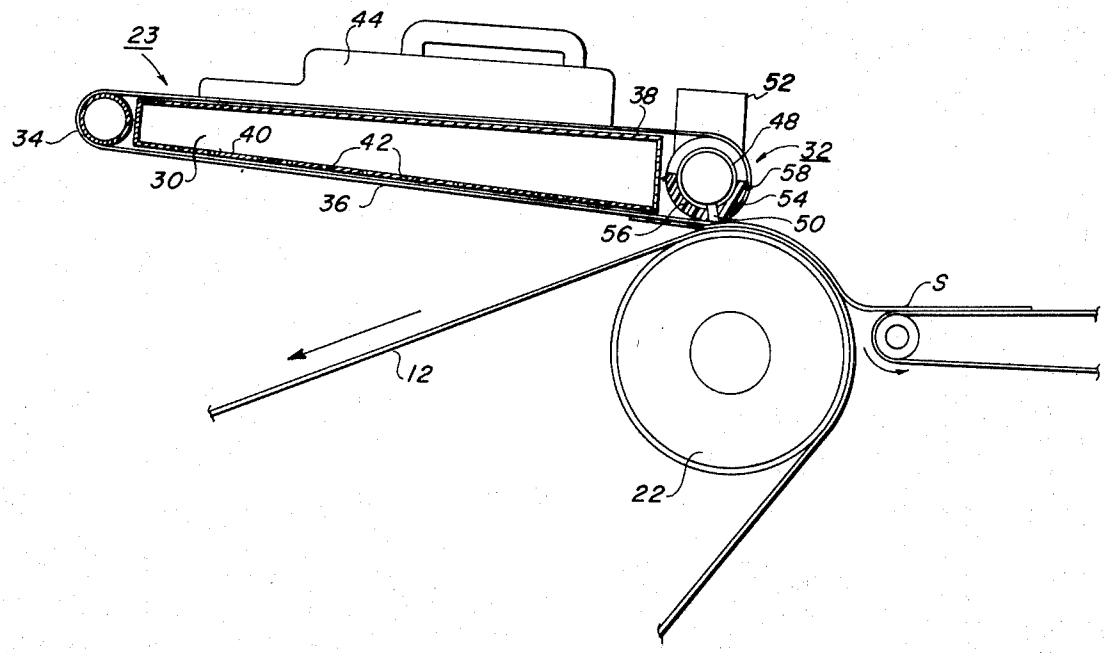
[57] **ABSTRACT**

A device for removing a copy sheet from a photoconductive surface and transporting the copy sheet therefrom. A belt type transport system is provided with stationary vacuum ports in the transport belt roller assembly to lift the leading edge of a copy sheet being advanced on a photoconductive surface. Vacuum ports in the belt transport platen communicate with perforations in the transport belts to provide a low pressure area adjacent the belts for retaining the copy sheet on the transport for movement away from the photoconductor.

