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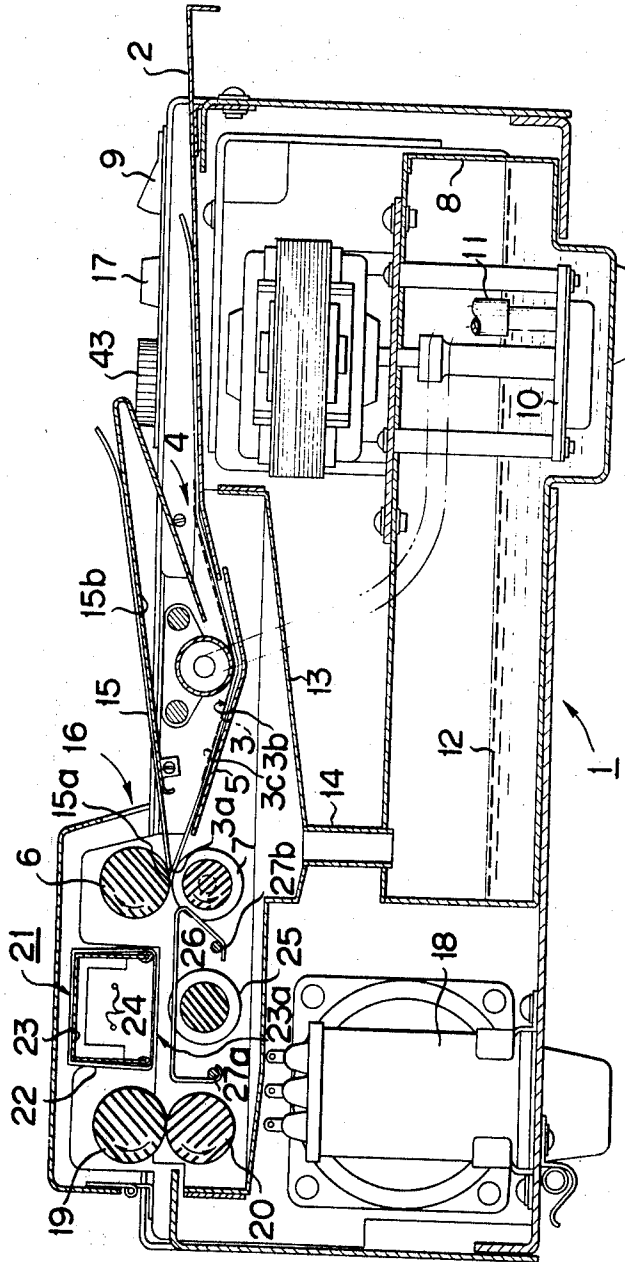
3,615,130

WET TYPE PHOTOSTATIC DEVICE WITH LENGTH CONTROL

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2 Sheets-Sheet 1

FIG. 1



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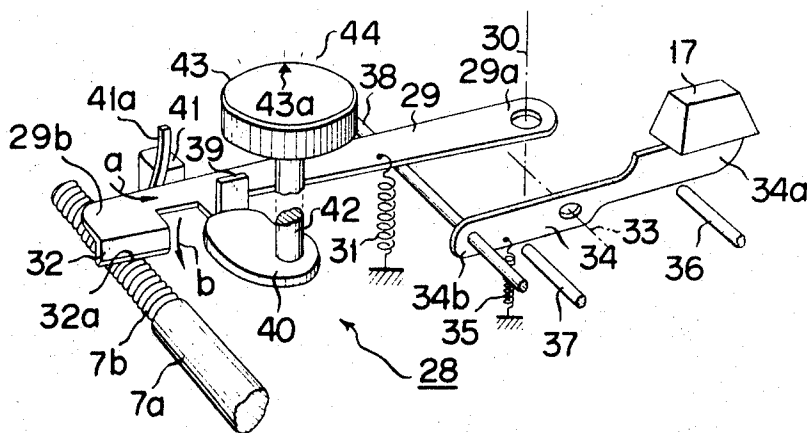
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FIG. 2



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WET TYPE PHOTOSTATIC DEVICE WITH LENGTH CONTROL

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2 Claims

ABSTRACT OF THE DISCLOSURE

A wet type electronic photographic copying device in which a copy to be made is independently inserted in the device and visually aligned and superposed with an original to be subjected to passage through the device and corona discharge. A power supply drives roller means and energizes the corona discharge. Control means or the power supply includes a switch opened and closed by movement of a rocking lever that abuts a cam to determine the length of energization.

BACKGROUND OF THE INVENTION

The present invention relates to an electronic photographic copying device and more particularly a device for copying a copy whose pattern is formed by the electronic photographic copying method.

