

12

EUROPEAN PATENT APPLICATION

21 Application number: **87301547.3**

51 Int. Cl.⁴: **G 03 G 15/22**
G 03 G 13/22

22 Date of filing: **23.02.87**

30 Priority: **21.02.86 GB 8604369**

43 Date of publication of application:
02.09.87 Bulletin 87/36

84 Designated Contracting States: **DE GB**

71 Applicant: **Crosfield Muirhead Limited**
154 Croydon Road
Beckenham Kent BR3 4DE (GB)

72 Inventor: **Needham, Jack Adams Well**
Broom Lane Langton Green Tunbridge Wells
Kent TN3 9JL (GB)

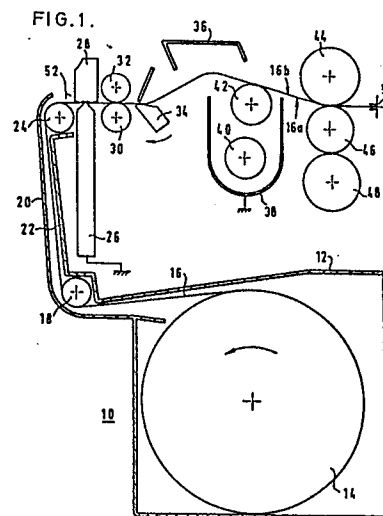
Elvidge, John Arthur Kylemore
Derby Road, Haslemere
Surrey GU27 1BP (GB)

Semark, James Henry 18 Groveland Road
Beckenham
Kent BR3 3QA (GB)

74 Representative: **White, Martin David**
MARKS & CLERK 57/60 Lincoln's Inn Fields
London WC2A 3LS (GB)

54 **Electrostatographic copying.**

57 An electrostatographic copying apparatus 10 is modified, to avoid having to use electrically conductive resin-impregnated paper for copying, by inclusion of a radio-active source (at 52 or 54) for ionising the paper in place of the resin.



Description

ELECTROSTATOGRAPHIC COPYING

The present invention relates to electrostatographic copying. A particular application of the invention is to electrostatographic copying in conditions of high temperature and/or high humidity, for example, 45°c and/or 95% humidity.

A method of electrostatographic copying is known in which the copying is done onto electrostatic paper which has a film of highly electrically resistive material on a single side of the paper, the paper being impregnated with electrically conductive resin. The known method comprises the steps of applying an electric field pattern to the paper so as to induce a pattern of charges of opposite polarity on opposite sides of the film (due to the field effect), discharging the charge pattern on one side of the film (by means of conduction through the resin-impregnated paper) while substantially retaining the charge pattern on the other side of the film, applying toner medium to the paper so that the toner medium adheres to the paper in the pattern of the retained charge, due to the retained charge, and fixing the toner medium in the aforesaid pattern.

Unfortunately, in conditions of high temperature and/or high humidity, the electrically conductive resin is liable to become tacky or sticky.

It is an object of the invention to provide an electrostatographic copying method and an electrostatographic copying apparatus in which resin-impregnated paper need not be used.

According to a first aspect of the present invention there is provided a method of electrostatographic copying onto electrostatic paper which has a film of highly electrically resistive material on a single side (16a) of the paper (16), comprising the steps of applying (26,28) an electric field pattern to the paper so as to induce a pattern of retained charges, applying (40,42) toner medium to the paper (16) so that the toner medium adheres to the paper in the pattern of the retained charge due to the retained charge, and fixing (44,46,48) the toner medium in the aforesaid pattern, characterised in that the paper (16) is exposed to emissions of particles from a radio-active source (52,54) before, during or after applying the electric field pattern, so as to prevent a pattern of charges forming on, or discharge any pattern of charges formed on, one side of the film while permitting formation and substantial retention of a charge pattern of opposite polarity on the other side of the film.