2 Claims, 3 Drawing Figures



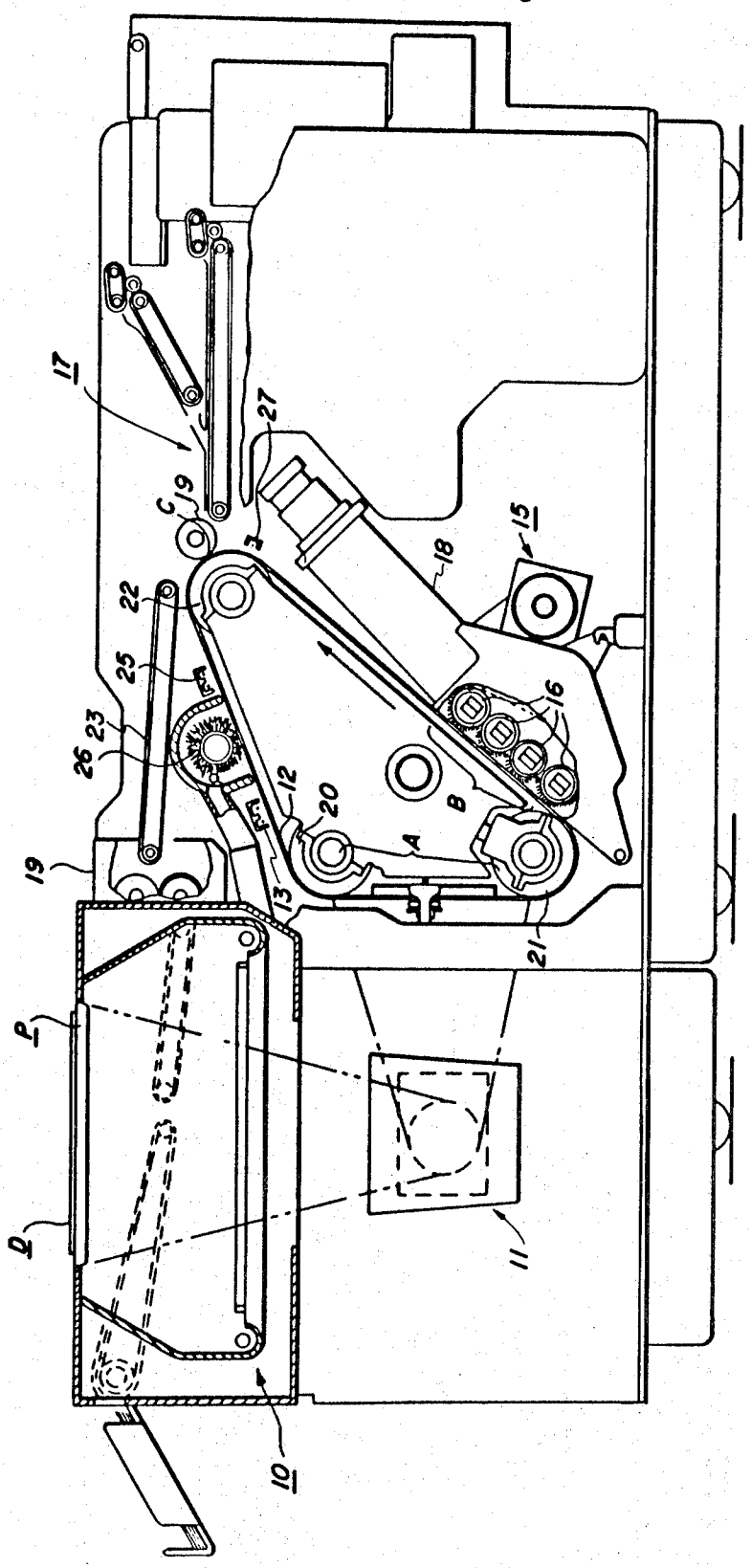


FIG. 1

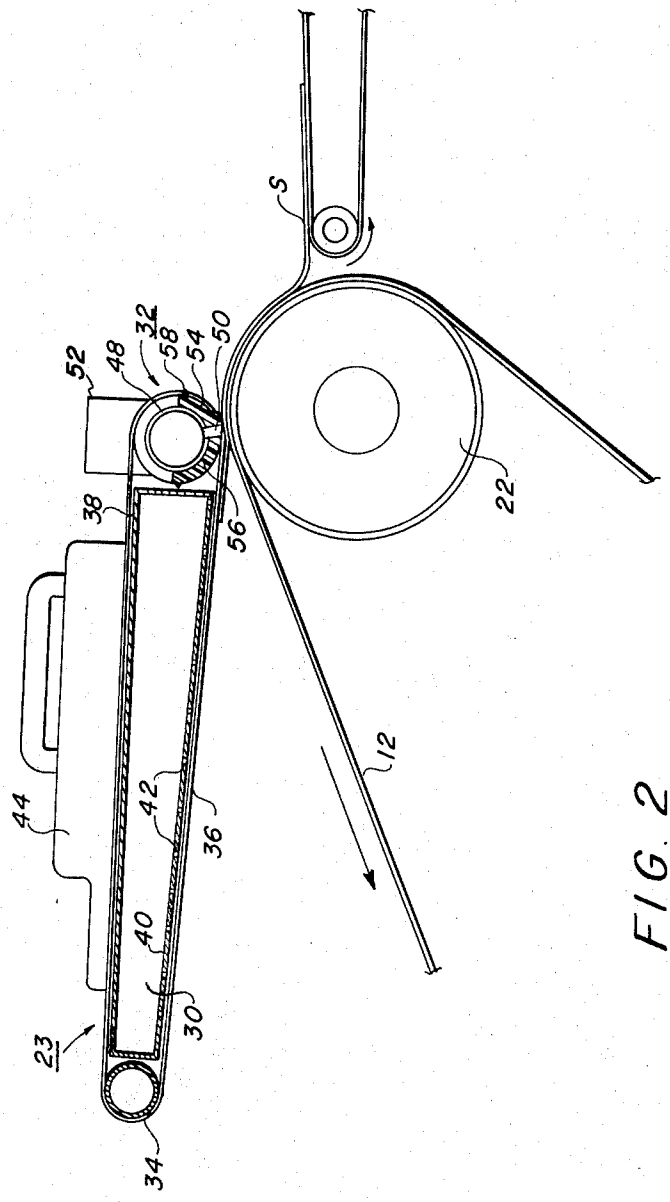


FIG. 2

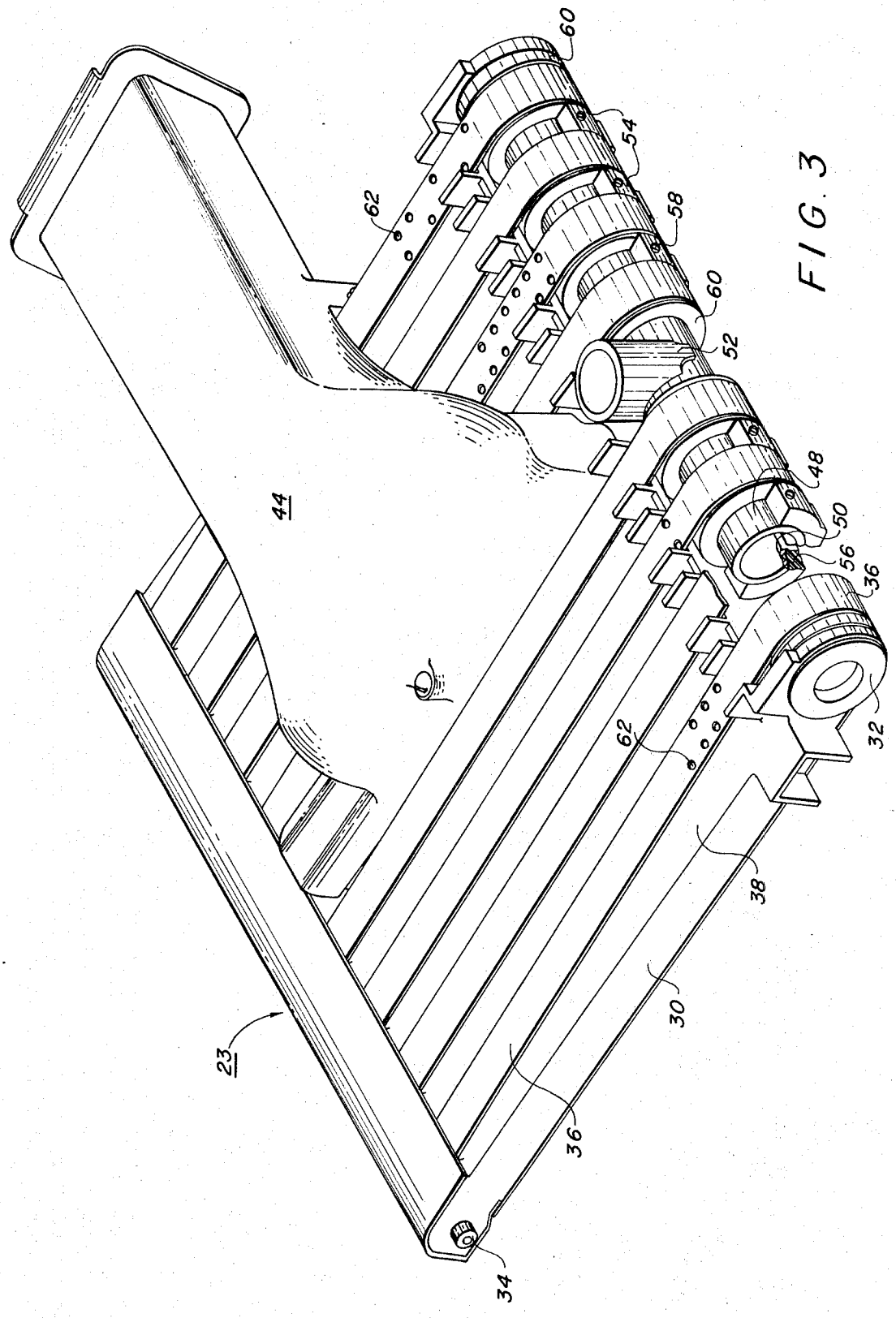


FIG. 3

VACUUM STRIPPING ROLL WITH STATIONARY PICKUP SLOTS

BACKGROUND OF THE INVENTION

In conventional xerography, a xerographic surface comprising a layer of photoconductive insulating material affixed to a conductive backing is used to support latent electrostatic images. In the process, the xerographic surface is electrostatically charged and the charged surface is then exposed to a light pattern of the image being reproduced to thereby discharge the surface in the areas where the light strikes the surface. The undischarged areas of the surface thus form an electrostatic charge pattern in conformity with the configuration of the original pattern.

