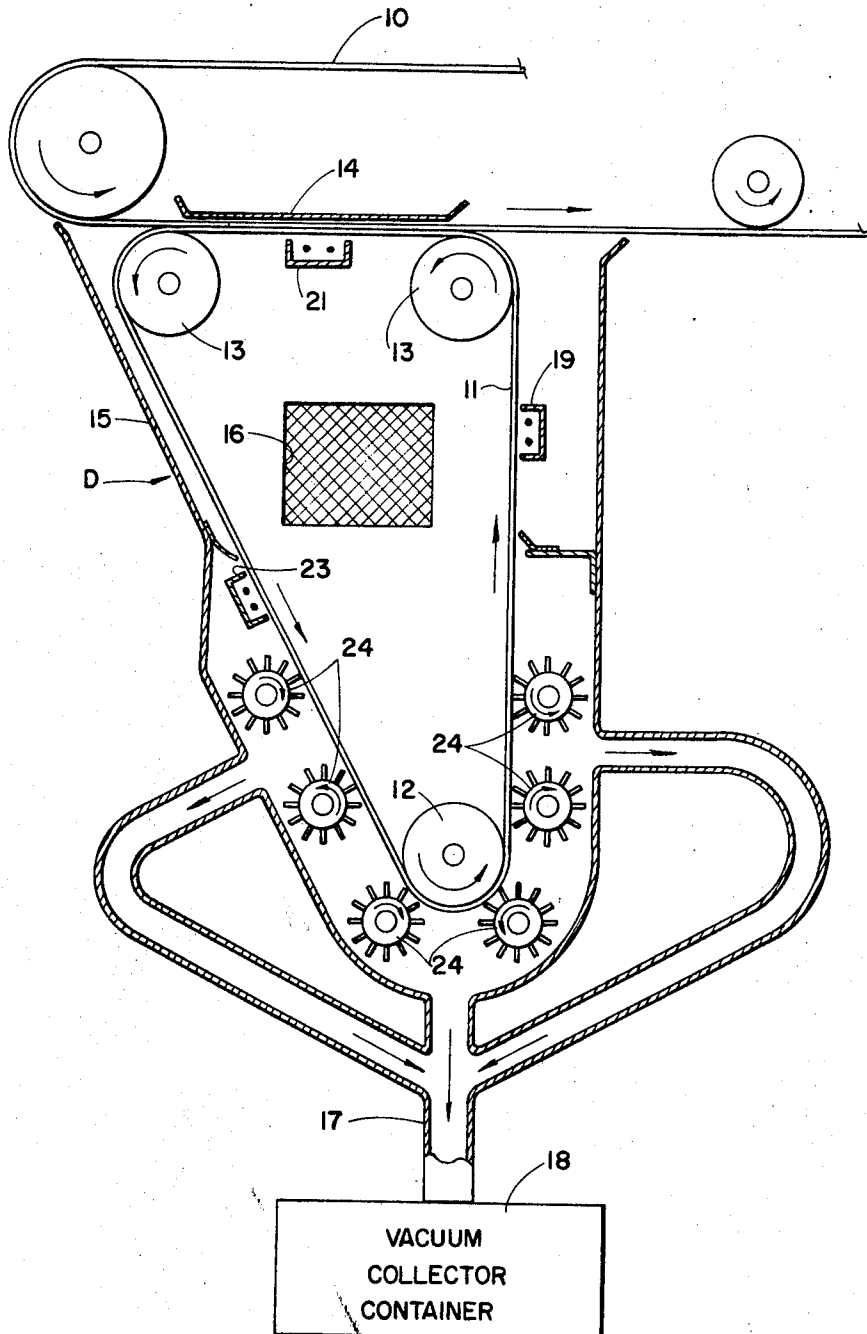


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H. O. STOEVER
ENDLESS CLEANING WEB

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ENDLESS CLEANING WEB

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11 Claims

ABSTRACT OF THE DISCLOSURE

Residual toner particles on a photoconductive belt are cleaned therefrom by frictional contact of a pervious cleaning web running along an endless path in the opposite direction to the belt. A corona may be used to place a charge on the cleaning belt opposite that on the particles to be cleaned so that they are attracted to the belt and an A.C. corona may be used following cleaning to loosen the particles from the cleaning web which may be further loosened as by beating with brushes. The loosened particles then are removed from the web by drawing air therethrough as by a vacuum, so that the cleaning web may be reused.

