

[54] ADHESIVE PAPER PICK-OFF SYSTEM

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[51] Int. Cl. B65h 29/54

[58] Field of Search 355/133, 14, 3 R; 221/210; 271/33, DIG. 2, 174

[56]

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[57]

ABSTRACT

An adhesive paper pick-off apparatus for lifting and guiding a sheet of paper from a supply stack or the like or adhering to a photoreceptor layer of an electrostatographic copying machine. The apparatus includes an adhesive tape supply which may be housed in a cartridge having a wall with one or more open windows. The apparatus is positioned relative to the supply stack or photoreceptor layer so that the exposed side of the paper comes in contact with one side of the window. The apparatus includes means for pressure contacting the sticky side of the tape to the paper from the cartridge through the window for lifting the paper from the supply stack or the photoreceptor layer and the like. Preferably, the window is screened with a mesh of fine wires or filaments with openings large enough to allow contact of the tape to the paper, but small enough to prevent the paper from deforming into the openings and is of a design that helps the release of the adhesive tape from the paper when the tape is retracted. Preferably, the wires or filaments are made of a nonsticky substance such as teflon or silicon rubber so that the adhesive tape does not stick to them and they do not collect lint from the paper. The apparatus is provided with means for advancing the adhesive tape supply to bring a fresh portion of the sticky side of the adhesive tape as a used portion begins to loose its stickiness due to the lint collected from the surfaces of the sheets.

