United States Patent

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Canberra, Australia
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[33] **Australia**
[31] **46076/68**

[54] **METHOD OF CONTOUR CHARGING**
7 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** ..... **317/262 A,**
250/49.5 C, 250/49.5 GC
[51] **Int. Cl.** **G03g 15/02**
[50] **Field of Search** 317/3, 4,
262 A; 250/49.5, 49.5 GC, 49.5 C

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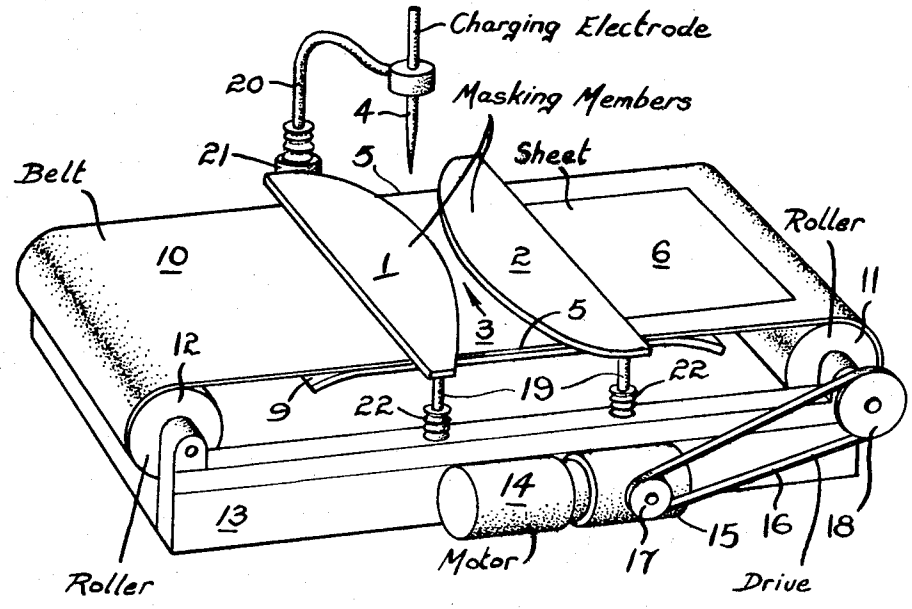
ABSTRACT: The invention relates to a method of charging electrophotographic coatings wherein successive areas of coating are progressively presented to a charging electrode, the characterizing feature being the interposing of masking means between the charging electrode and the surface to be charged to extend generally transversely to the direction of motion and fixed generally in relation to the charging electrode so that the charging duration of different parts of the area being charged is varied in proportion to the charge intensity at that area. Thus charging intensity is balanced in relation to the distance from the charging electrode. The invention also relates to control of the part of the corona used.



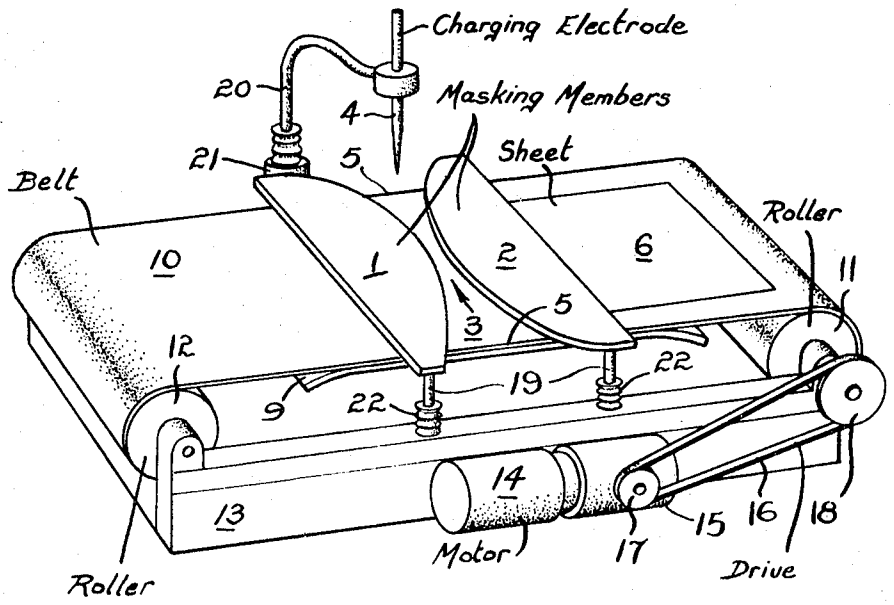

Charging Electrode
20
Masking Members
4
21
5
Sheet
Belt
Roller
10
1
2
6
11
3
5
12
19
22
9
22
14
13
15
16
18
Motor
17
Drive
Roller

