United States Patent [19]

Catabrette et al.

[11] **3,840,879**

[45] **Oct. 8, 1974**

[54] **EXCESS TONER SHIELD FOR ELECTROGRAPHIC APPARATUS**

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[73] Assignee: **Xerox Corporation,** Stamford, Conn.

[22] Filed: **Jan. 29, 1973**

[21] Appl. No.: **327,390**

[52] **U.S. Cl.** ..... **346/74 ES,** 117/17.5

[51] **Int. Cl.** **G01d 15/06,** G03g 13/08

[58] **Field of Search** .... 346/74 ES, 74 MP; 118/637; 117/17.5

[56] **References Cited**

UNITED STATES PATENTS

2,357,809	9/1944	Carlson	346/74 ES
3,057,966	10/1962	Heller	346/74 ES
3,611,018	10/1971	Ring	346/74 ES

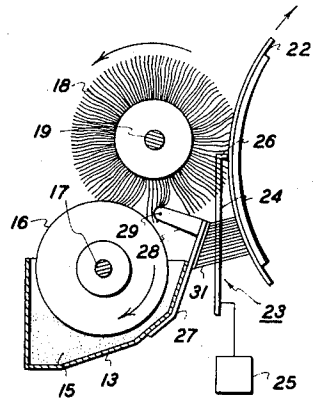
Primary Examiner—Bernard Konick

Assistant Examiner—Jay P. Lucas

[57] **ABSTRACT**

An excess toner shield for use in an electrographic apparatus which includes a writing stylus movable back and forth across a recording medium. The stylus projects through an opening intermediate the developer housing and the recording paper with the opening being substantially closed by a fiber brush through which the stylus moves. A urethane foam strip having a slit thereacross through which the stylus projects may also be employed to prevent excess toner from passing through the opening between the developer housing and the recording paper.