15 Claims, 6 Drawing Figures

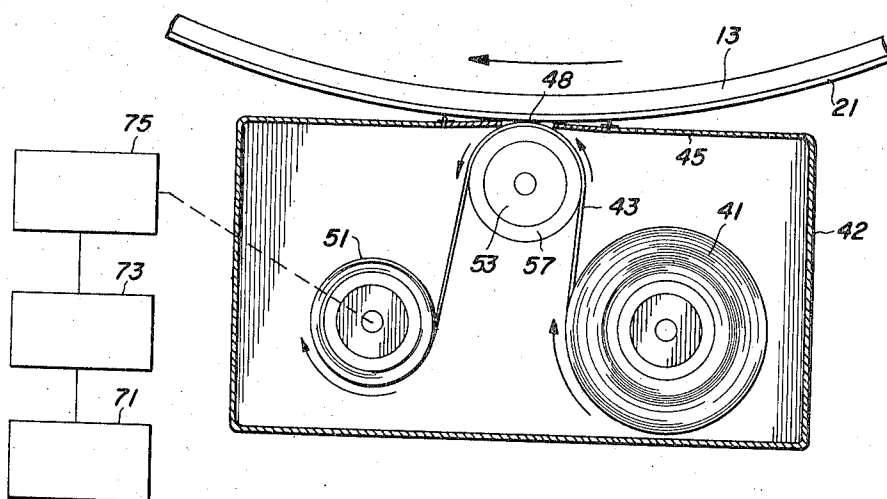


FIG. 1

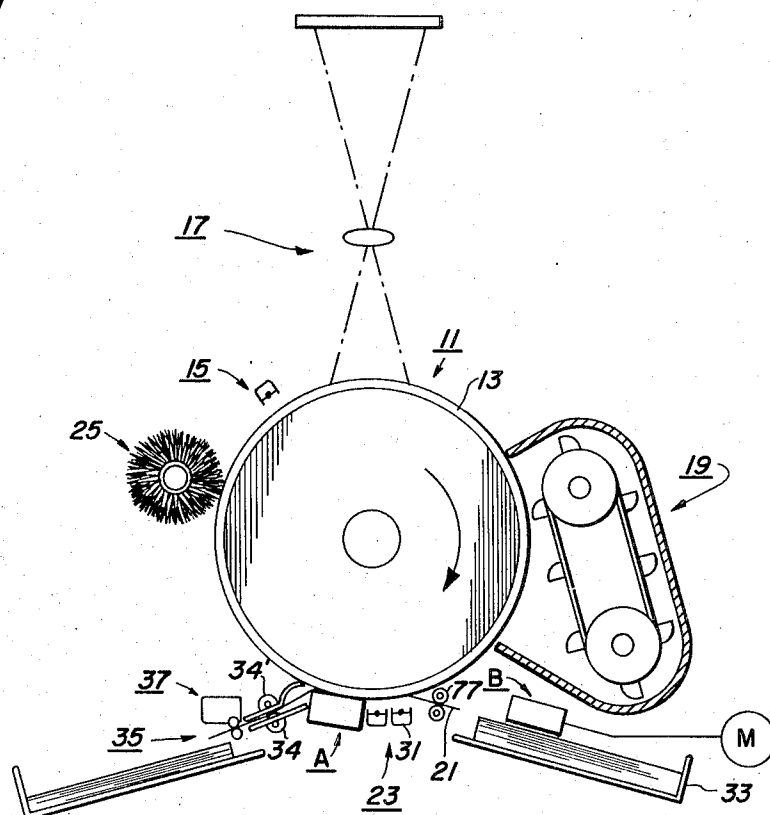


FIG. 2

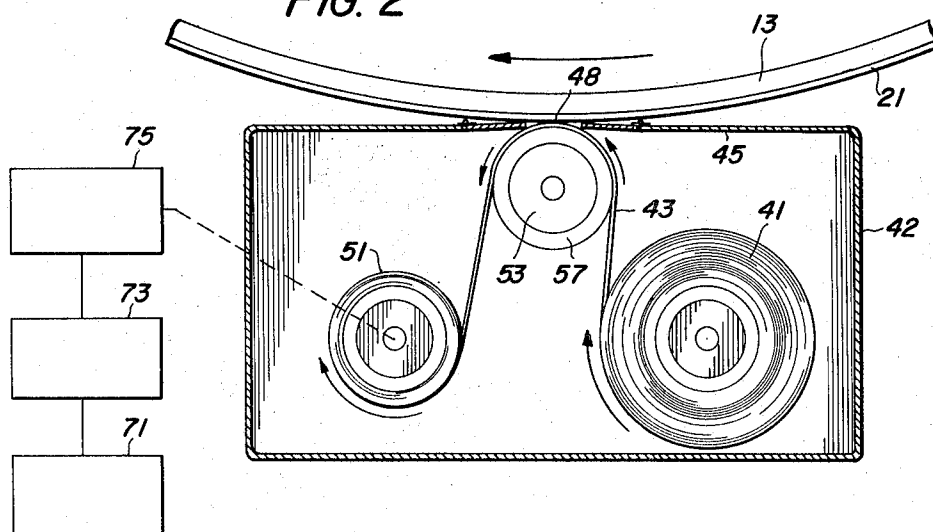


FIG. 3

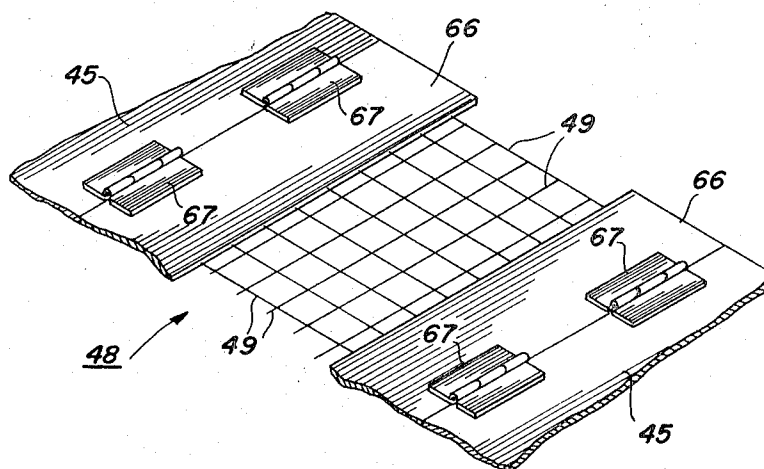


FIG. 4

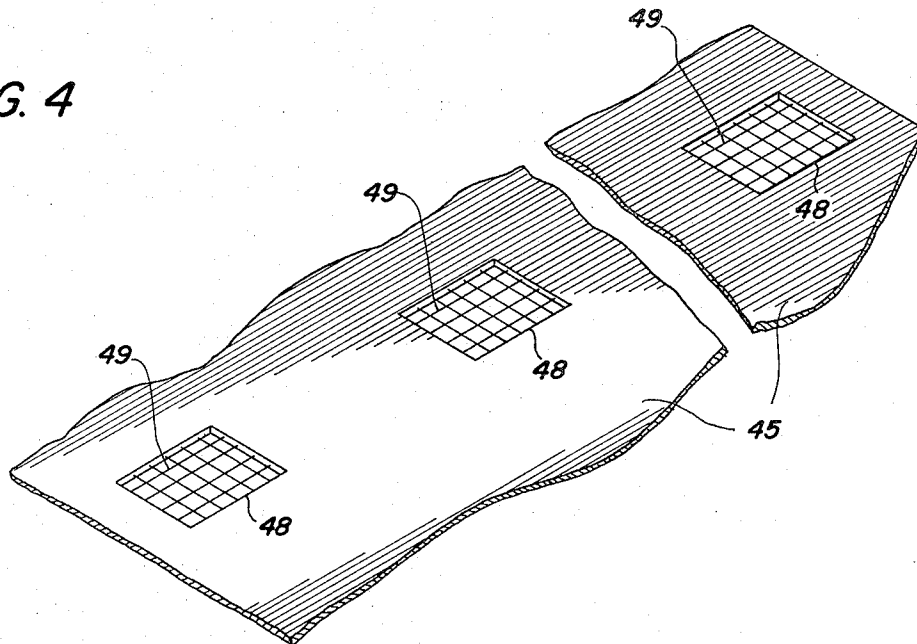


FIG. 5

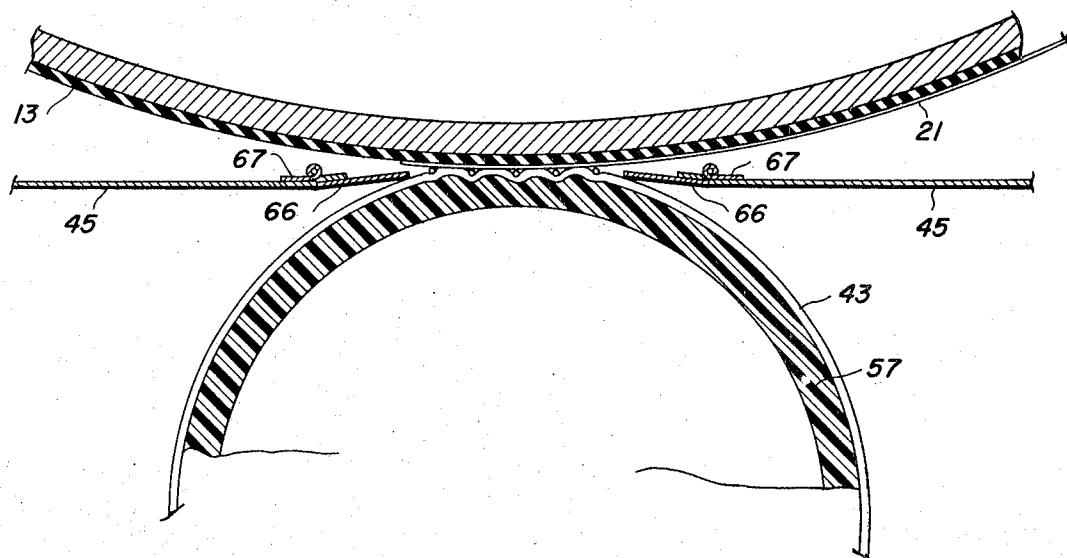
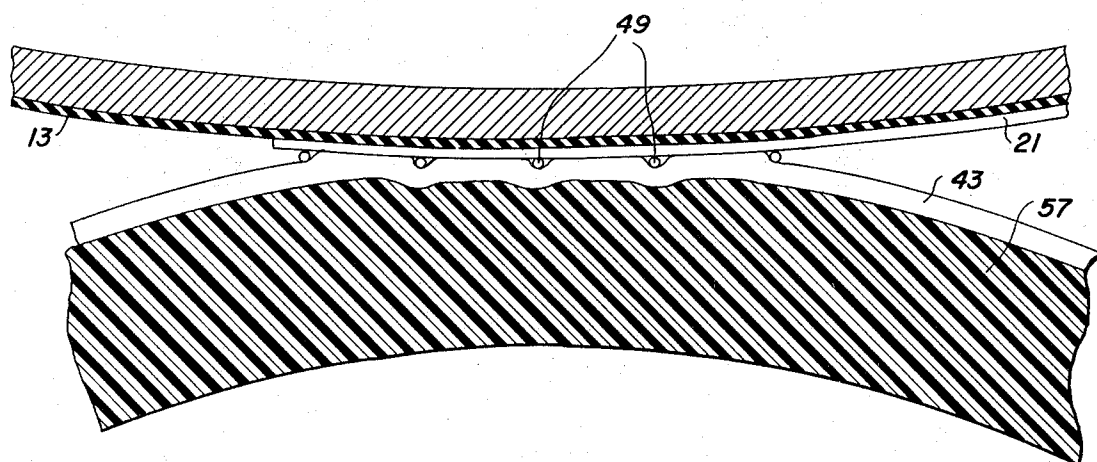


FIG. 6



ADHESIVE PAPER PICK-OFF SYSTEM

FIELD OF THE INVENTION

This invention relates to a sheet transfer apparatus in general and more particularly, an adhesive tape pick-off apparatus for lifting and guiding a sheet member from a stack or the like or adhering to a surface.

BACKGROUND OF THE INVENTION

In a xerographic copier/duplicator machine, as it is generally known, the toner image is transferred to an ordinary untreated bond paper by electrostatic means. To maintain a high transfer efficiency, it is desirable to apply a