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(54) IMPROVEMENTS IN AND RELATING TO ELECTROSTATIC COPYING APPARATUS

(71) We, AGFA - GEVAERT AKTIENGESSELLSCHAFT, a body corporate recognised under German Law, of Leverkusen, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 The invention relates to electrostatic copying apparatus.

In one form of such apparatus, in order to transfer toner images in powder form from an electrostatically-charged record support onto a copy support, at the moment of transfer, the copy support has a charged dielectric layer placed behind it, the electrostatic charge of the layer being used for the transfer of the toner powder. The charging of the dielectric layer, which rests with its reverse side against a rigid conductive electrode, is effected by means of a corona discharge device.

Known devices of this type suffer from the disadvantage that the dielectric layer resting against the metal electrode does not cling sufficiently to the record support or the copy support, respectively, to bring about the optimum transfer of the toner image. It has already been proposed, therefore, that the charging of this layer should be carried out inhomogeneously in order to increase the effect of its charge on the toner powder. The inhomogeneity can, however, lead to an irregular transfer of the toner image. In any case, the charges must be made correspondingly high, because of the fact that, in places, the distance from the toner powder is considerable.

The invention provides electrostatic copying apparatus which comprises a record support on which a toner image in powder form can be produced and means for transferring the toner image from the record support onto a copy support, which means comprises a transfer member comprising compressible supporting means, a flexible layer of dielectric material supported by the supporting means and a flexible electrode interposed between

the layer of dielectric material and the supporting means, and which means further comprises a corona discharge device and means for applying a potential difference between the corona discharge device and the flexible electrode, the arrangement being such that, in use, the corona discharge device charges the dielectric layer which in turn charges the copy support to cause the toner powder on the record support to be transferred onto the copy support.

The arrangement of the invention makes it possible by providing a flexible electrode and compressible supporting means for the dielectric layer to cling to the record support and the copy support to any required degree. Its charge can therefore have the optimum effect. In addition, damage to the sensitive surface of the record support can be avoided.

The dielectric layer itself need have only a relatively small degree of compressibility with this arrangement, and can therefore be relatively thin compared to previous arrangements, which is advantageous because the resultant short distance between its surface and the flexible electrode makes it possible with low charging voltages to apply large quantities of charge with a high degree of uniformity. This effect is presumably due to the fact that the fields of the charged particles applied to the surface of a thin dielectric layer are bound to a great extent to the electrode and thus disturb neither the further charging process nor the fields of the adjacent charged particles. The electrode is preferably in the form of a conducting layer which may be sufficiently thin that it neither prevents the pressing function, that is to say, the periodic deformation, of the dielectric layer, nor itself suffers damage during these distortions. The conducting layer is advantageously in the form of a deposit on the compressible supporting means, and the supporting means is advantageously a flexible layer of material, preferably, an elastomer, which is relatively thick compared to the dielectric layer.

[Price 33p]

Price 7^p

Advantageously, the transfer member is in the form of a roller of which the outer surface is formed by the dielectric material, the compressible supporting means forming an inner portion of the roller.

In principle, the flexible electrode could project beyond the dielectric layer and be contacted by means of a sliding contact. In order to avoid premature wear on the electrode, however, the roller preferably has a conductive core, and the electrode, is conductively connected to the core. When the electrode is a conducting layer, the conducting layer advantageously extends over the end faces of the roller to contact the core.

In order to avoid blurring of the toner image at the first contact between the dielectric layer and copy support, it is advantageous for the roller which carries this layer and is not itself driven for the sake of simplicity, to have the smallest possible moment of inertia. Its core is therefore preferably tubular.

According to further advantageous features of the invention, the compressible support means is a layer of material having a Shore hardness of from 30 to 60 Shore and a thickness of from 2 to 10 mm, the dielectric layer has a thickness of from 0.02 to 0.5 mm, and the conducting layer has a thickness of from 0.02 to 2 microns. The elastomer layer is preferably composed of a polyurethane and the dielectric layer of a polyolefin, preferably polyethylene, or a halogenised polyolefin, preferably PVC. The dielectric layer is advantageously formed by a tube shrunk onto the conducting layer and preferably has a dielectric constant ϵ of from 2 to 6.

The material used for the dielectric layer should have a high resistance to ozone and the smoothest possible surface with a high surface resistance ($>10^{14}$ Ohms). It should be puncture resistant and even in thin layers should have sufficient rigidity to prevent distortion of the toner image during print-off, in spite of the great flexibility of the underlying supporting means.