6 Claims, 4 Drawing Figures



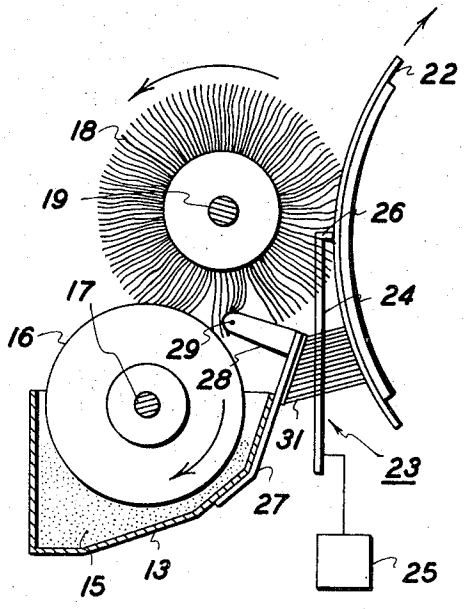


FIG. 1

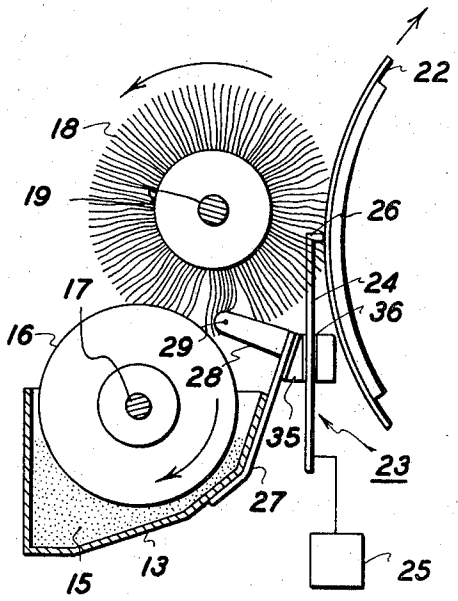


FIG. 3

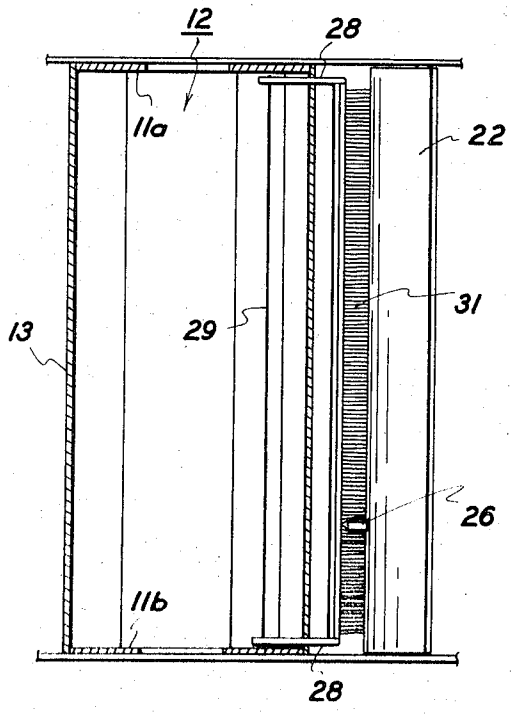


FIG. 2

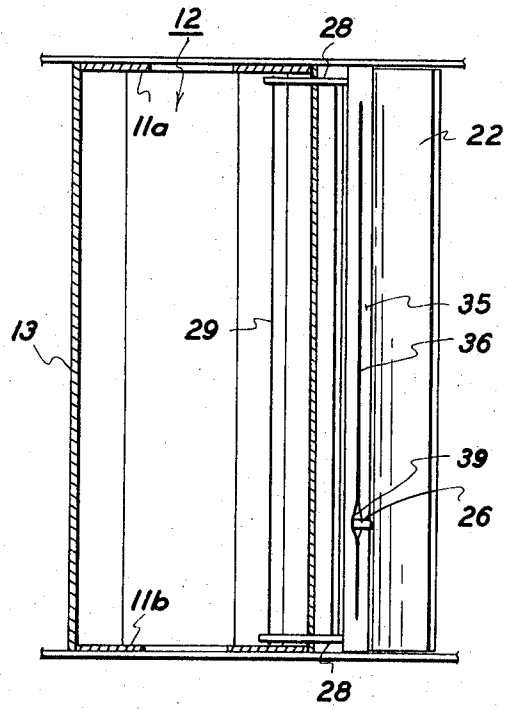


FIG. 4

EXCESS TONER SHIELD FOR ELECTROGRAPHIC APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to electrography. More particularly, this invention relates to an apparatus for preventing the accumulation and deposition of excess electroscopic developer particles or toner on the operating components of the apparatus.

Conventionally, in an electrographic process, an electrostatic charge pattern corresponding to alphanumeric characters or symbols is placed upon a suitable recording media by a charging mechanism. In order to form a visible rendering of the electrostatic image it is necessary to develop the image with electroscopic powders or toner.

Assuming that the charged surface has a positive charge, a toner is selected such that it will be charged to a polarity opposite to that of the electrostatic image. When the oppositely charged toner is deposited on the image surface having a positive electrostatic charge, the charge on the image exerts a force of attraction on the toner and retains the toner in the charged areas. By this means the image is made visible.

In the development process, the objective sought is a reproduction of the original which has sharp contrast and is free of background smudging. The development of the electrostatic latent image can be achieved by employing various techniques. One technique is to cascade developer material on the surface carrying the electrostatic image and to transfer this developed image to a recording sheet or web while in contact with the image carrying surface and thereafter fixing the image by application of heat to the recording means. U.S. Pat. No. 2,990,278 to Carlson describes in more detail such a technique.

Another technique conforms in many respects to that just described except that a powder cloud of developer particles is dispersed over the surface carrying the latent image, as discussed in U.S. Pat. No. 3,239,465. A third method is to deposit developer or toner onto the image bearing surface by means of a magnetic brush set forth in U.S. Pat. No. 2,791,949. The magnetic brush is composed of a mass of very small iron particles which form "fibers" under the influence of a magnetic field. When the desired developer or toner is mixed with the magnetic powder it is charged triboelectrically and upon being picked up by a magnet a brush is formed with charged toner particles adhering in a random manner to the iron fibers.

Still another technique of image development is to deposit toner thereon by means of a fibrous member or fur brush impregnated with toner, as set forth in U.S. Pat. No. 3,251,706.

Various problems are associated with each of the above discussed techniques. For example, with regard to the fur brush development system, excess or loosely held toner in the brush can cause higher than desirable background densities on the output copy and toner accumulation on machine components. In particular, in machines using the fur brush development system and employing a stylus, any excess disposition of toner on the electrostatic copy paper in the area to be traversed by the stylus will cause dark toner streaks on the paper due to the force of the stylus rubbing the toner into the paper and possibly clogging the stylus itself.

The above noted problems are particularly acute in the case of an electrographic copy machine in which a stylus is traversed across the recording media and each character is developed immediately after imprinting by means of a fur brush toner depositing arrangement. In such a situation, means must be provided to permit movement of the stylus widthwise of the recording media while simultaneously preventing excess toner deposited via the brush from clogging the stylus or the machine components located therebelow.

SUMMARY AND OBJECT OF THE INVENTION

It is therefore an object of the invention to provide an apparatus to effectively reduce the amount of excess toner on the fur brush in a developer system.

A further object is to reduce the uncontrolled scattering of toner within the developer housing and to confine its movement within an acceptable area thereby preventing its accumulation on components of the machine.

A further object is to provide apparatus of the above noted type in which a developing brush is rotated into contact with the recording stylus movable widthwise across the recording media, the toner being applied to develop each character immediately after recording.