strong electrostatic field until the paper is separated from the photoreceptor layer of the xerographic drum or plate surface. Image stability is improved if charges opposite to that of the toner are present in the paper during and after it is separated from the drum or plate. Heretofore, various approaches have been used for stripping a paper electrostatically adhering to the photoreceptor layer with varying degrees of success. One such approach has been an electrostatic "detack" apparatus that relies on the reduction of the electrostatic charge on the paper by reducing the electrostatic field after the field is applied to the toner to transfer the toner image from the photoreceptor layer surface to the paper. While this approach serves the desirable aim of reducing the tacking force of the paper to the drum or plate, it tends to reduce the image density and form dust particles that require cleaning. Similarly, while other approaches, such as, air puff or vacuum pick-off or gripper bar systems have been used with varying degrees of success. However, they include various shortcomings associated with the approaches utilized. Thus, the need for a reliable paper stripping apparatus for picking off the paper sheet is an on-going problem which has yet to be improved. More generally, the need for an improved means for lifting and guiding a sheet member from its supply stack or adhering to a surface such as printing master cylinder still exists.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an improved means for lifting and guiding a sheet from its supply stack.

It is another object of the present invention to provide an improved means for stripping a sheet material such as copy paper adhering to a photoreceptor layer of a xerographic drum or plate or printing master cylinder or the like.