The copying device of the type described is utilized when it is desired to obtain a plurality of copies after only one exposure step or when it is desired to obtain a second copy by direct exposure photocopying method.

Known is a wet process type electronic photographic or electrostatic photocopying method in a mixture in which finely divided powder of a photoconductive material such as zinc oxide dispersed in a binder is applied over a substrate such as paper, thereby forming a photoconductive layer; electrically charging this photoconductive layer; forming an electrostatic latent image upon the photoconductive layer by exposure; and thereafter applying to the exposed photoconductive layer a processing solution in which toner obtained by processing into resinous form finely divided material such as carbon black is suspended in a carrier having a high electrical resistance, thereby developing the latent image.

The features of the wet process type electrostatic photographic method are high resolution because of the development process with the use of finely divided particles, simple and easy to attain continuous tones, capable of providing a reversed image if necessary and clean operation because finely divided particles are not scattered. On the other hand, the substrate upon which is formed a coating of photoconductive material is generally made of an opaque paper and the photoconductive layer or coating such as zinc oxide has generally a tendency to absorb the light especially the spectrum effective to photocopying. Therefore, the advantage of the use of transparent substrate is not fully utilized in practice. Therefore, the copy obtained by the wet process type electrostatic photography, for which there are many applications, cannot be used as it is, as an original for direct exposure type photocopying.

In view of the above, the primary object of the present invention is to provide a wet process type electrostatic photographic device simple in construction and efficient in operation, providing a plurality of copies only by one exposure step and eliminating the defect of the conventional wet process method of the type described by forming an image upon a transparent paper or the like such

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as tracing paper so as to provide an original adapted for use in direct exposure type photocopying.

SUMMARY OF THE INVENTION

It is extremely difficult to superpose a copying paper correctly upon an original wetted previously with a processing solution. To eliminate this difficulty, the present invention provides the arrangement as described hereinafter. The copying paper and the original are inserted into the copying device through independent inlets and their leading edges are abutted against the nip of a pair of feed rollers held stationally so as to align these side edges with each other. This can be done by observing the alignment through the inlet. Thus the original and the copying paper can be correctly superposed one upon the other for processing. In order to ensure the close contact between the original and the copying paper and to facilitate the transfer of the toner from the original to the copying paper, they are electrically charged. When it is desired to provide a plurality of copies from one original, they are electrically charged again with a polarity opposite to that of the first charging before the original is separated from the copying paper in order to prevent the whole toner transfer from the original to the copying paper.

Depending upon sizes of an original and a copying paper, the time during which the feed rollers are actuated and the charging time must be controlled. For this purpose, the present invention provides a switch actuating device for controlling the time when the feed rollers as well as the charging device are actuated and stopped. This actuation timing adjustment can be attained by adjusting the angle of rotation of a rocking member adapted to actuate an actuating element of a switch which opens or closes a power supply circuit to the feed roller drive and to the discharging device.

The above and other objects, advantages and features of the present invention will become more apparent from the following description with reference to the accompanying drawing.

BRIEF DESCRIPTION OF DRAWING

FIG. 1 is a sectional view of one embodiment of a wet type electronic photographic copying device according to the present invention; and

FIG. 2 is a perspective view of one example of a switch actuating device employed in the device shown in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring particularly to FIG. 1, a wet type electronic photographic copying device according to the present invention is generally designated by reference numeral 1. To an original holder 2 is directed through an inlet 4 an original 3 having an image formed by the wet type electronic photographic method and is held in position with the leading edge 3a of the original held between a nip of a pair of rollers 6 and 7 pressed against each other after passing through a processing solution tray 5. In this case, the original 3 must be so positioned that its image side is directed upwardly. Upon actuation of a pump 10 to be actuated by a main switch 9, the processing solution 12 is supplied to the processing solution tray or saucer 5 through a pipe 11 from a processing solution reservoir 8. The original 3 is wetted with the processing solution when passing through the processing solution tray or saucer 5 and the processing solution is returned to the reservoir 8 from a drain 14. That is, the processing solution in the tray or saucer 5 is circulated by the pump 10 and is similar to the type used as a carrier which is a mother liquor of a processing solution used in the above described wet type electronic photographic copying method.

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A transparent copying paper 15 such as tracing paper and the like is inserted into an inlet 16 with the surface being directed downwardly in FIG. 1. The copying paper 15 is then held stationary with its leading edge 15a abutted against the nip of the rollers 6 and 7 as in the case of the original 3. In this case, both of the leading edges 3a and 15a must be aligned. Since the inlet 16 is relatively wider, the operation of aligning the leading edge 15a of the copying paper 15 with that of the original 3 can be made in a simple manner while observing the operation through the inlet 16.