CROSS-REFERENCE TO RELATED APPLICATION

This application is an improvement on commonly assigned copending application Ser. No. 725,742, entitled "Endless Cleaning Web" to Hans O. Stoever and Stephen F. Michatek filed on even dated herewith.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to a device for cleaning residual toner particles from a photoconductive surface, and more particularly a web movable along an endless path, which web is treated by one or more corona chargers to assist picking up toner particles from the photoconductive surface and to facilitate removal of such particles from the cleaning web. Toner particles may be further loosened by cleaning brushes or beaters and the residual particles removed by drawing air through the belt as by a vacuum.

Description of the prior art

In a conventional electrophotographic apparatus, an electrostatic image is formed on a photoconductive surface. This image is then toned by a suitable developing material, such as a dry toner powder. The developed toner image is then transferred to a receiver. However, a small amount of residual toner will remain on the photoconductive surface which must be removed therefrom prior to the forming and transfer of subsequent images to prevent ghost images from being formed during subsequent transfers. Various attempts have been made to clean photoconductive surfaces. One is by means of a rotating brush. Brushes are usually made from fur of such animals as beaver, fox and rabbit and hence are relatively expensive. Also, brush cleaning can create a cloud of toner particles, as they are brushed from the photoconductor, which may settle on other parts of the machinery.

Another known method of cleaning a photoconductive surface is by the use of a web of material fed from a supply spool to a take-up spool with an intermediate portion thereof being brought into frictional contact with the photoconductive material for cleaning. With this system, the used web material must be replaced periodically with a clean roll of cleaning material. Unfortunately, the cleaning web may run out at a critical time, such as in the middle of a printing operation, requiring shut down of the

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machine at an inopportune time. If the web is changed when the machine is normally not in use, chances are that it will be changed before all of the cleaning web has been used, resulting in the loss of some unused material.

Another prior art device utilizes an endless web for recirculating toner from the photoconductor to the toning station.

In commonly assigned copending application Ser. No. 725,742, entitled "Endless Cleaning Web" to Hans O. Stoever and Stephen F. Michatek, an endless cleaning web is provided which frictionally contacts a photoconductive surface to remove residual toner particles therefrom which are collected on the web. The web is then cleaned by a vacuum device which pulls air therethrough removing toner particles thereon. Thus, the web may be used over and over again without replacement for a substantial period of time.

SUMMARY OF THE INVENTION

This invention is an improvement over the one disclosed in the above-mentioned Ser. No. 725,742. Thus, a first D.C. corona may be used to place a charge on the cleaning web prior to cleaning which charge has a polarity opposite the charge of residual toner particles to be cleaned from a photoconductive surface so that the toner particles will be attracted to the cleaning web. Also, a second D.C. corona may be used along the cleaning portion of the web having a charge opposite that of the toner particles whereby the ion flow or field will cause the photoconductive surface to be brought into intimate contact with the cleaning web. In addition, a corona such as an A.C. corona may be applied to the toner particles picked up by the web to neutralize any charge on them so that they may be removed more easily by air drawn through the web, as by a vacuum. If necessary, the cleaning web may be beaten or brushed so as to further loosen the toner particles so that they may be drawn away from the web by the vacuum. Of course, these various devices for treating the cleaning web may be used separately or in any combination.

Additional features of this invention will become apparent from the description which follows taken in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

The figure is a diagrammatic side elevation of the cleaning device of this invention, partly in section to show details thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In accordance with this invention, a photoconductor 10, which may be in the form of an endless belt, may be driven past a conventional charging station, an exposure station, a developing station, and a transfer station, such as illustrated in U.S. application Ser. No. 725,742, filed May 1, 1968, and finally past the novel web cleaning device D of this invention which is adapted to remove residual toner particles from photoconductor 10 so that it may be reused again and again.