The latent electrostatic image can then be developed by contacting it with a finely divided electrostatically attractable material such as powder. The powder is held on the image areas by the electrostatic charge on the layer. Where the charge is greater, the greater amount of material is deposited. Thus a powder image is produced in conformity with light image of the copy being reproduced. The developed image is then generally transferred to a suitable transfer member and the image affixed there to form a permanent record of the original document.

The electrostatically attractable developing material commonly used in xerography comprises a pigmented resinous powder referred to herein as "toner" and a larger granular material referred to as "carrier." The carrier is formed, or coated with, a material removed in the triboelectric series from the toner so that a charge is generated between the powder and the carrier material by the interaction therebetween. The charge causes the powder to adhere to the carrier. The carrier, besides provding a charge on the toner, permits mechanical control so that the toner-carrier can be more easily handled for contacting the exposed xerographic surface for development thereof. The toner particles are attracted to the electrostatic image from the carrier to produce a visible toner image on the xerographic surface.

In the practice of xerography the transfer member, ordinarily copy paper, is caused to move in synchronized contact with the photoconductive surface. During this time, an electrical potential opposite from the polarity on the toner is applied to the side of the paper remote from the photoconductive surface to electrostatically attract the toner image from the xerographic surface to the copy paper.

The copy paper, which is an insulator, retains the charge, while inducing a reverse charge in the nondischarged areas of the xerographic surface. This charge orientation creates an electrostatic bond between the paper and xerographic surface. Removal of the copy sheet and the toner image loosely adhering thereto has long been a problem in the xerographic art.

Numerous devices have been employed with varying degrees of success to remove copy sheets from the photoconductive surface in automatic xerographic reproduction apparatus. Probably one of the best known and most widely used devices is an air puffer. The copy sheet is stripped from the surface by introducing a relative high pressure stream of air between the copy sheet and the surface to overcome the attraction between the paper and the surface.

However, when high air pressures are employed, the air tends to agitate the unfused toner image on the paper and disrupt the image configuration of the toner on the copy sheet. This exhibits itself as smears on the final copy. This blowing of toner powder may also result in toner dust problems in that the air stream broadcasts loose toner particles throughout the copy reproduction apparatus. Further, because of the volume and velocity of the air stream required to perform the stripping operation, puffer devices are inherently noisy and therefore undesirable.

Another technique for separating copy sheet from a xerographic surface is to mechanically wedge the copy sheet from the xerographic surface by means of mechanical picker fingers. However, since the fingers must of necessity be wedged between the photoconductive surface and the paper adhering thereto, the fingers have a tendancy to scratch and abrade the xerographic surface.

A further technique for separating a copy sheet from a xerographic surface is to neutralize the charge on the copy sheet with a corona discharge device while the sheet is on the xerographic surface. Assuming the copy sheet is completely neutralized, it will separate therefrom under the influence of gravity if the copy paper is on the underside of the xerographic surface.

Another method for removing copy sheets from the xerographic surface is to provide a vacuum stripping device for pulling the leading edge of the copy sheet from the xerographic surface for subsequent movement of the copy sheet away from the xerographic surface by a suitable paper transport. Problems may be encountered with this type of device in that as the leading edge of the paper is pulled from the xerographic surface the paper must be "pushed" by the moving photoconductive surface to a point where the paper transport or suitable grippers can contact the paper for pulling the paper along the paper path. In utilizing the photoconductive surface to move the copy paper, there may be a tendancy for the paper to slip on the photoconductive surface and thereby smear the toner image therebetween. Further, the required spacing between the xerographic surface, the vacuum pickoff device, and the subsequent transport all give rise to areas wherein the paper may be jammed or deflected out of the desired paper path.

SUMMARY OF THE INVENTION

The present invention relates to a reproduction machine wherein a transfer member is electrostatically tacked to a moving image support member, the machine including apparatus for removing the transfer member from the support member and transporting the transfer member toward the next station in the machine, the transport having vacuum means disposed within the confines thereof for lifting the leading edge of the transfer member from the support member into contact with the moving surface of the transport for subsequent removal of the transfer member from the support member by the transport.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic sectional view of an electrostatic reproduction machine embodying the principles of the present invention;

FIG. 2 is an enlarged elevational view in cross-section of the transport assembly positioned between the transfer station and the fuser assembly of the machine;

FIG. 3 is a partial isometric view of the transport roller assembly adjacent the transfer station of the reproduction machine.