The foregoing and other objects are achieved according to the present invention by providing an apparatus having an adhesive tape that may be housed in a cartridge having a wall with a screened window and means for pressure contacting the sticky side of the tape to the sheet through openings of the screen and lift the sheet from the supply stack or adhering to a surface.

According to a feature of the invention, preferably the screen is made of a fine gage wire or filament having nonsticky surfaces. A high tensile strength steel wire coated with teflon or silicon rubber or monofilament teflon wire may be used.

According to another feature of the present invention, the apparatus is provided with means for advancing the tape when a spot loses its stickiness after a

number of repeated uses so that a new and unused spot of the tape is brought to lift the sheet.

The foregoing and other objects and features of the present invention will be made clearer from the following detailed description of an illustrative embodiment in conjunction with the following drawings, in which:

FIG. 1 shows schematically a xerographic copier/duplicator apparatus in which the detacking apparatus according to the present invention may be utilized;

FIG. 2 shows a schematic side view of the pick-off apparatus according to the present invention;

FIG. 3 shows a magnified perspective view of the screen openings of the windows of the present pick-off apparatus;

FIG. 4 shows an illustration of a situation where more than one screened window may be used in the present apparatus;

FIG. 5 shows an enlarged cross-sectional view of the immediate portion of the pick-off area and vicinity, and

FIG. 6 shows a magnified cross-sectional view of the screened opening showing details of the paper surface sticking to the adhesive tape.

DETAILED DESCRIPTION

Referring to FIG. 1, generally stated, a xerographic copier/duplicator comprises a drum 11 having a photo-sensitive insulating peripheral surface or, in short, a photoreceptor layer 13. As the drum rotates, the layer is uniformly charged at a charging station 15, image wise exposed to form a latent image at an imaging station 17 and then developed by a toner at a developing station 19 and then transferred to a paper 21 at a transfer station 23. For succeeding operation, the drum is cleaned by suitable cleaning means at a cleaning station 25 before recharged at the charging station 15 for succeeding operation. At the image transfer station 23, there is usually provided a scorotron 31 positioned so that the copy sheet fed to the drum from a paper supply 33 is fed between the scorotron 31 and the surface of the photoreceptor layer 13. The scorotron used to transfer the toner image also causes the paper to adhere to the surface of the photoreceptive layer 13 by the electrostatic force provided by the energized scorotron. Heretofore, suitable means such as an air puffer, vacuum pick-off or gripper bar systems have been used to lift the leading edge of the copy sheet and then guide the detacked copy sheet into a paper path 35 having guide rollers 34 and 34' which pick up the leading end of the detacked paper and advance the paper to a fusing station 37 for fusing operation.

The conventional air puff or vacuum pick-off system required an additional step of reducing the charge applied to the paper by using a suitable means such as a corotron 41 for reducing the force with which the paper adheres to the drum surface. While this resulted, to a degree, in easing the detacking problem, it tended to reduce the transfer efficiency of the image toner and thereby reduce the image density and increase the toner dust generation and aggravate the cleaning problem.

According to the present invention, the foregoing shortcomings are overcome by using an adhesive paper pick-off apparatus. An embodiment of the apparatus is illustrated in FIGS. 2-6 and generally includes an adhesive tape 41 that may be housed in a cartridge 42. The cartridge 42 includes relatively planar side wall 45 hav-

ing one or more openings or windows 48. The cartridge 42 is mounted so that the openings 48 that come in contact with the exposed surface of the paper 21 moving therepast while adhering to the photoreceptor layer 13 after the image transfer operation.

Preferably, the window is provided with a mesh of fine wires 49 with openings large enough to allow the tape to contact the paper through the openings but small enough to prevent the paper from deforming into the openings. The wires may be made of high tensile strength metal or plastic material of a suitable size to meet a need of a particular usage. In a typical situation involving the detacking of a cut sheet of ordinary untreated bond paper, a high tensile strength steel wire of 3-5 mils diameter or monofilament teflon wire of about the same size is found suitable.