Galvanically applied gold, cadmium, copper or tin is preferably used as the conducting layer. These materials are good conductors even in thin layers and are sufficiently resistant to ozone. They are so clinging that even in somewhat thicker layers they can still follow the distortions of the supporting means without permanent deformation.

Advantageously, the transfer member is movable towards and away from an operative position adjacent to the record support in which the toner powder on the record support can be transferred onto the copy support when the copy support has reached the record support, and means for sensing the copy support as it passes a fixed point in its path of transport, to the record support is

provided, the sensing means being arranged to control the movement of the transfer member after a predetermined time delay.

Previously, there has been no adequate guarantee that in the gaps between successive copy supports the transfer member will not touch the record support covered with toner powder, with the result that the toner powder is transferred to the transfer member and dirties the back of the copy support during the next print-off.

It is indeed a known procedure in conventional printing machines for the application of counter pressure rollers to be timed as a function of the paper transport means. This known apparatus cannot however be used without further measures in duplicating machines, in which the transportation of the copy support generally occurs with a low degree of forcible actuation, and wherein copy support formats of different lengths are also frequently handled.

With the arrangement of the invention, the leading and/or the trailing edges of the copy support can themselves effect the control of the transfer member application. The functioning of this device need not therefore be adversely affected either by inaccuracies in the copy support transport or by the presence of different format lengths, and can thus produce a high degree of switching reliability.

Advantageously, the arrangement is such that the transfer member tends to move away from its operative position and an electromagnet is provided which, on actuation, is arranged to urge the transfer member towards its operative position. With such an arrangement, the immediate lift-off of the transfer member can be ensured in the event of current failure in control means. The arrangement may be such that the transfer member tends to move away from its operative position under the action of gravity and/or it may be resiliently urged away from its operative position. The transfer member may be supported on rocker arms and be pivotally movable towards and away from its operative position.

In principle, the time lag could be produced by means of any suitable mechanical or electrical time delay device. However, a high degree of switching accuracy can be obtained if, as is advantageous, the sensing means comprises a feeler arranged at the said fixed point in the path of transport of the copy support and if the sensing means also comprises first and second switches and a rotatable cam, the first switch being mechanically connected to and actuable by the feeler to cause or allow the cam to rotate and the second switch being actuable by the cam as it rotates to actuate the electromagnet that urges the transfer member towards its operative position. Preferably, there is provided an electromagnetic armature, movement of which

is controlled by the first switch, and the cam is provided with two stops arranged to co-operate with the armature, the arrangement being such that the cam is allowed to rotate from a position in which one stop engages the armature to a position in which the other stop engages the armature on movement of the said armature. Advantageously, deactuation of the second switch is arranged to deactuate the electromagnet so as to allow the transfer member to move away from its operative position, and the cam is arranged to maintain the second switch in its actuated state over a portion of the surface of the cam. That portion of the surface of the cam which is arranged to actuate the second switch is preferably of such a length and so positioned relative to the two stops arranged to co-operate with the electromagnetic armature, when such stops are provided, that, in use, the transfer member moves into its operative position at the same time as, or immediately before, the leading edge of the copy support contacts the record support and moves away from its operative position at the same time as, or immediately after, the trailing edge of the copy support moves out of contact with the record support. A friction coupling may be provided to transmit drive to the cam and the drive for the cam is preferably derived from the drive of the transport means for the copy support.

In a simple manner, this arrangement allows an extremely accurate association of the switching timing with the leading and trailing edges of the copy support, so that both dirtying of the transfer member and loss of part of the toner image being transferred, owing to the movement in or out of the transfer member taking place at the wrong time, can be avoided. In principle, the transfer member should move away and into position exactly at the moment when the edge in question is passing through the point of contact between the transfer member and the record support. It has been ascertained, however, that an over-run of the transfer member beyond the copy support of approximately 2 to 3 mm still leads to no noticeable dirtying of the transfer member. The cam control is therefore preferably adjusted in such a way that an over-run of these edges will occur rather than an under-run, in order to ensure that there is no partial loss of the toner image.

Electrostatic copying apparatus constructed in accordance with the invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a section through a portion of the electrostatic copying apparatus along the line I—I in Figure 2;

Figure 2 is a section along the line II—II in Figure 1;

Figure 3 shows diagrammatically the charging process during the operation of the apparatus;

Figure 4 shows diagrammatically the transfer of the toner powder during the operation of the apparatus;

Figure 5 is a view of a time delay device of the electrostatic copying apparatus; and

Figure 6 is a section along the line III—III in Figure 5.