FIG 1

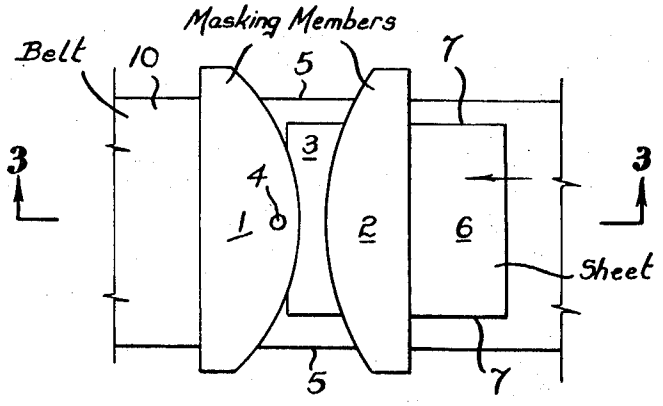

Masking Members
Belt
10
5
7
3
3
4
1
2
6
3
Sheet
5
7

FIG 2

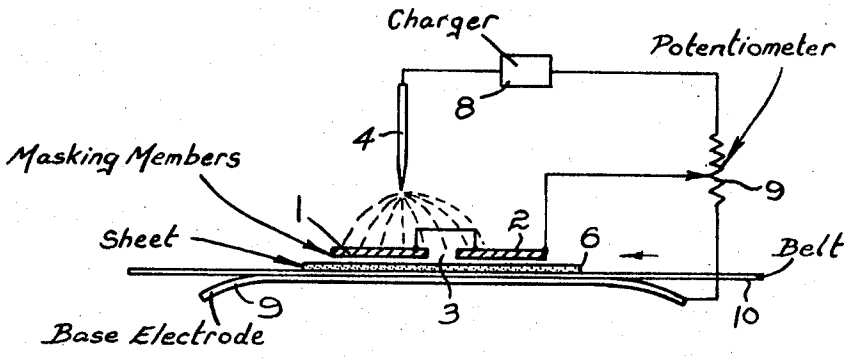

Charger
Potentiometer
8
4
Masking Members
9
1
2
6
Sheet
Belt
9
3
10
Base Electrode

FIG 3

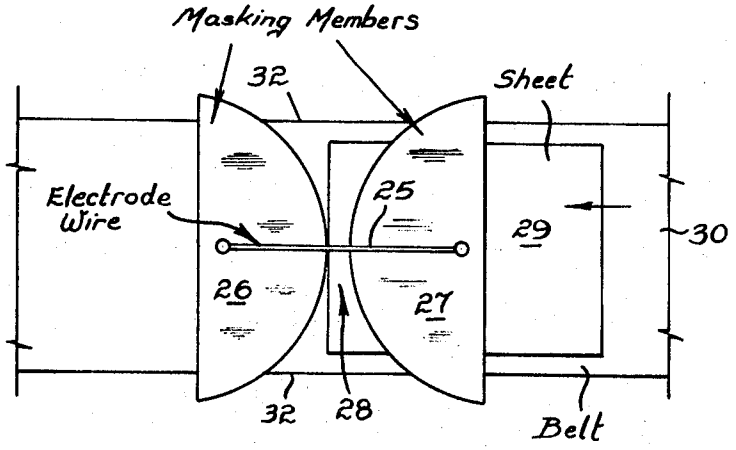

Masking Members
32
Sheet
Electrode Wire
25
29
30
26
27
32
28
Belt

FIG 4

METHOD OF CONTOUR CHARGING

This invention relates to improvements in and to the charging of surfaces such as for the production of a latent electrostatic image in xerography, where a photoconductive surface is first charged and is then subjected to a light or X-ray image, or requires to have a uniform charge placed on it after the surface is light modified by the imaging means.