Cleaning device D includes a cleaning web movable along an endless path, such as endless cleaning web 11, which may be made of close woven pervious cloth material passing around a drive roller 12 and pair of pressure rollers 13 to bring a substantial area of the web into contact with photoconductive belt 10. A platen 14 may be provided on the opposite side of photoconductive belt 10, if needed, to hold the belt in frictional contact with cleaning web 11. Advantageously, the cleaning web is driven in a direction opposite that of photoconductor 10. A shroud or housing 15 extends around a substantial portion of cleaning web 11, as shown, to form a cleaning zone and is provided with an air inlet 16 and an air out-

let 17 to which a vacuum may be applied to provide air moving means for cleaning toner particles from the web to be collected in a container 18. Conveniently, inlet 16 is on the inside of cleaning web and outlet 17 is on the outside of the web so that air is pulled through web 11 causing toner particles to be removed from the web so that it may be used over and over again to clean photoconductive belt 10.

To further facilitate the cleaning of the photoconductor, the cleaning web may be pretreated in a pretreating zone by using a D.C. corona 19 to place a charge on cleaning web 11 having a polarity opposite that of residual toner particles on photoconductor 10 so that the particles will be attracted to the cleaning web as the web and photoconductor come into frictional contact in the vicinity of platen 14. In addition, a corona 21, also generating a charge on web 11 opposite that of residual toner particles, may be provided in a photoconductive surface cleaning area between pressure rollers 13. The action of the ion flow from corona 21 to photoconductor 10 will help to bring the cleaning web into intimate contact with the photoconductor to aid cleaning. In fact, the use of corona 21 may eliminate the need for platen 14 in some applications.

An A.C. corona 23 may be provided in a web cleaning area which neutralizes any charge on the residual toner particles carried by the cleaning web so that they are loosened and easier to remove by the vacuum. In addition, oppositely rotating beaters or brushes 24 may be provided within the web cleaning area of shroud 15, as shown, which beat the web and further loosened the toner particles so that they may be removed from the cleaning web by the air passing through the cleaning web 11 from inlet 16 to outlet 17.

Of course, it will be understood that the three corona chargers shown may be used separately or in any combination desired and that they may be used in conjunction with the cleaning brushes or separately therefrom as a particular application requires.

From the foregoing, the advantages of this invention are readily apparent. A cleaning web for cleaning a photoconductor has been provided which may be both pretreated and post treated to aid in cleaning. A corona charge may be applied to the web having a charge opposite that of the residual toner particles to be cleaned so that the toner particles will be attracted to the cleaning web. In addition, a corona charge, also of opposite polarity to the charge on the toner particles, may be used in the cleaning area to draw the photoconductor and cleaning web into intimate contact. In addition, an A.C. corona may provide post treatment of the web by neutralizing the charge of the toner particles so that they will be easier to remove by the vacuum. The web may be post-treated further by one or more rotating beaters which beat the cleaning web to assist separating the particles therefrom so that they may be pulled away from the web by the vacuum.

The invention has been described in considerable detail with reference to a preferred embodiment thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

I claim:

1. In a cleaning device for cleaning charged residual toner particles from a photoconductive surface, said device including a pervious cleaning web having an inside surface and an outside surface, means for moving said cleaning web along an endless path, means urging the outside surface of said cleaning web into frictional contact with said photoconductive surface so that said toner particles will be cleaned therefrom and collected on said cleaning web, and means for moving air through said web from said inside surface to said outside surface to remove toner particles from said web so that said web may be reused, the improvement comprising:

means defining a web cleaning zone; and

means in said zone for loosening residual toner particles on said cleaning web to facilitate removal therefrom by said air moving means.

2. In a cleaning device, as claimed in claim 1, wherein said particle loosening means includes:

a corona for neutralizing any charge on said particles.