After the original has been wetted with the processing solution and the leading edge 3a of the original is aligned with that of the copying paper 15, a pushbutton 17 for a switch (not shown) is depressed so as to actuate a motor 18. Consequently, the rollers 7 and 20 are rotated in the directions indicated by the arrows through a suitable transmission mechanism (not shown) such as chains, sprocket wheels, etc. Thus, the mating rollers 6 and 19 are also rotated in the directions indicated by the arrows respectively and concurrently a charging device generally designated by reference numeral 21 is energized.

The charging device 21 is arranged and disposed such that electrically insulating thread such as nylon thread is wound in a wide pitch around an elongated frame member 23 having a bottom; wire electrodes 24 are extended in the frame member 23; and the open side of the elongated frame member 23 is disposed in opposition to an electrode roller 25 having the opposite polarity to that of the wire electrodes 24. Across these electrodes 24 and 25a is applied a high voltage so as to cause a corona discharge therebetween, thereby imparting charges to the original 3 and the copying paper 15 passing between these electrodes. In order to prevent the wetted original 3 from being wound around the electrode roller 25 and the roller 7, a guide member 26 made of a wire is provided. The wire guide member 26 is folded so as to loosely fit into peripheral grooves formed in both of the roller 7 and the electrode roller 25 and both ends of the wire guide member are fixedly secured to pins 27a and 27b respectively while the straight portion is maintained in horizontal position.

The original 3 maintained in superposed relation with the copying paper 15 with the surface 15b thereof in contact with the pattern 3b of the original is held between the rollers 6 and 7, imparted with a suitable pressure therefrom and directed toward the charging device 21. Since toner 3c forming the pattern 3b of the original is wetted by the processing solution as described above, when the pattern 3b is pressed against the surface of the copying paper 15 by a suitable pressure to such an extent that the pattern 15a may not be destroyed, the toner 3c is mechanically transferred to the surface 15b of the copying paper. The superposed original and copying paper is subjected to corona discharge in the charging device 25 so that a charge having a polarity opposite to that of the toner 3c upon the original 3 is applied to the rear surface of the copying paper 15. Consequently, the pattern 3b upon the original 3 and the surface 15b of the copying paper 15 are closely attracted to each other by the electrostatic force. The attracted and superposed original and copying paper are further directed out of the copying device 1 by means of the pair of rollers 19 and 20. When the original 3 is separated from the copying paper 15, some portions of the toner 3c remain attached upon the surface 15b of the copying paper, thus completing one copying operation and providing a second original.

However, when it is desired to provide a plurality of copies, a charge having the opposite polarity to that of the original charge is applied to the rear surface of the copying paper 15 by the discharging device 25 again. Thereafter, the original 3 is removed from the copying paper 15, still leaving substantially 80% of the toner on the side of the original 15 so that this original may be used again for further copying.

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The pushbutton 17 which is depressed after the leading edges 3a and 15a of the original 3 and the copying paper 15 have been aligned with each other at the contact portion of the pair of rollers 6 and 7 is operatively interconnected to a switch actuating device 28 as shown in FIG. 2, thereby controlling the timing of the actuation of the motor 18 as well as the charging device 21.