Referring to Figures 1 and 2 of the accompanying drawings, on a spindle 1 of an apparatus frame 2 there are mounted rocker arms 3 and 4 which carry a spindle 5. On this spindle 5, a tubular roller core 6 is arranged so that it is easily rotatable by means of ball-bearings. The roller core 6 is provided with a compressible supporting layer 7 formed of an elastomer which consists of polyurethane with a Shore hardness of 30 to 60 Shore.

The elastomer layer 7 is covered with a thin conductive layer 8, a portion 8a of which extends over the sides of the elastomer layer 7 and a portion 8b of which rests actually on the core 6 itself. The conductive layer 8 is applied galvanically. For this purpose an adhesion agent, for example, a silane, is first applied to the elastomer surface. After drying, this silane layer is covered with reduction silver by means of a spray device, and thus a layer is formed which is sufficiently conductive for subsequent galvanic deposition of the ductile material. The actual ductile layer consists of a good-conducting and malleable material such as gold, cadmium, copper or tin, for example. It has at least a minimum thickness of 0.02 microns which will produce a coherent layer. Its maximum thickness is 2 microns, so that it cannot hinder the pressing function of the underlying elastomer layer by reason of excessive rigidity. The side portions 8a and 8b of the layer 8 serve to produce a conductive connection with the roller core 6. Finally, a relatively thin tube 9 having a dielectric constant ϵ of from 2 to 6 is shrunk onto the conductive layer 8.

With the rocker arms 3 and 4 there engages an armature 10 of a pull magnet 11, which pivots the roller 6 to 9, counter to the action of a tension spring 12, against a record support in the form of a copying cylinder 14 covered with a selenium coating 13. When the magnet 11 is not excited, the rocker arms 3 and 4 rest against stops 15 and 16 fixed to the apparatus.

To the point of contact between the roller 6 to 9 and the copying cylinder 13 and 14, a copy support 19 is led in the direction of the arrow A by way of a guide path 17 and 18 by means of support means (not shown). The guide path 17 has an aperture 17a through which a feeler 20 of a micro-switch 21 engages. The micro-switch 21 with a time switch 22 interpolated, lies in a current circuit 23, 24 of the pull magnet 11. The time switch 22

will be described in more detail with reference to Figures 5 and 6.

For charging the dielectric layer 9, a corona discharge wire 25 is provided which is arranged in an earthed corona housing 26 and is connected to a high voltage supply 27. The charging current circuit is closed by the fact that the conductive layer 8 is also connected to an earth lead 28 by way of the roller core 6 and the rocker arms 3 and 4. In order to allow the transfer of the toner powder after the charged roller 6 to 9 has been pivoted against the copying cylinder 13, 14, the latter is also earthed in a known manner by means of a sliding contact 29 or the like.

Figures 3 and 4 show the path of the lines of force during charging of the dielectric layer 9 and during the transfer of the toner powder, respectively. Figure 3 shows how the lines of force of the positively-charged particles sprayed onto the surface of the dielectric layer 9 by means of the positively-charged electrode 25 are predominantly bound to the influenced negatively-charged particles in the conductive layer 8, so that they neither hinder the further spraying-on of charged particles nor mutually influence one another with their lines of force. In this way, a very dense and uniform charging of the dielectric layer 9 can be produced with low charging voltages.

As soon as a positively-charged record support 13 carrying negatively-charged toner particles 30 is opposite the dielectric layer 9 and the copy support 19 which is in contact therewith, as shown in Figure 4, a considerable proportion of the lines of force of the positively-charged particles on the layer 9 are drawn to the negative charges of the toner powder. The electrostatic attraction force required for the transfer of the toner powder 30 to the copy support 19 is produced, and, when the charges on the dielectric layer 9 are sufficiently great, overcomes the attraction force between the toner particles 30 and the layer 13 of the record support.

Referring to Figures 5 and 6, a spindle 32 of the copying cylinder 13, 14 has arranged on it a friction coupling 33 which connects this spindle 32 with a further spindle 34. Secured to the spindle 34 there is a cam disc 35 which has a cam surface 35a having a front transition curve 35b seen in the direction of rotation (Fig. 3) and a rear transition curve 35c seen in the same direction. The cam 35a to 35c co-operates with a feeler 36 of a micro-switch 37.