These and other objects of the invention are achieved by the use of a flicker wire and toner shield mechanism. The flicker is disposed such that it contacts a given portion of the developer brush after the brush has been in contact with the donor roll and prior to the brush contacting the electrographic copy paper. The flicker wire interferes with the brush bristles thereby causing loose toner to be dislodged, the dislodged toner being guided toward the shield and eventually falling back into the sump. Additionally, the invention provides for the use of a strip of soft brush or fur which is positioned such that the recording stylus may project and move freely through the fibers thereof, the brush preventing toner accumulation on components positioned below the stylus.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features, and advantages of the invention will be apparent from the preferred embodiments of the invention as illustrated in the accompanying drawings in which:

FIG. **1** is a diagrammatic side elevation of an electrographic machine in accordance with the invention;

FIG. **2** is a plan view of the machine of FIG. **1** with the donor roller and developer brush omitted;

FIG. **3** is a side elevation view of a modified arrangement according to the invention; and

FIG. **4** is a plan view of the apparatus of FIG. **3** with the donor roller and developer brush omitted.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. **1** and **2**, there is diagrammatically illustrated portions of an electrographic machine of the invention including a fibrous member toning system comprising a developer housing or sump **12** containing electroscopic developer particles or toner **15**. The developer particles **15** may be mixed with grossly larger carrier beads 200 microns in diameter, in a conventional manner, to prevent the toner, which ranges from 5 to 20 microns in diameter, from lumping together while in the sump **12**.

The housing **12** may take any suitable configuration but is shown as a generally rectangular box defined by two side walls **11**a and **11**b and a sump wall **13.** The top of the sump **12** is generally open and has located therein a transfer or donor roller **16.** Various arrangements of agitating means (not shown) may also be included within the housing **12** for preventing caking or agglomeration of the toner material **15.**

The transfer or donor roller **16** is of conventional design and is cylindrical in shape mounted for clockwise rotation (as viewed in FIG. **1**) on a shaft **17** at a predetermined rate, the shaft **17** being journalled in the sidewalls **11***a* and **11***b* of the developer housing **12.** Donor roller **16** is a cylinder which may be made of a metal such as aluminum having a coating of a dielectric material such as a methyl terpolymer. The donor roller **16** has a very lightly etched surface so that the roller not only holds toner by the electric charge and by the affinity it has for the methyl terpolymer coating but also holds a slight amount of toner within the etched voids in the surface. The shaft **17** is located such that the roller **16** is in contact with the toner material **15** contained in the housing **12.**

Through triboelectric action, donor roller **16** picks up a predetermined amount of toner **15** from the sump **12** and carries it, upon rotation, to a developer brush **18,** the developer brush **18** being mounted for rotation counter to the direction of rotation of the donor roller **16** on a shaft **19** which is parallel to the shaft **17.** A metering or wiper blade (not shown) may be positioned adjacent the donor roll **16** to strip all but a thin layer of toner from the donor roll prior to its contacting the developer brush **18.** The diameters of the donor roller and the developer brush are such that a sufficient overlap exists therebetween to provide continuous contact at the points of tangency. The developer brush **18** may comprise synthetic or natural fibers or mixtures of various fibers as outlined in U.S. Pat. No. 3,251,706. The preferred embodiment, however, is a natural fiber of New Zealand rabbit fur.

During rotation of the developer brush **18** its fibers contact a recording medium or paper **22** which bears a latent electrostatic charge corresponding to information, the charge having been deposited on the paper **22** by a writing stylus **23.** Toner particles **15** are thereby deposited from the developer brush **18** onto the paper **22** and attracted to the charged surface portions thereof, since it is selected to have a charge with a polarity opposite thereto. The information corresponding to the charge pattern is thereby made visible.

For optimum image development, the toner, donor roller surface, and the fibrous developer brush should be selected from materials arranged in the triboelectric series also set forth in U.S. Pat. No. 3,251,706 in order that the toner will readily adhere to the donor roller **15** and in turn can be picked up by the fibrous developer brush **18.** Thus, the toner **15,** donor roller surface **16** and the developer brush **18** are arranged in a triboelectric series with positive polarity (the fibrous developer brush) at the top and negative polarity (the toner) at the bottom or vice versa depending on the toner polarity desired. In this manner, any material placed in contact with another which is below it in the triboelectric series will become positively charged and the material below it in the series will become negatively charged. Thus, if a positively charged electrostatic image is to be developed the electroscopic powder must be charged negatively by contact with a brush material which is above it in the series. The negative electroscopic particles will then be deposited upon the positively charged image by electrical attraction.