3. In a cleaning device, as claimed in claim 1, wherein said particle loosening means includes:

a rotatable beater mounted for engagement with said cleaning web to loosen toner particles thereon.

4. In a cleaning device, as claimed in claim 1, the improvement further comprising:

charge applying means for applying a charge to said cleaning web of opposite polarity to a charge on said residual toner particles before said web is brought into contact with said photoconductive surface.

5. In a cleaning device, as claimed in claim 1, the improvement further comprising:

means for applying a charge to said web of a polarity opposite that of said residual toner particles when said web is in contact with said photoconductive surface to pull said photoconductive surface into intimate contact with said cleaning web.

6. In a cleaning device, as claimed in claim 1 wherein said particle loosening means includes:

a corona for neutralizing any charge on said particles; and

a rotatable beater mounted for engagement with said cleaning web to loosen said neutralized toner particles.

7. In a cleaning device for cleaning charged residual toner particles from a photoconductive surface, said device including a pervious cleaning web having an inside surface and an outside surface, means for moving said cleaning web along an endless path, means urging the outside surface of said cleaning web into frictional contact with said photoconductive surface so that said toner particles will be cleaned therefrom and collected on said cleaning web, and means for moving air through said web from said inside surface to said outside surface to remove toner particles from said web so that said web may be reused, the improvement comprising:

means defining a pretreating zone; and

means in said zone for pretreating said web prior to contact with said photoconductive surface so that said residual toner particles are attracted to said cleaning web.

8. A cleaning device, as claimed in claim 7, wherein said pretreating means includes:

a corona for placing a charge on said cleaning web of opposite polarity to the charge on said residual toner particles.

9. In a cleaning device for cleaning charged residual toner particles from a photoconductive surface, said device including a pervious cleaning web having an inside surface and an outside surface, means for moving said cleaning web along an endless path, means urging the outside of said cleaning web into frictional contact with said photoconductive surface so that said toner particles will be cleaned therefrom and collected on said cleaning web, and means for moving air through said web from said inside surface to said outside surface to remove toner particles from said web so that said web may be reused, the improvement comprising:

means defining a photoconductive surface cleaning zone; and

a corona positioned to apply a charge to said cleaning web of opposite polarity to the charge on said residual toner particles when said cleaning web is in said cleaning zone so that ion flow between said corona and said photoconductive surface will hold said photoconductive surface in intimate contact with said cleaning web.

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10. In a cleaning device for cleaning charged residual toner particles from a photoconductive surface, said device including a cleaning web having an inside surface and an outside surface, means for moving said cleaning web along an endless path, means urging the outside of said cleaning web into frictional contact with said photoconductive surface so that said toner particles will be cleaned therefrom and collected on said cleaning web, and means for moving air through said web from said inside surface to said outside surface to remove toner particles from said web so that said web may be reused, the improvement comprising:

- a first D.C. corona positioned to charge said cleaning web prior to contact with said photoconductive surface to a polarity opposite the polarity of said residual toner particles;
- a second D.C. corona for applying a charge of opposite polarity to that of said residual toner particles to said web while said web is in contact with said photoconductive surface so that ion flow between said corona and said photoconductive surface will hold said photoconductive surface in intimate contact with said cleaning web; and
- means for loosening toner particles on said cleaning web to facilitate removal therefrom by said air moving means.

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11. In a cleaning device, as claimed in claim 10, wherein said particle loosening means includes:
 an A.C. corona positioned to neutralize any charge on said residual toner particles on said cleaning web; and
 rotatable beaters for loosening said neutralized residual toner particles from said cleaning web so that said particles may be removed from said web by said air moving means.

References Cited

UNITED STATES PATENTS

2,709,270	5/1955	Morrill et al.	15—89
2,832,977	5/1958	Walkup et al.	15—1.5
2,949,760	8/1960	McCartney et al.	15—89
3,074,086	1/1963	Remer	15—1.5
3,324,291	6/1967	Hudson.	
3,411,932	11/1968	Malone et al.	

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