Attached to a bearing support 38 of the spindles 32 and 34 there is also a pressure magnet 39 which moves an armature 41 in the direction of the arrow C by means of a push-rod 39a, against the action of a compression spring 40. The armature 41 has stops 41a and 41b, which in each case project into the path of stops 35d and 35e attached to the cam disc 35.

The method of operation of the apparatus is as follows: Whilst the copying drum 13, 14 revolves, the stop 35e of the cam disc 35 is pressed by the friction coupling 33 against the stop 41b of the pull armature 41. As soon as the feeler 20 shown in Fig. 1 registers the entry of the leading edge of a copy support 19, the pressure magnet 39, which in Figs. 5 and 6 takes the place of the component indicated only diagrammatically as time delay section 22 in Fig. 1, pushes the armature 41 in the direction of the arrow C against the action of the spring 40. The stop 35e is thereby liberated and the cam disc 35 begins to move in the direction of the arrow B. The transition curve 35b of the cam surface 35a, after passing through a delay angle $\alpha 1$, comes into contact with the feeler 36 of the micro-switch 37. This micro-switch 37 closes the excitation current circuit of the pull magnet 11 shown in Fig. 1. In addition, the stop 35d fitted on the cam disc 35 meets the stop 41a of the armature 41 which is in its way when the magnet 39 is excited. The cam disc 35 thereby remains in one position, in which the micro-switch 37 is actuated, until the pressure magnet 39 is switched off by means of the micro-switch 21.

The magnet 39 is switched off as soon as the trailing edge of the copy support 19 has passed the feeler 20. The armature 41 is thus brought back into its initial position again by means of the compression spring 40 and thereby liberates the stop 35d. The cam disc begins to move again, so that after passing through a further delay angle $\alpha 2$ the micro-switch 37 is switched off. The cam disc 35 continues to move until the stop 35e again rests against the stop 41b, thus restoring the initial position of the time delay device.

WHAT WE CLAIM IS:—

1. Electrostatic copying apparatus which comprises a record support on which a toner image in powder form can be produced and means for transferring the toner image from the record support onto a copy support, which means comprises a transfer member comprising compressible supporting means, a flexible layer of dielectric material supported by the supporting means and a flexible electrode interposed between the layer of dielectric material and the supporting means, and which means further comprises a corona discharge device and means for applying a potential difference between the corona discharge device and the flexible electrode, the arrangement being such that, in use, the corona discharge device charges the dielectric layer which in turn charges the copy support to cause the toner powder on the record support to be transferred onto the copy support.

2. Apparatus as claimed in claim 1, wherein the flexible electrode is a conducting layer.

will be described in more detail with reference to Figures 5 and 6.

For charging the dielectric layer 9, a corona discharge wire 25 is provided which is arranged in an earthed corona housing 26 and is connected to a high voltage supply 27. The charging current circuit is closed by the fact that the conductive layer 8 is also connected to an earth lead 28 by way of the roller core 6 and the rocker arms 3 and 4. In order to allow the transfer of the toner powder after the charged roller 6 to 9 has been pivoted against the copying cylinder 13, 14, the latter is also earthed in a known manner by means of a sliding contact 29 or the like.

Figures 3 and 4 show the path of the lines of force during charging of the dielectric layer 9 and during the transfer of the toner powder, respectively. Figure 3 shows how the lines of force of the positively-charged particles sprayed onto the surface of the dielectric layer 9 by means of the positively-charged electrode 25 are predominantly bound to the influenced negatively-charged particles in the conductive layer 8, so that they neither hinder the further spraying-on of charged particles nor mutually influence one another with their lines of force. In this way, a very dense and uniform charging of the dielectric layer 9 can be produced with low charging voltages.

As soon as a positively-charged record support 13 carrying negatively-charged toner particles 30 is opposite the dielectric layer 9 and the copy support 19 which is in contact therewith, as shown in Figure 4, a considerable proportion of the lines of force of the positively-charged particles on the layer 9 are drawn to the negative charges of the toner powder. The electrostatic attraction force required for the transfer of the toner powder 30 to the copy support 19 is produced, and, when the charges on the dielectric layer 9 are sufficiently great, overcomes the attraction force between the toner particles 30 and the layer 13 of the record support.

