United States Patent [19]

Ito

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[54] **CORONA DISCHARGER CLEANING APPARATUS**

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Related U.S. Application Data

[63] Continuation of Ser. No. 322,228, Jan. 9, 1973, abandoned.

[30] **Foreign Application Priority Data**

Jan. 18, 1972 Japan 47-7024

[52] **U.S. Cl.** ..... **250/324;** 317/262 A

[51] **Int. Cl.** **H01j 37/26**

[58] **Field of Search** ..... 250/324, 325, 326; 317/262 A

[56] **References Cited**

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Assistant Examiner—Davis L. Willis
Attorney, Agent, or Firm—Fitzpatrick, Cella, Harper & Scinto

[57] **ABSTRACT**

A corona discharger used in an electrophotographic copying apparatus or the like includes corona discharge electrodes, a shield member surrounding the corona discharge electrodes and at least having a discharging slit, support members at the opposite ends of said shield member, a member for connecting the corona discharge electrodes with a source of high voltage, and a member movable in frictional contact at least with the corona discharge electrode to thereby clean the same. The cleaning member can move in frictional contact with the shield member as well, thereby cleaning the same. The corona discharger may further includes means for holding the cleaning member to one end of the corona discharger during non-cleaning, and means for frictionally moving the cleaning member during cleaning.