In the case of steel wire, it is desirable to have it coated with non-sticky materials such as silicon rubber or teflon that makes them highly resistant to any sticky substance so that they do not stick to the sticky surface of the adhesive tape 43 or accumulate lint coming off of the paper 21.

As illustrated in FIG. 3, the wires may be formed into an array of three by three grid of $\frac{1}{4}$ by $\frac{1}{2}$ inch rectangular size. If necessary, a number of screened windows of the type described above may be used for receiving a corresponding number of adhesive tapes in order to give high enough level of sticking force to the paper to overcome the electrostatic force with which the paper is held onto the surface of the photoreceptor layer 13. Advantageously, the windows may be aligned transversely to the direction of the movement of the drum so that the sticking forces supplied by each of the tapes may be applied substantially simultaneously against the electrostatic force (see FIG. 4).

Referring back to FIG. 2, the apparatus may include a take-up roll 51 and a feed roller 53 mounted in a manner illustrated for enabling the pick-up roller 51 to reel up the tape past the tape roller 53 from a tape supply roll 41. Preferably, the feed roller 53 includes a somewhat resilient surface layer 57 made of a suitable material such as a relatively hard rubber. As illustrated in FIGS. 5 and 6, such a resilient surface is helpful in that it enlarges the amount of the contact area when the feed roller is brought against the paper and the photoreceptor layer 13 the overall area of the contacting surface yields a little and part of it is depressed by the grid wires 49. This results in the formation of a good pressure contact between the paper and tape through the grid openings.

More generally, the amount of the area of the contact at each opening may be conveniently controlled by controlling the spacing of the grid wires, by controlling the level of resiliency of the feed roller surface or by adjusting the level of stickiness of the adhesive tape or any combination of these factors. In some applications, it may be feasible to eliminate the use of the grid wires. It has been found, however, that, in connection with the stripping operation in the xerographic copier/duplicator, the use of a grid is necessary to eliminate the tendency of the paper to deform into the opening or tear or to minimize the tendency of adhesive tape staying stuck to the paper.

The stripping capability of the present apparatus may be enhanced further by hingedly mounting the screened window to the wall 45. As shown in FIGS. 3 and 5, the frames 66 of the screened window are

mounted to the wall 45 by hinges 67 so that when the resilient surface 57 of the feed roller 53 is exerted against the photoreceptor layer 13, the frames 66 yield enough to help the feed roller to press the screened window up against paper and help the tape to form a positive contact with the paper.

The leading edge of the copy paper stuck to the sticky side of the tape in the manner described above, lifts from the photoreceptor layer as the drum or plate continues to move forward. As this occurs, the beam strength of the paper enables the leading edge to lift the end of the paper straight away from the curved surface of the drum. The leading end is grabbed by the pair of feed rollers 34 and 34' (FIG. 1) and then pulled away from the adhesive tape by the rollers.

According to another aspect of the present invention, the apparatus is provided with a means for advancing the tape. After a given number of usage, a portion of the adhesive tape loses its stickiness due to lint that accumulate on the sticky side. So a fresh and unused portion of the adhesive tape needs to be advanced forward for use in stripping the succeeding sheets of the copy paper. This need is met by an advancing means of a suitable design that reels up the tape by an increment to bring a new portion to the window. Digressing for the moment, it is generally known that a present day copier/duplicator machine generally includes a counting circuitry for counting the copies being made by the machine. According to an aspect of the present apparatus, the count signals used in such a machine may also be utilized in deriving the signals necessary for advancing the adhesive tape. Thus, for example, the count signals from the copy counting means 71 of the machine may be applied to a suitable means 73 designed to count a given number of counts using a conventional counter and then generate an enabling signal. This signal is then applied to a suitable means 75 such as a pawl and ratchet mechanism which advances or rotates the take-up roll 51 by a predetermined angle at a time. For example, the counter 73 may be designed to count 5 representing five copies and also five usage of one portion of the tape and then output the signal that actuates the pawl and ratchet mechanism and rotate the take-up reel 51 by a few degrees, enough to bring a new portion of the tape to the screened window.