Referring to Figures 5 and 6, a spindle 32 of the copying cylinder 13, 14 has arranged on it a friction coupling 33 which connects this spindle 32 with a further spindle 34. Secured to the spindle 34 there is a cam disc 35 which has a cam surface 35a having a front transition curve 35b seen in the direction of rotation (Fig. 3) and a rear transition curve 35c seen in the same direction. The cam 35a to 35c co-operates with a feeler 36 of a micro-switch 37.

Attached to a bearing support 38 of the spindles 32 and 34 there is also a pressure magnet 39 which moves an armature 41 in the direction of the arrow C by means of a push-rod 39a, against the action of a compression spring 40. The armature 41 has stops 41a and 41b, which in each case project into the path of stops 35d and 35e attached to the cam disc 35.

The method of operation of the apparatus is as follows: Whilst the copying drum 13, 14 revolves, the stop 35e of the cam disc 35 is pressed by the friction coupling 33 against the stop 41b of the pull armature 41. As soon as the feeler 20 shown in Fig. 1 registers the entry of the leading edge of a copy support 19, the pressure magnet 39, which in Figs. 5 and 6 takes the place of the component indicated only diagrammatically as time delay section 22 in Fig. 1, pushes the armature 41 in the direction of the arrow C against the action of the spring 40. The stop 35e is thereby liberated and the cam disc 35 begins to move in the direction of the arrow B. The transition curve 35b of the cam surface 35a, after passing through a delay angle α_1 , comes into contact with the feeler 36 of the micro-switch 37. This micro-switch 37 closes the excitation current circuit of the pull magnet 11 shown in Fig. 1. In addition, the stop 35d fitted on the cam disc 35 meets the stop 41a of the armature 41 which is in its way when the magnet 39 is excited. The cam disc 35 thereby remains in one position, in which the micro-switch 37 is actuated, until the pressure magnet 39 is switched off by means of the micro-switch 21.

The magnet 39 is switched off as soon as the trailing edge of the copy support 19 has passed the feeler 20. The armature 41 is thus brought back into its initial position again by means of the compression spring 40 and thereby liberates the stop 35d. The cam disc begins to move again, so that after passing through a further delay angle α_2 the micro-switch 37 is switched off. The cam disc 35 continues to move until the stop 35e again rests against the stop 41b, thus restoring the initial position of the time delay device.

WHAT WE CLAIM IS:—

1. Electrostatic copying apparatus which comprises a record support on which a toner image in powder form can be produced and means for transferring the toner image from the record support onto a copy support, which means comprises a transfer member comprising compressible supporting means, a flexible layer of dielectric material supported by the supporting means and a flexible electrode interposed between the layer of dielectric material and the supporting means, and which means further comprises a corona discharge device and means for applying a potential difference between the corona discharge device and the flexible electrode, the arrangement being such that, in use, the corona discharge device charges the dielectric layer which in turn charges the copy support to cause the toner powder on the record support to be transferred onto the copy support.

2. Apparatus as claimed in claim 1, wherein the flexible electrode is a conducting layer.



3. Apparatus as claimed in claim 2, wherein the conducting layer is relatively thin compared to the dielectric layer.

4. Apparatus as claimed in claim 2 or claim 3, wherein the conducting layer is in the form of a deposit on the compressible supporting means.

5. Apparatus as claimed in any one of claims 1 to 4, wherein the supporting means is a flexible layer of material which is relatively thick compared to the dielectric layer.

6. Apparatus as claimed in any one of claims 1 to 5, wherein the transfer member is in the form of a roller of which the outer surface is formed by the dielectric material, the compressible supporting means forming an inner portion of the roller.

7. Apparatus as claimed in claim 6, wherein the roller has a conductive core and the flexible electrode is conductively connected to the core.

8. Apparatus as claimed in claim 7, wherein the flexible electrode is a conducting layer and the conducting layer extends over the end faces of the roller to contact the core.

9. Apparatus as claimed in claim 7 or claim 8, wherein the roller core is tubular.

10. Apparatus as claimed in any one of claims 1 to 9, wherein the compressible supporting means is a layer of an elastomer.

11. Apparatus as claimed in claim 10, wherein the elastomer is a polyurethane.

12. Apparatus as claimed in any one of claims 1 to 11, wherein the compressible supporting means is a layer of material having a Shore hardness of from 30 to 60 Shore and a thickness of from 2 to 10 mm.

13. Apparatus as claimed in any one of claims 1 to 12, wherein the dielectric layer has a thickness of from 0.02 to 0.5 mm.