The production of a uniform charge pattern from a corona point or wire has always been subject to certain difficulties and considerable research has been undertaken in this connection as can be exemplified in two earlier Australian Pat. applications in our name numbered respectively No. 63,375 dated Aug. 30, 1965 and No. 21,718 dated May 15, 1967.

Thus for instance in Australian Pat. application No. 63,375/65 a method was suggested which used only portions of the areas of the corona discharge because, at that time, it was found that the corona discharge gave bands of different effect at different distances from the central point to which the corona was directed.

In that specification the charging electrode was spaced from a base electrode to produce a series of outwardly defined bands about a core which was substantially medial to the discharge direction from the electrode, but the workpiece on which the charge was to be effected was inserted into an outer band of the corona pattern so that the workpiece was charged only by this band of the corona pattern.

This resulted in a much better form of control of the charge on the surface, and represented a considerable step forward in the understanding of the action required when charging photoconductive surfaces.

In application No. 21,718/67 the general principle taught in the earlier specification was followed, but in this relative rotation between the discharge point and the surface being charged was used to allow a larger area to be charged from a given corona, and this therefore represented a still further advance in the art in that during rotational movement the relative rotational motion between the point and the surface about an axis perpendicular to surface, caused the corona to sweep the surface in a generally radial direction, and this enabled a relatively uniform charge acceptance to take place over each incremental area due to this relative movement.

The present invention envisages a still further step forward in the art and consists in the use of masking means for the corona so arranged that the effectiveness of the corona can be made uniform over a substantial area and for this purpose the invention comprises a method of charging an electrophotographic coating whereby the coating moves relative to the discharge means, and charge uniformity is achieved by the combination of the motion and masking means placed between the coating and the discharge means.

In this way it will be realized that by an appropriate shaping of the masking means, charging at each incremental area can be controlled to ensure that uniformity of charge results irrespective of distance from the charging means, and it will be realized that generally by having a relatively narrow exposed slit at the more intense charging areas and widening the slit outwardly from the intense area to the weaker areas in proportion to the falloff of charging intensity, a relatively wide band can be charged in a completely uniform manner where there is relative motion between the charging means and surface.

The invention also allows the advantages of the first-mentioned specification to be attained in that it allows masking of those areas of the charge where unwanted effects occur, such as immediately beneath the charging electrode, and it will be realized therefore that by correct masking a very improved effect will be possible in which not only will the density of the charge per unit area be controllable at different distances from the corona-producing device, but the particular bands of the corona can be selected which will give the most effective charging.

The method of producing the corona can of course be widely varied within the present invention and the corona can for instance be produced from a point or points or can be produced from a wire or wires, and in order that the general principles of the invention can be fully appreciated a description will now be made with reference to the accompanying drawings which are by way of example only and are not to be taken as limiting the invention.

In these drawings:

FIG. 1 is a perspective view of a charging machine according to one form of the invention,

FIG. 2 shows schematically in plan how a pair of masking elements can be associated with an offset corona discharge point to produce a uniform charge of required characteristic through a slit of varying dimensions to charge a surface moving relatively to the slit,

FIG. 3 is a section taken on line 3—3 of FIG. 2, and

FIG. 4 shows a similar arrangement to that indicated in FIG. 2 but utilizing a wire charging member instead of a point.

It will be noted from FIGS. 1, 2 and 3 that a pair of masking members 1 and 2 are provided which form between them a slit 3 shaped to be narrowest adjacent the corona discharge point of the electrode 4 and widening out towards the outer edges 5 so that as a sheet 6 of photoconductive material which is being moved is charged through the slit 3. Charging is of a uniform nature in that at the greater charge intensity adjacent to the electrode 4 only a short charging time exists in relation to the charging time of the outer edges 7 of the sheet 6 for a given rate of movement of the sheet, and it will be realized that, if the curvature is correctly designed, exactly the same amount of exposure per unit of area can result over the complete width of the sheet 6.

Because the charging electrode 4 is disposed on one side of the slit 3 the problem area of the corona-charging device, which is immediately below the point, is shielded from the sheet 6 as this is masked by the masking means 1 therefore avoiding the imperfections which result when this is within the area of the photoconductor surface.