DESCRIPTION OF THE PREFERRED EMBODIMENT

For a general understanding of an electrostatic processing system in which the invention may be incorporated, reference is had to FIG. 1 in which various components of the system are schematicly illustrated. As in all electrostatic systems such as a xerographic machine of the type illustrated, a light image of an original to be reproduced is projected onto the sensitized surface of a xerographic plate to form an electrostatic latent image thereon. Thereafter, the latent image is developed with an oppositely charged developing material comprising carrier beads and smaller toner particles triboelectrically adhering thereto to form a xerographic powder image corresponding to the latent image on the plate surface. The powder image is then electrostatically transferred to a support surface to which it may be fixed by a fusing device whereby the powder image is caused permanently to adhere to the support surface.

In the illustrated machine, an original D to be copied is placed upon a transparent support platen P fixedly arranged in an illumination assembly generally indicated by the reference numberal **10.** While upon the platen, an illumination system flashes light rays upon the original thereby producing image rays corresponding to the informational areas on the original. The image rays are projected by means of an optical system **11** to an exposure station A for exposing the photosensitive surface of a moving xerographic plate in the form of a flexible photoconductive belt **12.** In moving in the direction indicated by the arrow, prior to reaching the exposure station A, that portion of the belt being exposed would have been uniformly charged by a corona device **13** located at a belt run extending between belt supporting rollers **20** and **22.** The exposure station extends between the roller **20** and a third support roller **21.** The belt run between these rollers is encompassed entirely by the exposure station for minimizing the space needed for the belt and its supporting rollers.

The exposure of the belt surface to the light image discharges the photoconductive layer in the areas struck by light, whereby there remains on the belt a latent electrostatic image in image configuration corresponding to the light image projected from the original on the supporting platen. As the belt surface continues its movement, the electrostatic image passes around the roller **21** and through a developing station B located at a third run of the belt and in which there is positioned a developing apparatus generally indicated by the reference numeral **15.** The developing apparatus **15** comprises a plurality of brushes **16** which carry developing material to the adjacent surface of the upwardly moving inclined photoconductive belt **12** in order to provide development of the electrostatic image.

As the developing material is applied to the xerographic belt, toner particles in the development material are attracted electrostatically to the belt surface to form powder images. As toner powder images are formed, additional toner particles are supplied to the developing material in proportion to the amount of toner deposited on the belt during xerographic processing. For this purpose, a toner dispenser generally indicated by reference numeral **18** is used to accurately meter toner, upon demand, to the developer material in the developing apparatus **15.**

The developed electrostatic image is transported by the belt **12** to a transfer station C located at a point of tangency on the belt as it moves around the roller **22** whereat a sheet of copy paper is moved at a speed in synchronism with the moving belt in order to accomplish transfer of the developed image. There is provided at this station a transfer roller **19** which is arranged on the frame of the machine for contacting the non-transfer side of each sheet of copy paper as the same is brought into transfer engagement with the belt **12.** The roller **19** is electrically biased with sufficient voltage so that a developed image on the belt **12** may be electrostatically transferred to the adjacent side of a sheet of paper S as the same is brought into contact therewith.

There is also provided a suitable sheet transport mechanism adapted to transport sheets of paper seriatim from a paper handling mechanism generally indicated by the reference numeral **17** to the developed image on the belt as the same is carried around the roller **22.** A programming device operatively connected to the mechanism **17** and the illumination device for producing an electrostatic latent image on the belt **12** is effective to present a developed image at the transfer station C in timed sequence with the arrival of a sheet of paper.

After the sheet is stripped from the belt **12,** it is conveyed by the stripper transport **23** into a fuser assembly generally indicated by the reference numeral **19** wherein the developed and transferred xerographic powder image on the sheet is permanently affixed thereto. After fusing, the finished copy is discharged from the apparatus at a suitable point for collection externally of the apparatus. The toner particles remaining as residue on the developed images, background particles, and those particles otherwise not transferred are carried by the belt **12** to a cleaning apparatus positioned on the run of the belt between the rollers **20, 22** adjacent the charging device **13.** The cleaning device comprises a rotating brush **26** and a corotron **25,** for neutralizing charges remaining on the particles. It will be appreciated that the run of the belt adjacent the cleaning device is at an inclined angle relative to the horizontal as this run leaves the uppermost roller **22** where a developed image is transferred. Such an arrangement maintains the relatively straight line of copy sheet movement which operatively cooperates with the printing belt **12** at its highest point.