The stylus **23** is of conventional design and includes a body portion **24** extending intermediate the interior wall of the sump **12** and the recording paper **22.** The stylus **23** includes a writing head **26** of conventional design including a plurality of metal tips pressed lightly into contact with the paper for depositing an electrostatic charge thereon. The stylus **23** is movable widthwise back and forth across the paper **22** on a carriage (not shown) by conventional transport mechanism **25.**

Attached to the sump wall **13** is a shield plate **27** which extends toward the paper **22** and widthwise across the machine. The plate **27** includes two side arms **28,** the side arms **28** supporting at their apexes a flicker wire **29** which extends widthwise across the machine and is supported contacts the fibers of the developer brush **18.**

The shield plate **27** has attached thereto by means of a suitable adhesive a fibrous strip **31** which substantially spans the gap between the plate **27** and the paper **22.** The stylus projects through the thin flexible fibers of the strip **31** into contact with the paper **22.** The thin flexible fibers of the strip **31** retard the passage of excess toner **15** through the opening between the paper **22** and the developer sump **12,** while concurrently permitting substantially free widthwise movement of the stylus **23.** The body portion **24** of the stylus **23** may be particularly shaped to push aside the flexible fibers of the member **31** more easily during widthwise movement thereof. The flicker wire **29** serves to remove excess toner **15** from the developer brush **18** after which the removed toner accumulates on the shield plate **27,** eventually falling back into the sump **12.**

A second embodiment of the invention is shown in FIGS. **3** and **4** in which the same electrographic machine as described with reference to FIGS. **1** and **2** is shown, with the same numerals being used to identify corresponding components. In this embodiment, for the purpose of retarding the passage of excess toner through the opening between the shield **27** and the paper there is provided a urethane foam strip **35** of generally rectangular shape having a slit **36** cut thereacross in which the stylus **23** rides. The strip **35** is supported with a suitable adhesive or other conventional means from the sump wall **13** and also from the sidewalls **11**a and **11**b of the machine housing. The foam strip **35** is biased in a manner such that opposing lips of the slit are in contact with each other except at the point at which the stylus **23** is located. Thus, as the stylus **23** moves across the paper **22** it pushes aside the lips of the slit **35** to create an opening immediately adjacent the body portion of the stylus, as seen in FIG. **4.** A suitable lubricating coating (not shown) may be applied to the body portion of the stylus in this embodiment to permit easier movement of stylus along the slit **35.**

The urethane foam may be in contact on its one side with the recording paper **22** or may be placed a small distance therefrom. In either case, passage of excess toner through the opening between the sump **12** and the paper **22** to the components below is substantially reduced. Various other plastic foam materials may be substituted for the urethane foam without departing from the teachings of the invention.

Thus, it will be seen that the apparatus embodying the invention is simple in form and provides a simple and inexpensive means of preventing excess toner from being deposited on the stylus transport mechanism **25** or other components located below the opening through which the stylus projects.

What is claimed is:

1. Apparatus comprising

a platen on which is moved a recording medium,

a container for housing developer particles,

a stylus assembly projecting intermediate said container and said recording medium to a position adjacent said recording medium,

means for moving said stylus widthwise of said recording medium,

a developer brush for depositing developer particles on said charged medium immediately after each character is imprinted thereon by said stylus, the fibers of said brush contacting said stylus during rotation thereof,

a donor roller located in part in said container and in contact with both said development particles and said development brush, and

a fibrous element substantially spanning the opening between said container and said medium, said stylus projecting through the fibers of said element, said element substantially blocking the passage of developer material through said opening to other parts of the apparatus while permitting movement of said stylus widthwise of said media.

2. The combination recited in claim **1** wherein said element is a natural fur.

3. An electrographic machine comprising a writing stylus movable widthwise of a recording medium, said writing stylus having a writing head and a body portion, a developer housing containing developer material and defining in combination with said medium an opening through which said stylus projects to a position adjacent said medium, a developer brush mounted above said opening for depositing developer particles on said medium immediately after each character is imprinted thereon by said stylus, the fibers of said brush contacting said writing head during rotation thereof, and a resilient member spanning substantially said entire opening, said stylus extending through said member, said member maintaining loose contact with said body portion of said stylus and blocking the passage of excess development material through said opening to other parts of the machine while permitting widthwise movement of said stylus.

4. The combination recited in claim **3** wherein said member comprises a natural fur.

5. The combination recited in claim **3** wherein said member comprises a synthetic plastic foam.

6. The combination recited in claim **5** wherein said foam includes a slit widthwise thereacross, said stylus projecting through said slit.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,840,879 Dated February 13, 1975

Inventor(s) Joseph R. Calabrette and Maynard K. Beckman

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

The first listed inventor's surname is spelled incorrectly in two places on the title page of the patent (paragraphs [19] and [75]) and should be corrected as follows:

-- Joseph R. Calabrette --

Signed and sealed this 8th day of April 1975.

(SEAL)
Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
★ U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.

UNITED STATES PATENT OFFICE
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