16 Claims, 6 Drawing Figures

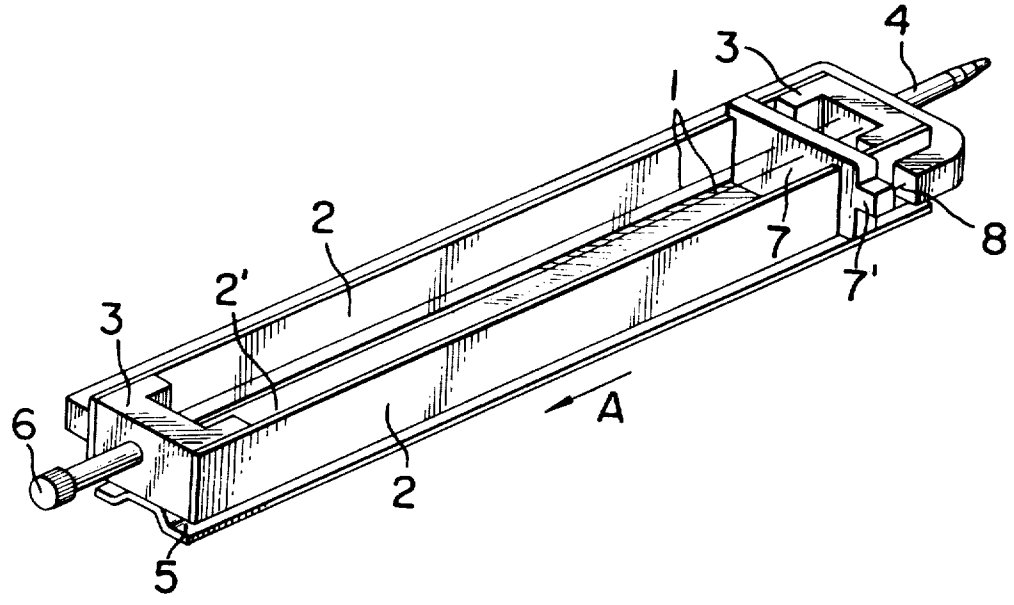


FIG. 1

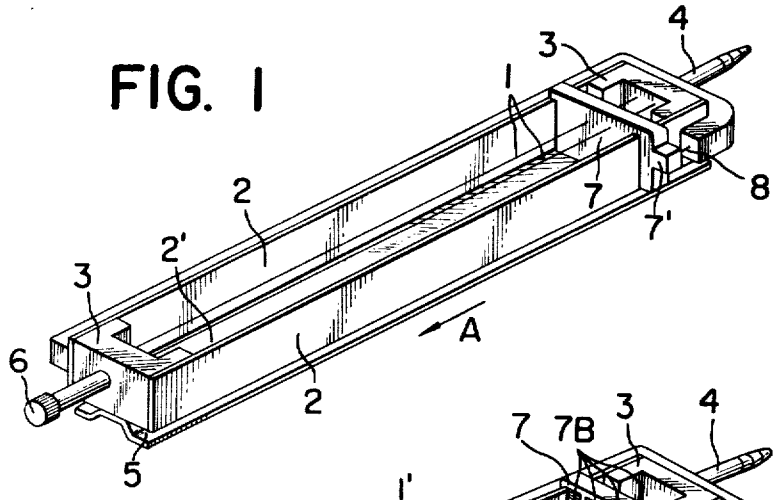


FIG. 2

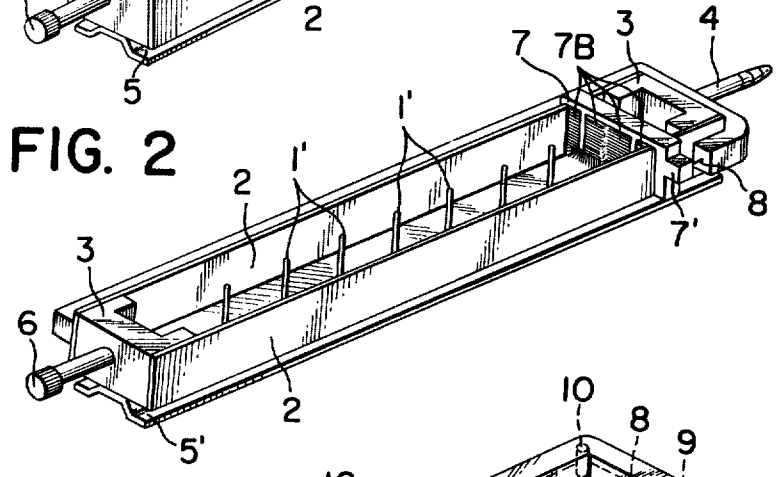


FIG. 3

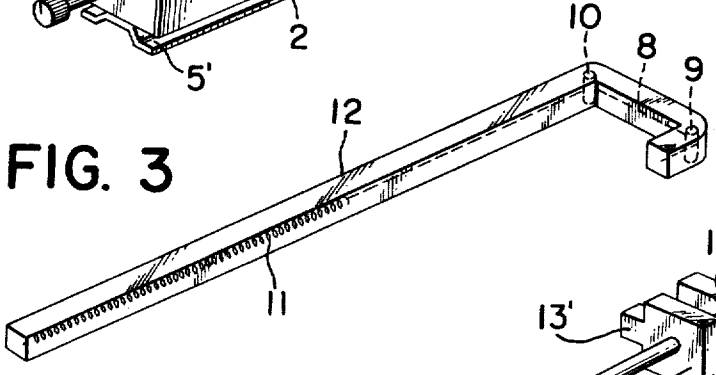


FIG. 4

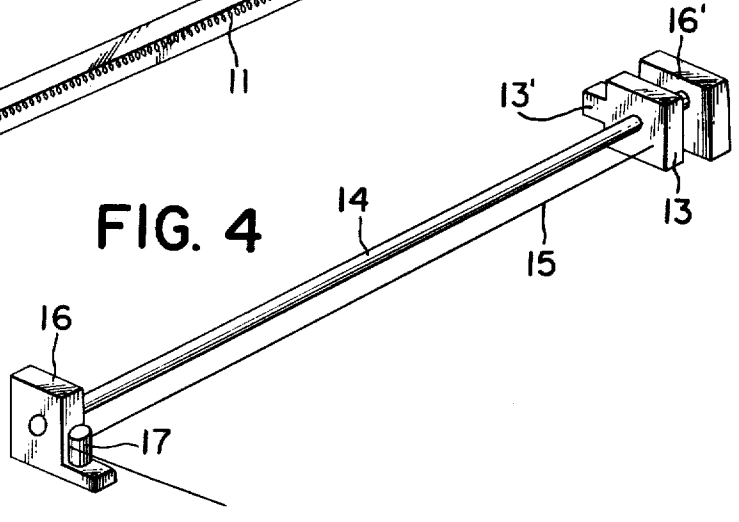


FIG. 5

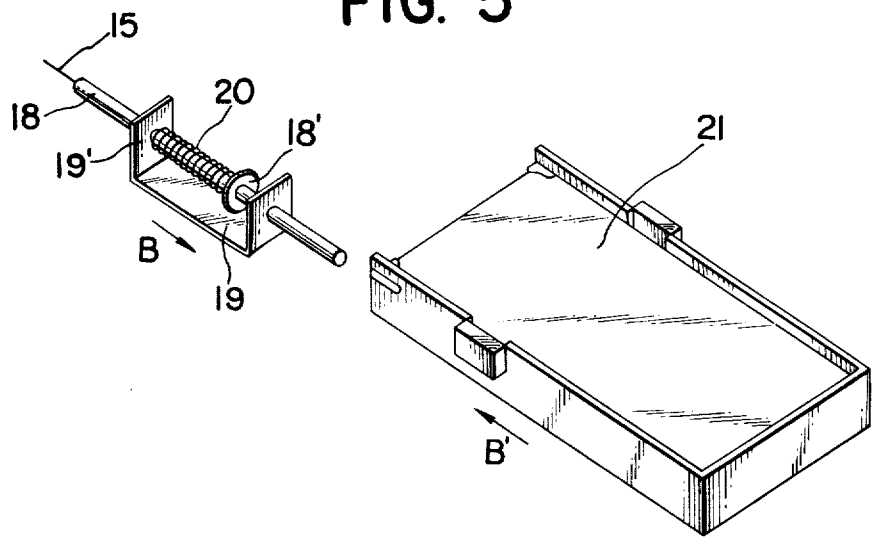
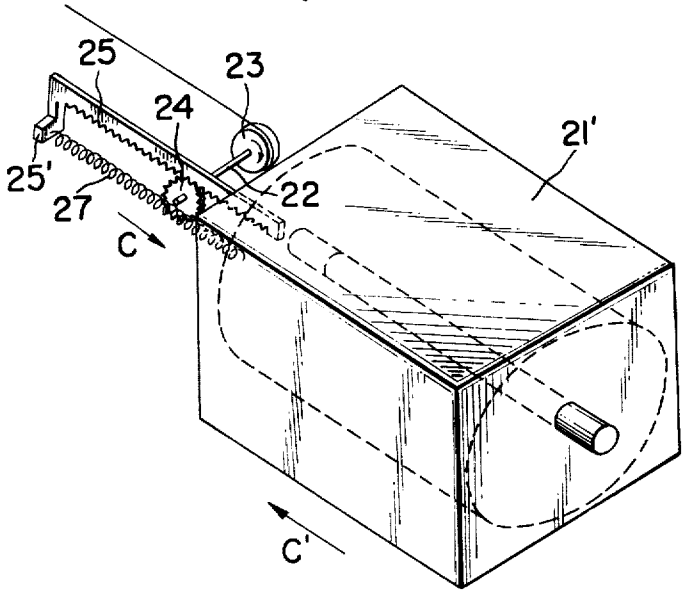


FIG. 6



CORONA DISCHARGER CLEANING APPARATUS

This is a continuation of application Ser. No. 322,228, filed Jan. 9, 1973, and now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention generally relates to a corona discharger used in an electrophotographic copying apparatus or the like. More particularly, it relates to a corona discharger provided with cleaning means for manually or automatically cleaning the shield member and corona discharge electrodes of such corona discharger with great ease.

2. Description of the Prior Art

In general, toner, dust and other contaminants are normally present in suspension within an electrophotographic copying apparatus or the like. As copying operation continues for a long time, these contaminants tend to adhere to and build up on the components of the corona discharger such as shield member and corona discharge electrodes. During several thousand cycles of copying, such adherence of contaminants would reduce the discharging efficiency and cause an irregular discharging effect, which would in turn result in reduced quality of the resultant copy images.