The method of supplying the voltage to the charging point 4 can of course be varied but preferably charging means 8 are connected between the electrode 4 and a base electrode 9.

The sheet 6 can be moved through the charging area by a belt 10 passing around rollers 11 and 12 supported in bearings on a frame 13, the frame carrying a motor 14, a gearbox 15, the drive from the gearbox being transmitted by a belt 16 through pulleys 17 and 18 to the roller 11 and thus to the belt 10.

The masking members 1 and 2 are supported from the frame 13 by supports 19, while the charging electrode 4 is supported by an arm 20 from insulator means 21 on the frame 13.

Charging potential is applied between the charging electrode 4 and the base electrode 9 by any suitable high-voltage device. A potentiometer 19 can have its slider connected to the masking members 1 and 2 to control potential.

The masking members may have ground potential or a potential intermediate the charging electrode and the base electrode and for this purpose the supports 19 can be carried on insulators 22. In the embodiment shown in FIG. 4 the point is replaced by a wire 25, while masking means 26 and 27 are again used which form between them a slit 28 arranged again to ensure the same intensity of charging over the complete area of the sheet 29 which moves through the slit 28 during charging. The belt is designated 30.

It is of interest to note that with a wire 25 placed across a pair of conductive masking members 26 and 27, there appears to be a relatively uniform flow from the wire down on to the masking members, but this field extends outwardly also and has sufficient intensity at the more remote areas which exist at the edges 32 of the sheet 29 to still give adequate charging because of the greater length of exposure at this area. The wire electrode 25 is of course insulated from the masking members and forms the charging electrode, a base electrode being again used beneath the transfer belt as in FIG. 2. The

masking members 26 and 27 can be grounded or held at a potential intermediate the potential of the charging electrode and the base electrode.

Although certain embodiments have been illustrated they are merely to show the general principles of the invention and it will be clear that the variations which can be effected within the spirit of the invention are numerous. It will also be obvious that instead of using a pair of masking members to form between them a slit as shown in the illustrations it would be possible to use a single-shaped masking member, such as the member 1, associated with a point or points which can still achieve the advantages of shielding the surface to be charged from some of the less desirable parts of the corona, and the curvature of the single masking member could in that case perhaps follow the curvature of a particular section of the corona discharge pattern to still achieve the uniform charging.

From the foregoing it will be realized that a simple and effective method of and means for controlling the charge intensity on a sheet of photoconductive or similar material is possible according to this invention, using only the part of the corona which gives the best results, and by a variation of the masking means or the dimensions of the slit formed between the masking means, a very exact control of charging over the complete width is possible.

We claim:

1. A method of charging an electrophotographic coating, comprising advancing a coating relative to a charging electrode to expose the coating progressively to the charging electrode, interposing a fixed masking device between the charging electrode and the surface to be charged to extend generally transversely to the relative direction of advancement, and forming a window in the masking device widening laterally outwards to vary the charging duration of different parts of the area being charged in proportion to the charge intensity at that area.

2. The method of charging according to claim 1, comprising forming the charging electrode as a point and forming the window as a slit increasing in width as the distance from the point increases, whereby areas more remote from the point receive similar incremental charge value as nearer areas.

3. The method according to claim 1, comprising forming the charging electrode as a point and positioning the charging electrode offset from said window and above a solid portion of the masking device.

4. The method according to claim 1, comprising forming the charging electrode as a wire extending generally in the direction of relative advancement between the charging electrode and the surface being charged.

5. Apparatus for charging an electrophotographic coating, said apparatus comprising, a base electrode, a charging electrode remote from the base electrode to form a charging zone therebetween, means to apply a charging potential between the charging electrode and the base electrode, means to provide relative movement of the coating through said charging zone, and masking means between the said charging electrode and the path of relative movement of the coating, said masking means being arranged generally transversely to the direction of relative movement of the said coating and having a shaped slit widening laterally outwards to increase the charging duration outwardly from said charging electrode during such traverse in proportion to the decrease of the intensity of the charge with distance from said electrode.

6. Apparatus according to claim 5, wherein said charging electrode is a point offset from said slit and located above a solid portion of said masking means.

7. Apparatus according to claim 5, wherein said charging electrode is a wire extending generally in the direction of relative motion of said surface and across said slit.