According to a second aspect of the present invention there is provided an apparatus for electrostatographic copying onto electrostatic paper which has a film of highly electrically resistive material on a single side (16a) of the paper (16), comprising means (26,28) for applying an electric field pattern to the paper so as to induce a pattern of charges means (40,42) for applying toner medium to the paper so that the toner medium adheres to the paper in the pattern of the retained charge due to the retained charge, and means (44,46,48) for fixing the toner medium in the aforesaid pattern, characterised

in that a radio-active source (52,54) arranged to expose the paper to emissions of particles from the radio-active source before during or after the application of the electric field, so as to prevent a pattern of charges forming on, or discharge any pattern of charges formed on, one side of the film while permitting formation and substantial retention of a charge pattern of opposite polarity on the other side of the film.

Although resin-impregnated paper may be used in the above-mentioned method and apparatus (other than in conditions of high temperature and/or high humidity, of course) the provision of the radio-active source obviates the need for resin-impregnated paper, since the energy of the particles from the radio-active source is sufficient to ionise the paper even without resin-impregnation.

The invention will be described by way of example with reference to the accompanying drawings, wherein:-

Fig. 1 is a diagrammatic illustration of an electrostatographic copying apparatus embodying the invention; and

Fig. 2 is a partial view of a modification.

Referring to Fig. 1, the illustrated electrostatographic copying apparatus 10 comprises a housing 12 which contains a reel 14 of copying paper 16 which has no resin-impregnation but which has a film of highly electrically resistive material on a single side 16a of the paper 16 (and no such film on the other side 16b).

The paper 16 is arranged to pass out of the housing 12, via a roller 18, upwardly between two guides 20, 22 to a further roller 24, then between a selectively electrically energisable 'comb' 26 and a 'backplane' 28 to a pair of feed rollers 30, 32, then to a guillotine 34, then past a paper loop detector 36 to a toner box 38 having two rollers 40, 42 for applying toner (to the "out-side" of the film) and thence, via a stand of three pressure fix rollers 44, 46, 48 (the paper passing between the two upper rollers 44, 46) to an outlet 50.

The selectively electrically energisable comb 26 has, for example, 1728 copper wires (not shown) in two lines (not shown), for inducing a dot-matrix charge pattern on the paper according to the energisation of the wires as the paper passes between the comb 26 and the backplane 28. The backplane 28, which is on the far side of the paper from the electrically resistive film, is maintained at a high positive voltage (for example, +600 volts). "Energisation" of the wires in the comb 26 takes the form of selective earthing of the wires.

Because the paper 16 has no resin-impregnation, the apparatus 10 includes means to achieve ionisation of the paper (but not the electrically resistive film) in the form of a radio-active source. There are a number of possible positions for this radio active source, for example, just upstream of the comb 26 (as at 52) or just downstream of the comb 26 (as at 54) - see Figs. 1 and 2. The radio-active source may

for example be americium-241 or nickel-63 or polonium-210. More particularly, the particles emitted by the radio-active source may be the same polarity as the eventually retained charge pattern or the opposite polarity.

In the embodiment illustrated, the radio-active source is on the opposite side of the paper from the film, whilst the side of the film from which the charge pattern is discharged, due to the ionisation of the paper by the particles from the radio-active source, is the side of the film in contact with the paper, i.e the "in-side" of the film.

The required radiation density may for example be 100 microcuries per square centimetre. The charge pattern is induced on the paper by the field effect, as with conventional resin-impregnated paper, and the ionisation of the paper by the irradiation persists after the paper has left the region of the radio-active source, which is why it is possible to position the radio-active source either upstream (as at 52) or downstream (as at 54) of the backplane 28, by means of which the charge pattern is induced.

As with a conventional copying apparatus using resin-impregnated paper (with the resistive film on one side) care needs to be taken in the design of the apparatus to avoid build-up of static.