To overcome such disadvantages, rather primitive means has heretofore been employed, for example, the user or service engineer of the copying apparatus periodically withdrew the corona discharger out of the apparatus or manually urged some cleaning means against the corona discharge electrodes to clean the discharger. These cleaning operations, however, would very often result in inadvertent breakage of the discharge wires or damages of the discharge needles if the cleaning was done by an unskilled person. Also, these cleaning operations were very cumbersome in that they had to be carried out periodically without being neglected, otherwise it would be very difficult to prevent the reduction in the quality of the copy images. In addition, cleaning of the discharger required the discharger to be withdrawn from the apparatus so that the contaminants therein might be removed through visual discrimination, and actually it was often the case that the contamination of the discharger was not noticed until the reduced quality of the copy images was detected, and only thereafter the cleaning was carried out, thus leaving the discharging done in unsatisfactory conditions for long hours.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an improved corona discharger in which the corona discharge electrodes may always be maintained in an ideally cleaned state.

It is another object of the present invention to provide an improved corona discharger in which not only the corona discharge electrode but also the shield member may always be maintained in an ideally cleaned state.

It is still another object of the present invention to provide an improved corona discharger in which a cleaning member is slidable in frictional contact with the corona discharge electrodes and with the shield member to thereby clean the same.

It is yet another object of the present invention to provide an improved corona discharger in which the discharging slit portion of the shield member serves also as the guide member for guiding the cleaning member when the latter frictionally slides in the corona discharger.

It is yet still another object of the present invention to provide an improved corona discharger in which the cleaning member is set to a predetermined position except during its use so as not to interfere with the corona discharging.

It is a further object of the present invention to provide an improved corona discharger in which the frictional sliding of the cleaning member may be manually accomplished safely and positively by withdrawing the corona discharger out of a copying apparatus.

It is still a further object of the present invention to provide an improved corona discharger in which the frictional sliding of the cleaning member may be accomplished periodically and automatically.

According to a broad feature of the present invention, the corona discharger includes a cleaning member provided within the discharger and slidable therein while keeping a frictional contact with the shield member and corona discharge electrodes of the discharger, thereby cleaning the same. The corona discharger may be either manually cleaned by the cleaning member when the discharger is withdrawn out of the copying apparatus, or periodically cleaned by utilizing the movement of a member which is periodically moved in the copying apparatus during the noncopying operation thereof. For example, a copying apparatus generally employs sheets of copy paper or a roll of copy paper, and the container for such copy paper is of course manually mounted in the apparatus. Moreover, a sheet cassette is often capable of containing several hundred sheets of copy paper, while a roll of copy paper can often correspond in amount to about one thousand sheets. Although such paper supply capacity is more or less variable with the size of the apparatus body, paper replenishment is required during the course of copying operation at a rate of at least once per about 1,000 copying cycles. At each of these operations for the paper replenishment, the discharger of the present invention utilizes the movements involved in such paper replenishment to automatically clean itself to maintain its ideal discharging conditions. Thus, the present invention enables the cleaning of the discharger to be effected automatically and periodically.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will become fully apparent from the following detailed description thereof taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a perspective view showing the corona discharger provided with a cleaning member according to an embodiment of the present invention;

FIG. **2** is a perspective view showing another embodiment of the corona discharger; and

FIGS. **3, 4, 5** and **6** are perspective views of showing the mechanism for moving the cleaning member of FIG. **1** or **2.**

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. **1,** the corona discharger according to an embodiment of the present invention is shown in perspective view and includes corona discharge wires **1** of stainless steel or like material, a shield member **2** disposed to surround the corona discharge wires **1,** a

shield member 2' similar to the shield member 2 but optically providing a slit for simultaneous application of light and discharge or providing a fully open slit, and insulative support members 3 for supporting the corona discharge wires 1 and shield members 2 and 2'. The discharger is provided with a terminal 4 for applying therethrough a high voltage from a voltage source to the corona discharge wires, a guide rail 5 for removably mounting the corona discharger to the body of a copying apparatus, and a knob 6 usable to mount or dismount the corona discharger.

FIG. 2 shows another embodiment of the present invention which employs corona discharge needles 1' instead of the corona discharge wires 1 shown in FIG. 1.