14. Apparatus as claimed in any one of claims 1 to 13, wherein the dielectric layer consists of a polyolefin.

15. Apparatus as claimed in claim 14, wherein the dielectric layer consists of polyethylene.

16. Apparatus as claimed in any one of claims 1 to 15, wherein the dielectric layer consists of a halogenised polyolefin.

17. Apparatus as claimed in claim 16, wherein the dielectric layer consists of PVC.

18. Apparatus as claimed in any one of claims 1 to 17, wherein the dielectric layer has a dielectric constant from 2 to 6.

19. Apparatus as claimed in any one of claims 1 to 18, wherein the dielectric layer has been formed by shrinking a tube onto the flexible electrode.

20. Apparatus as claimed in any one of claims 1 to 19, wherein the flexible electrode is a conducting layer having a thickness of from 0.02 to 2 microns.

21. Apparatus as claimed in any one of claims 1 to 20, wherein the flexible electrode is a conducting layer which consists of gal-

vanically applied gold, cadmium, copper or tin.

22. Apparatus as claimed in any one of claims 1 to 21, wherein the transfer member is movable towards and away from an operative position adjacent to the record support in which the toner powder on the record support can be transferred onto the copy support when the copy support has reached the record support, and wherein means for sensing the copy support as it passes a fixed point in its path of transport to the record support is provided, the sensing means being arranged to control the movement of the transfer member after a predetermined time delay.

23. Apparatus as claimed in claim 22, wherein the sensing means is arranged to sense the leading edge of the copy support as it passes the said fixed point and the arrangement is such that, in use, the transfer member is moved into its operative position a predetermined length of time after the leading edge of the copy support has been sensed.

24. Apparatus as claimed in claim 22 or claim 23, wherein the sensing means is arranged to sense the trailing edge of the copy support as it passes the said fixed point and the member is moved out of its operative position a predetermined length of time after the trailing edge of the copy support has been sensed.

25. Apparatus as claimed in any one of claims 22 to 24, wherein the arrangement is such that the transfer member tends to move away from its operative position and wherein an electromagnet is provided which, on actuation, is arranged to urge the transfer member towards its operative position.

26. Apparatus as claimed in claim 25, wherein the arrangement is such that the transfer member tends to move away from its operative position under the action of gravity.

27. Apparatus as claimed in claim 25 or claim 26, wherein the transfer member is resiliently urged away from its operative position.

28. Apparatus as claimed in any one of claims 22 to 27, wherein the transfer member is supported on rocker arms and is pivotally movable towards and away from its operative position.

29. Apparatus as claimed in any one of claims 22 to 28, wherein the sensing means comprises a feeler arranged at the said fixed point in the path of transport of the copy support.

30. Apparatus as claimed in claim 29 when dependent on claim 25, wherein the sensing means comprises first and second switches and a rotatable cam, the first switch being mechanically connected to and actuable by the feeler to cause or allow the cam to rotate and the second switch being actuable by the cam as it rotates to actuate the electromagnet that urges



the transfer member towards its operative position.

- 5 31. Apparatus as claimed in claim 30, wherein there is provided an electromagnetic armature, movement of which is controlled by the first switch, and the cam is provided with two stops arranged to co-operate with the armature, the arrangement being such that the cam is allowed to rotate from a position in which one stop engages the armature to a position in which the other stop engages the armature on movement of the said armature.

- 10 32. Apparatus as claimed in claim 30 or claim 31, wherein deactuation of the second switch is arranged to deactuate the electromagnet so as to allow the transfer member to move away from its operative position, and the cam is arranged to maintain the second switch in its actuated state over a portion of the surface of the cam.

- 15 33. Apparatus as claimed in claim 32 when dependent on claim 31, wherein that portion of the surface of the cam which is arranged to actuate the second switch is of such a length and so positioned relative to the two stops arranged to co-operate with the electro-

magnetic armature that, in use, the transfer member moves into its operative position at the same time as, or immediately before, the leading edge of the copy support contacts the record support and moves away from its operative position at the same time as, or immediately after, the trailing edge of the copy support moves out of contact with the record support.

34. Apparatus as claimed in any one of claims 30 to 33, wherein a friction coupling is provided to transmit drive to the cam.

35. Apparatus as claimed in any one of claims 30 to 34, wherein the drive for the cam is derived from the drive of transport means for the copy support.

36. Electrostatic copying apparatus substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

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