It is desirable to prevent ionised air from reaching the sides of the paper 16 on which the charge pattern is retained (prior to the application and fixing of the toner) in order to prevent the retained charge from leaking away. This may be achieved by means of an air-flow pattern designed so that the side of the film on which the charge pattern is retained is upstream of and/or at a higher air pressure than where the air

Claims

1. A method of electrostatographic copying onto electrostatic paper which has a film of highly electrically resistive material on a single side (16a) of the paper (16), comprising the steps of applying (26,28) an electric field pattern to the paper so as to induce a pattern of retained charges, applying (40,42) toner medium to the paper (16) so that the toner medium adheres to the paper in the pattern of the retained charge due to the retained charge, and fixing (44,46,48) the toner medium in the aforesaid pattern, characterised in that the paper (16) is exposed to emissions of particles from a radio-active source (52,54) before, during or after applying the electric field pattern, so as to prevent a pattern of charges forming on, or discharge any pattern of charges formed on, one side of the film while permitting formation and substantial retention of a charge pattern of opposite polarity on the other side of the film.

2. A method as claimed in claim 1 characterised in that the source (52, 54) is on the opposite side (16b) of the paper from the film, said one side being the in-side of the film.

3. A method as claimed in claim 1 or 2 characterised in that the application of the toner medium is to the out-side of the film.

4. A method as claimed in any one of claims 1 to 3 characterised in that a substantial number of the particles are charged particles of opposite polarity to the polarity of the discharged charges on said one side of the film.

5. A method as claimed in any one of claims 1 to 3 characterised in that a substantial number of the particles are charged particles of the same polarity as the polarity of the discharged charges on said one side of the film.

6. A method as claimed in any one of claims 1 to 5 wherein the source is Americium - 241, nickel - 63 or polonium - 210.

7. A method as claimed in any preceding claim characterised in that ionised air produced by the emissions from the radio-active source is positively prevented from reaching said other side of the film to avoid discharging any retained charge pattern, by means of an air-flow pattern designed so that said other side of the film is upstream of and/or at a higher pressure than where the air becomes ionised.

8. An apparatus for electrostatographic copying onto electrostatic paper which has a film of highly electrically resistive material on a single side (16a) of the paper (16), comprising means (26,28) for applying an electric field pattern to the paper so as to induce a pattern of charges, means (40,42) for applying toner medium to the paper so that the toner medium adheres to the paper in the pattern of the retained charge due to the retained charge, and means (44,46,48) for fixing the toner medium in the aforesaid pattern, characterised in that a radio-active source (52,54) is arranged to expose the paper to emissions of particles from the radio-active source before during or after the application of the electric field, so as to prevent a pattern of charges forming on, or discharge any pattern of charges formed on, one side of the film while permitting formation and substantial retention of a charge pattern of opposite polarity on the other side of the film.

9. Apparatus as claimed in claim 8 characterised in that the source (52,54) is located on the opposite side (16b) of the paper (16) from the film, said one side being the in-side of the film.

10. Apparatus as claimed in any one of claims 19 to 23 characterised in that the means (40,42) for applying the toner medium is arranged to apply it to the out-side of the film.

11. Apparatus as claimed in any one of claims 19 to 24 characterised in that the radio-active source (52,54) is such that a substantial number of the particles are charged particles of opposite polarity to the polarity of the discharged charges on said one side of the film.

12. Apparatus as claimed in any one of claims 19 to 24 characterised in that the radio-active source (52,54) is such that a substantial number of the particles are charged particles of the

same polarity as the polarity of the discharged charges on said one side of the film.

13. Apparatus as claimed in any one of claims 8 to 12 wherein the source is Americium - 241, nickel - 63 or polonium - 210.

5

14. Apparatus as claimed in any one of claims 19 to 26 characterised in that, for positively preventing ionised air produced by the emissions from the radio-active source from reaching said other side of the film and discharging the retained charge pattern, air-flow means are located to produce an air-flow pattern such that said other side of the film is upstream of and/or at a higher air pressure than where the air becomes ionised.

10

15

15. Apparatus as claimed in any one of claims 19 to 32 characterised in that the electric field-applying means 26, 28 comprises a grid of electrodes arranged in proximity to the paper and means for selective electrical switching thereof.