Those parts which have been described so far generally form the essential parts of any one of various corona discharges that have heretofore been proposed. According to the present invention, such a conventional corona discharger may be provided with a cleaning member for cleaning the discharger without destroying its characteristic as corona discharger when it is contaminated during use in a copying apparatus. In FIG. 1, the cleaning member is designated by numeral 7 and provided for sliding along the discharge wires 1 while keeping a frictional contact therewith and with the shield member 2 so that the discharger is cleaned due to the frictional sliding. As indicated at 7B in FIG. 2, the cleaning member may also comprise a brush adapted to slide in frictional contact with the needle electrodes 1'.

An operating mechanism for the cleaning member will now be described in detail.

The cleaning member 7 has secured thereto a wire 8, which in turn has a coil spring 11 attached at one end thereto for imparting a tension in one direction through pulleys 9 and 10 (see FIG. 3). The other end of the coil spring 11 is secured to one end of a protective casing 12 which houses therein the wire 8, pulleys 9, 10 and coil spring 11. Thus, during the operative conditions of the copying machine and during the discharging operation of the discharger, the cleaning member may be immovably held by the tension of the coil spring 11 in the position of FIG. 1, i.e. the position in which the cleaning member does not interfere with the discharging effect. To cause the cleaning member 7 to slide for the cleaning purpose, a pull force strong enough to overcome the tension of the coil spring 11 must be imparted in counter direction. This may be accomplished by withdrawing the corona discharger out of the copying apparatus body with the aid of the guide rail 5 and by manually sliding the cleaning member 7. Alternatively, it may be done periodically and automatically by using the arrangement as shown in FIGS. 4 and 5. Referring to FIG. 4, a slide member 13 is provided to transmit to the cleaning member 7 a force which will cause this member to slide against the tension of the coil spring 11. The slide member 13 has a projection 13' adapted to engage the corresponding projection 7' of the cleaning member 7' to thereby cause the cleaning member to slide in the direction as indicated by arrow A in FIG. 1. The slide member 13 is slidable along a guide rail 14 by a wire 15 which is pulled by pull means as shown in FIGS. 4 and 5. Fixing means 16 and 16' support the guide rail 14 and are fixedly secured to the apparatus body. The wire 15 is connected to the pull means via a pulley 17 as shown in FIG. 5 or 6. Referring to FIG. 5, the wire 15 is connected to a slide bar 18, which in turn is slidably held by a frame 19. A spring 20 for pulling the slide bar 18 in the direction of arrow B with a greater force than the pull force of the coil spring 11 is provided on the slide bar 18 between the projection 18' secured to the slide bar and a support portion 19' of the frame 19 secured to the apparatus body. When a paper sheet supply container 21 is released as shown in FIG. 5, the slide bar 18 is biased in the direction of arrow B so that the cleaning member 7 is moved to the extremity in the direction of arrow A (FIG. 1). By mounting the paper sheet supply container 21 in the direction B', the slide bar 18 is moved in the direction B against the force of the spring 20 so that the cleaning member 7 is pulled back in the direction A' by the coil spring 11. In this manner, the cleaning member is reciprocated in the directions A and A' each time the paper sheet supply container 21 is mounted and dismounted, thus frictionally cleaning the corona wires and shield member.

FIG. 6 shows another embodiment which differs from that shown in FIG. 5. As shown, the wire 15 is secured to a rotatable member 23 at a peripheral point thereon, which rotary member 23 is securely mounted on a rotary shaft 22 rotatably journalled to the apparatus body, and the wire may be wound or unwound on the rotatable member 23 with the rotation thereof. At the other end, the rotary shaft 22 has a gear 24 rotatably mounted thereon and a gear rack 25 is in engagement and movable with the gear 24. At one end 25' of the rack 25 there is secured one end of a tension spring 27, whose other end is secured to a fixed point 26 on the apparatus body. The gear rack 25 is movable with the paper roll supply container 21' so that, when the paper roll supply container is being withdrawn, the gear rack 25 is moved in the direction of arrow C to rotate the rotary member in the direction of curved arrow to thereby wind the wire thereon, whereby the cleaning member of FIG. 1 is moved in the direction of arrow A. When the paper roll supply container is mounted in place, the cleaning member is moved in the direction A' to effect cleaning reciprocally.