At the end portion of a shaft 7a of the roller 7 are provided feed screw threads 7b. A rocking member 29 has its base end 29a fitted loosely over a pivot 30 fixed to a stationary member of the copying device 1. The rocking member 29 is imparted with a tendency to rotate in the counterclockwise direction as indicated by the arrow a and also to move downwardly as indicated by the arrow b by means of a spring 31 so that a bent portion 32 formed at the extremity 29b of the rocking member 29 is always pressed against the screw threads 7b. A rocking lever 34 is rotatably carried by a shaft 33 fixed to the side plate of the copying device 1 and is imparted with a tendency to rotate in the counterclockwise direction in FIG. 2 by means of a spring 35. The rotation of this rocking lever 34 is limited by stop pins 36 and 37 disposed below the ends 34a and 34b of the rocking lever 34 respectively. The pushbutton 17 is fixed to the end 34a of the rocking lever 34 while a pushup lever 38 is fixed to the other end 34b. The pushup lever 38 extends below the rocking member 29 so that when the pushbutton 17 is depressed, the rocking member 29 is pushed upwardly by the lever 38, whereby the bent portion 32 at the extremity 29b of the rocking member is released from the engagement with the threaded portion 7b of the shaft 7a. Consequently, the rocking member 29 is caused to rotate in the direction of the arrow a by the aforementioned tendency and in the direction of the arrow b by the force of the spring 31. Adjacent to the extremity 29b of the rocking member 29 is formed another bent portion 39 independently of the bent portion 32 and adapted to abut against the cam-shaped stopper 40 disposed in the path of rotation of the rocking member 29. More specifically the stopper 40 is located at a position corresponding to the starting end of the screw threaded portion 7b of the shaft 7a. When the bent portion 39 abuts against this stopper 40 and thereafter when the pushbutton 17 is released, the side edge 32a of the bent portion 32 presses against the above described starting end of the threaded portion 7b by its tendency. Upon rotation of the shaft 7a, the side edge 32a of the bent portion 32 is displaced in the direction opposite to the direction indicated by the arrow a by means of the threaded portion 7b. In the path of rotation of the rocking member 29 caused by the threaded portion 7b, is disposed a normally-opened microswitch 41 electrically interconnected to the power supply circuit of the photocopying machine 1. Thus, when the pushbutton 17 is depressed so that the rocking member 29 is released from an actuating element 41a of the microswitch 41, the switch is closed, thereby starting the rotation of the motor 18 and energizing the charging device 21. On the other hand, when the actuating element 41a is pushed by the rocking member 29 advanced by the threaded portion 7b, the contacts of the microswitch 41 are opened, thereby stopping the motor 18 and also de-energizing the charging device 21. Thereafter, when the pushbutton 17 is depressed again, the rocking member 29 is returned to its normal position by means of the spring 31 so that the actuating element 41a is released from the engagement with the rocking member 29, whereby the power supply circuit is closed, the charging device 21 is energized and the motor 18 is caused to rotate. Next the rocking member 29 is caused to rotate in the direction opposite to that indicated by the arrow a by means of the threaded portion 7b. The pitch and length of the threaded portion 7b may be determined depending upon the time required for actuating the copying device 1.

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The stopper 40 is rotatably carried by a shaft 42 fixed to the stationary member of the copying device 1 and is so arranged as to be rotated to a suitable position by means of a knob 43 fixedly secured to the shaft 42. Therefore, the position at which the peripheral edge portion of the stopper 40 abuts against the bent portion 39 of the rocking member 29, that is the initial position of the rocking member 29 is adjusted by the knob 43. The knob 43 is provided with an index mark 43a while a stationary member disposed peripherally of the knob 43 is graduated with scales adapted to indicate an energizing time which is varied depending upon the sizes of the original or copying paper. Thus, the energizing time is controlled by setting the index mark 43a to a suitable graduated scale.

It is generally very difficult to apply correctly a copying paper such as tracing paper upon an original wetted with the processing solution because they readily stick together very strongly. However, according to the present invention the leading edges of the copying and original can be aligned at the contact portion of a pair of rollers held stationarily while observing this alignment operation so that the misalignment between the original and copying paper can be completely eliminated when they are fed between the rollers. Furthermore, the present invention has another salient advantage to render an electronic photographic copying device compact in size and simple in construction.

The present invention has been described so far in detail with particular reference to one preferred embodiment thereof, but it will be understood that variations and modifications can be effected without departing from the true spirit of the present invention as described hereinabove and as defined in the appended claims.

We claim:

1. A wet type electronic photographic copying device wherein a copy to be made is independently inserted into the device to be superposed with its leading edge visually aligned with the leading edge of an original and moved through said device comprising:

a processing tray through which said original is passed to be wetted before said alignment is effected;
roller means located downstream of said processing tray to receive said superposed original and copy;
motor means for selectively driving said roller means;
charging means located downstream of said roller means for transferring an image from said original to said copy;

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a power supply for said motor means and said charging means; and

means for controlling the power to energize said motor means and said charging means comprising:

a rocking lever pivotally mounted on one end and subjected to means tending to force said rocking lever downwardly and in a counterclockwise direction;

said rocking lever having its other end normally engaged with a rotatable threaded member forcing said rocking lever in a clockwise direction;

a normally open switch for said power supply, said switch associated with said rocking lever;

a rocking member mounted on said device and selectively operated by a pushbutton to pivot said rocking lever upwardly out of engagement with said threaded member thereby closing said switch as said lever is moved upwardly and counterclockwise, said switch closing effective energizing of said motor means and said charging means for a time determined by the movement of said rocking lever in a clockwise direction; and

timing means associated with said rocking lever for determining said energization.

2. A wet type electronic photographic device according to claim 1, in which said timing means comprises a cam selectively settable for abutting a portion of said rocking lever to determine the end of the counterclockwise movement.

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