Alternatively, instead of advancing the full window size each five prints, the adhesive tape could be advanced one-fifth of the window length each print. This obviates the counter, yet insures against any portion of the tape making contact more than 5 times.

While the adhesive pick-off apparatus of the present invention has been described hereinabove primarily in the context of its use in stripping a copy paper from the surface of the photoreceptor layer of the xerographic copier/duplicator, obviously its use is not so limited. The apparatus could readily be used in other situations where a sheet member needs to be picked off from its supply stack or detacked from a surface to which it adheres wherein the phenomenon which causes the adherence of the paper to the underlying surface may be due to partial vacuum or other form of forces. For example, the present apparatus may be used as a paper feeding means B with a suitable reciprocating means driven by a motor M, as illustrated in FIG. 1, that bring the tape and pressure contact it to the leading end of the top sheet of a paper supply, lift and advance it forward to a pair of feed rollers 77 which will then take up

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the lifted paper. Various other changes or modifications may be made from the teachings of the present invention described hereinabove without departing from the spirit and the scope thereof.

What is claimed is:

1. An apparatus for stripping a sheet adherent to a surface, comprising:

a member having an opening;
an adhesive tape;

a mesh of a plurality of non-sticky wires positioned in the opening and forming a grid screen thin enough to allow contact of the adhesive tape to the sheet through the openings of said mesh but strong enough to prevent the paper from deforming into the openings;

means for positioning the adhesive tape against said grid mesh for pressure contacting the sticky side of the adhesive tape to the sheet through the grid.

2. The apparatus according to claim 1, wherein said wires are made of high strength metallic member coated with a non-sticky substance.

3. The apparatus according to claim 2, wherein said coating substance is teflon.

4. The apparatus according to claim 2, wherein said substance is silicon rubber.

5. The apparatus according to claim 1, wherein said wires are made of monofilament teflon.

6. The apparatus according to claim 1, including means for guiding and advancing forward the lifted leading edge of the sheet away from said surface.

7. In a xerographic copier/duplicator, wherein a copy sheet adheres electrostatically to a photoreceptor layer by the image transferring corona, the improvement which comprises a pick-off apparatus having an adhesive tape and a screened window disposed adjacent the image transfer station, said window having a non-sticky grid mesh wires arrayed to allow contact of the tape to the sheet through the mesh openings but spaced close enough to keep the sheet from deforming into the mesh

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openings, and means for pressure contacting the sticky side of the adhesive tape to the sheet for stripping the sheet away from the photoreceptor layer.

8. The apparatus according to claim 7, including a roll of adhesive tape and means for advancing the adhesive tape to move a new and unused portion of the sticky side of the tape into said window and move out the used portion of the adhesive tape.

9. The apparatus according to claim 8, including means for counting the copies made and generating a copy count signal;

said advancing means adapted to move said adhesive tape forward by an incremental amount in response to the copy count signal to bring the new and unused portion of the adhesive tape against the sheet.

10. The apparatus according to claim 9, wherein said advancing means is adapted to advance said adhesive tape by an amount sufficient to move out the entire portion of the used tape from said window and move in an entirely new portion into said window after a predetermined number of copy count signals.

11. The apparatus according to claim 9, wherein said advancing means is adapted to advance said adhesive tape by an amount so that a portion of the used tape is moved out of said window and an unused portion is moved into said window in response to each of the copy count signals.

12. The apparatus according to claim 7, said wires are made of high tensile material having non-sticky surface.

13. The apparatus according to claim 12, said wire is made of monofilament teflon.

14. The apparatus according to claim 12, said wire is made of metallic member coated with silicon rubber.

15. The apparatus according to claim 12, said wire is made of metallic member coated with teflon.

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