The material forming the cleaning member 7 may be insulative and preferably be resilient, such as, for example, a wiper member of foamed urethane rubber. The effective configuration of the brush portion 7B of the cleaning member 7 shown in FIG. 2 may be various, for example, such as brush hair lines of equal length disposed in alignment at the opposite sides of the needle electrode, brush hair lines of non-uniform length misalinged at the opposite sides of the needle electrode, or brush hair lines so disposed as to make oblique contact with the needle electrode. Also, the effective material for the brush may be glass fiber, Teflon (Trademark), nylon (Trademark) or the like.

As will be appreciated from the foregoing, the cleaning member of the present invention is easy to operate in that it can clean the interior of the corona discharger with the mounting and dismounting of the paper supply means. Also, since the paper supply means is mounted and dismounted relatively periodically in accordance with the number of paper sheets to be fed, the cleaning operation takes place correspondingly periodically and this is very convenient. In the illustrated embodiments, the cleaning operation of the cleaning member has been accomplished by utilizing the mounting and dismounting of the paper supply container, whereas it will be apparent that the cleaning operation may also be ac-

complished by utilizing the movement of some other means which is operated except during the copying operation, such as the movement of the means for opening and closing the lid of apparatus when it is desired to supply developer or to repair the cleaning device for photosensitive medium.

I claim:

1. A corona discharger comprising:
corona discharge electrodes;
a shield member surrounding said corona discharge electrodes and at least having a discharging slit;
support members provided at the opposite ends of said shield member;
a member for connecting said corona discharge electrodes with a source of high voltage;
a cleaning member movable in frictional contact at least with said corona discharge electrodes to thereby clean the same;
means for holding said cleaning member at one end of said corona discharger during non-cleaning; and
means for reciprocating said cleaning member between the opposite ends of and along said corona discharge electrodes responsive to movement of a detachable element for a copying device.

2. A corona discharger according to claim 1, wherein said cleaning member is movable in frictional contact also with said shield member to thereby clean the same.

3. A corona discharger according to claim 1, wherein said discharging slit of said shield member serves also as a guide rail for said cleaning member.

4. A corona discharger according to claim 1, wherein said corona discharge electrodes are discharge wires.

5. A corona discharger according to claim 1, wherein said corona discharge electrodes are discharge needles.

6. A corona discharger according to claim 1, wherein said cleaning member is a wiper member movable in frictional contact at least with said corona discharge electrodes.

7. A corona discharger according to claim 1, wherein said cleaning member is a brush member movable in frictional contact at least with said corona discharge electrodes.

8. A corona discharger according to claim 1, wherein said holding means is a member for pulling said cleaning member to said one end of said corona discharger.

9. A corona discharger according to claim 8, wherein said pulling member is a tension spring.

10. A corona discharger according to claim 9, wherein said tension spring is integrally provided along the outer circumference of said shield member.

11. A corona discharger according to claim 1, wherein said last named means comprises;
first means for frictionally moving said cleaning member to the other end of said corona discharger against said holding means; and
second means for suppressing the force of said first means which resists said holding means.

12. A corona discharger according to claim 11, wherein said holding means is a member for pulling said cleaning member to one end of said corona discharger, and said first means is a member for pulling said cleaning member to the other end of said corona discharger against the pulling force of said holding means.

13. A corona discharger according to claim 12, wherein said pulling member of said holding means is a tension spring, said pulling member of said first means is a tension spring, and said second means has a push member for stretching said tension spring of said first means.

14. A corona discharger according to claim 12, wherein said pulling member of said holding means is a tension spring, said pulling member of said first means is a compression spring, and said second means has a push member for compressing said compression spring of said first means.

15. A corona discharger according to claim 13, wherein said push member of said second means is a copy paper supply container retractably mounted in a copying apparatus.

16. A corona discharger according to claim 14, wherein said push member of said second means is a copy paper supply container retractably mounted in a copying apparatus.

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