20

25

30

35

40

45

50

55

60

65

4

FIG. 1.

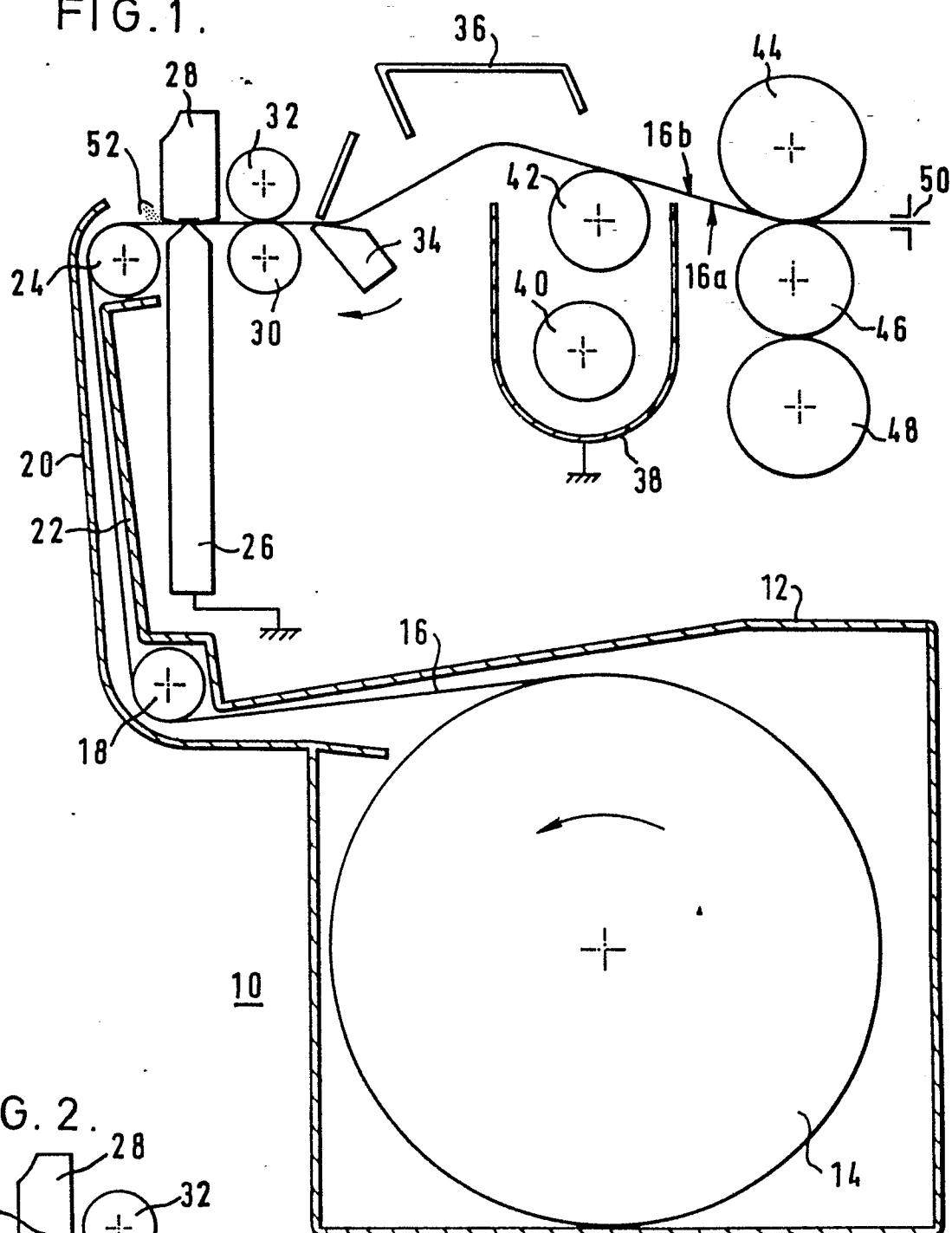


FIG. 2.