Referring now to FIGS. **2** and **3,** the stripper transport assembly **23** is comprised of a plenum assembly generally indicated at **30,** a stripper roller assembly **32,** a rear roller assembly **34,** and a plurality of endless belts **36.** The plenum assembly **30** is comprised of a top section **38** suitably affixed to a bottom section **40** having orifices **42** provided therein. The top section **38** is provided with a conduit **44** which is in fluid communication with the suction side of a suitable vacuum pump (not shown).

The stripper roller assembly **32** is comprised of a stationary shaft **48** having a plurality of aligned ports **50** formed therein. A conduit **52** in communication with

the interior of shaft **48** is adapted for connection to a suitable vacuum source (not shown) to provide a flow of air through ports **50** and the interior of shaft **48.** A plurality of stationary shoes **54** having ports **56** formed therein are mounted on the shaft **48** by suitable means such as screws **58,** the ports **56** in shoes **54** being in alignment with the ports **50** in shaft **48.**

A plurality of rollers **60** are mounted on shaft **48** for rotation relative thereto, the belts **36** being adapted for engagement with the rollers **60** and the rear roller assembly **34** to allow movement of the belt relative to the vacuum plenum assembly **30.** The perforations **42** in the plenum assembly, which are in alignment with perforations **62** in the belts **36,** provide a low pressure area adjacent the roller surface of the transport assembly for holding the copy paper on the underside thereof and transporting the paper from the transfer station of the machine to the fuser section.

It can be seen by reference to the drawings that the stationary shoes **54** project outwardly from shaft **48** to a location such that the outer surface of each shoe is substantially in alignment with the exterior surface of the belts **36** in the areas adjacent ports **56.**

By placing the paper strip-off ports in the roller shaft assembly of the vacuum transport, the copy paper is immediately contacted by the transport belts when it is lifted from the photoreceptor surface. Since the paper is immediately retained on the belts, there is minimal chance of slippage of the paper relative to the photoreceptor belt which could smear the image on the copy paper. Further, since a continuous surface from the pickoff ports to the fuser section of the machine is presented by the transport belts in the instant assembly, there are no areas for the leading edge of the paper to be caught or jammed and cause a machine shutdown.

While we have described a preferred embodiment of our invention it is to be understood that the invention is not limited thereto but may be otherwise embodied in the scope of the following claims.

What is claimed is:

1. In a reproduction machine wherein a transfer member is electrostatically tacked to a moving image support member, apparatus for removing the transfer member from the image support member and transporting the transfer member away from the support member including:

stationary shaft means positioned adjacent said support member, the axis of said shaft means being disposed parallel to the leading edge of said transfer member, said stationary shaft means having a plurality of vacuum ports formed therein, a plurality of guide shoes fixedly mounted on said stationary shaft, each guide shoe having an opening therethrough in communication with one of said ports on said stationary shaft,

a plurality of spaced roller means mounted on said stationary shaft means for rotation relative thereto, said ports being disposed in the spaces between said roller means;

second shaft means spaced from said stationary shaft means, the axis of said second shaft means being disposed parallel to said stationary shaft means; and

a plurality of endless belts operatively mounted on the roller means of said stationary shaft means and said second shaft means, said guide shoes projecting outwardly from said stationary shaft a distance such that the guide surface thereof is in substantial alignment with the outside surfaces of said endless belts, said shoes projecting outwardly from the surface of said belts toward said photoreceptive surface to provide minimal spacing between the transfer member and the guide shoes upstream from said ports, the flow of air into said ports causing the leading edge of said transfer member to be lifted from said support member toward said stationary shaft means said transfer member being engaged by said endless belts for movement thereby away from said support member.

2. In a reproduction machine according to claim **1** wherein the apparatus for removing the transfer member from the image support member and transporting the transfer member away from the support member further includes a vacuum platen disposed between said stationary shaft means and said second shaft means within the confines of said endless belts, said vacuum platen having a plurality of perforations formed therein, each of said endless belts having perforations therein in alignment with the perforations in said vacuum platen, movement of said belts along said platen causing the perforations in said belts to uncover the perforations in said platen to allow flow of air into said platen, thereby creating a low pressure area adjacent said belts to hold said transfer member on said belts for movement therewith.

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