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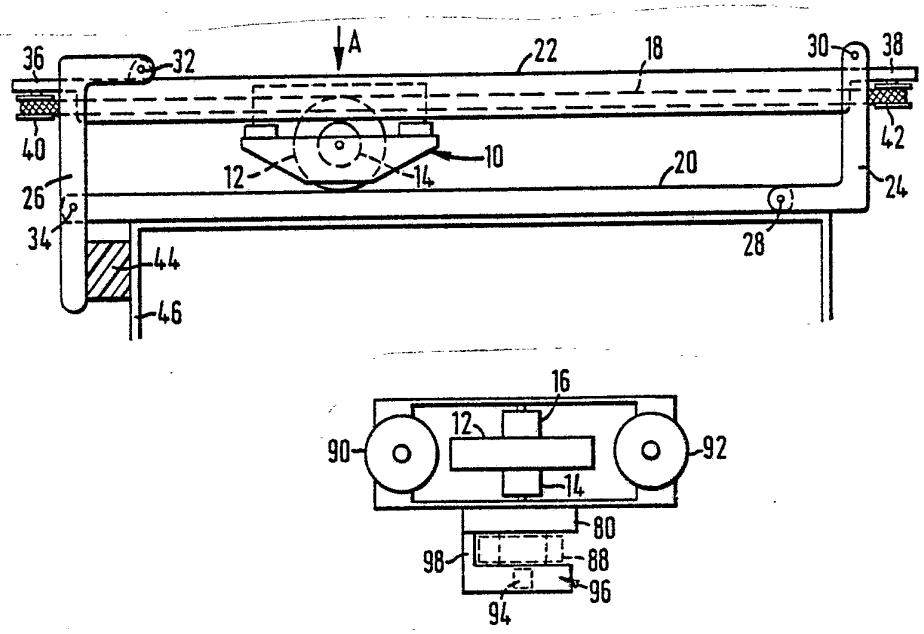

(57) Abstract

An electrostatic printer for producing an image on a surface comprises a carriage (10) carrying a toner applicator (88), a fixing roller (12), and upstream of the toner applicator an electrostatic printing head (94) adapted to lay down an electrostatic charge image on the fixing roller or on the surface as the head moves across the surface, the toner applicator serving to discharge toner medium onto the electrostatic charge image to which the toner medium adheres and the fixing roller serving to fix the toner medium in position due to pressure as the latter rolls across the surface.

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Title: Improvements in or relating to electrostatic printing

DESCRIPTION

Field of invention

This invention concerns electrostatic printing, involving the application of an electric charge and toner to roll or sheet material for example a roll or sheet of paper and then fixing the toner onto the material to form an image thereon.

Background to the invention

United Kingdom Specification 1603863 illustrates a printing head in which an electrostatic image is formed on a miniature roller onto which toner is then applied, the roller and toner being contained within a hand-held housing which can be moved transversely across a sheet of paper or the like. Electrical signals supplied to the hand-held unit generate the electrostatic images around the miniature roller.

No attempt is made in this particular device to fix the toner after it has been applied to the paper and reliance is placed on the use of a suitable toner powder and sufficient pressure between the roller and the surface of the paper to fix the toner onto the paper at the time of application of the toner to the paper so that no subsequent fixing step is actually necessary. This is quite distinct from normal photocopying processes in which the pressure between a drum bearing the toner image and the paper is reduced to just that sufficient to cause

transfer of the toner from the drum surface to the paper to limit damage to the surface of the drum which is typically coated with an expensive and delicate material. Pressure for fixing is normally applied after the toner has been applied to the paper in the manner as aforesaid, either using transversely extending elongate rollers or a transversely reciprocal roller member as described.

It is an object of the present invention to provide an improved electrostatic printer which in use is moved transversely relative to a surface for example that of a piece of paper so as to form an electrostatic image and cause toner to be attracted thereto and to provide for fixing of the image during the same pass of the device over the surface.

The invention

According to one aspect of the present invention, an electrostatic printer for producing an image on a surface comprises a carriage carrying a toner applicator, a fixing roller, and upstream of the toner applicator an electrostatic printing head adapted to lay down an electrostatic charge image on the fixing roller or on the surface as the head moves across the surface, the toner applicator serving to discharge toner medium onto the electrostatic charge image to which the toner medium adheres and the fixing roller serving to fix the toner medium in position due to pressure as the latter rolls across the surface.

The invention may be used for printing on the surface of either dielectric or plain material, eg paper. In the former case, the electrostatic printing head forms an electrostatic charge image on the surface. In the latter

case, the fixing roller is provided with a dielectric coating, eg of aluminium oxide, and an electrostatic image is formed on the dielectric coating. The image is toned, eg with an adjacent magnetic roller, and the toned image placed on plain paper and fixed by pressure. The roller is cleaned electrostatically, eg with a corona wire, and/or mechanically, eg using a blade or brush.

The printing head is preferably capable of working in both directions of movement relative to the surface, provided the information supplied to the electrostatic charging device is in an appropriate form so as to take account of the opposite directions of movement thereof. Electrical information relating to characters can readily be put into such form by using appropriate buffer memories and reading out the memories in the appropriate directions at the appropriate synchronised intervals of time during a printing process.

Such a buffer memory may be incorporated into the printing head together with appropriate addressing devices or may be incorporated into apparatus to which the printing head is connected by a flexible cable.

In one embodiment of the invention, a mechanism for moving the carriage transversely across recording material supported on a thrust bed, the mechanism exerting a pressure between the fixing roller and thrust bed so as to squeeze the recording material therebetween, comprises:-

1) a first roller (the fixing roller) supported within the carriage so that part of the roller protrudes below the carriage to engage the material;

2) a second roller of smaller diameter than the first roller, which extends coaxially on opposite sides of the

first roller and is rotatably mounted within the first roller for rotation relative thereto;

3) two guide rails mounted above and parallel to the bed on which the sheet material rests, between which the first roller passes, the laterally extending second roller engaging the two rails in rolling engagement;

4) means for exerting a downward pressure on the two rails so as to force the roller assembly towards the bed on which the material rests to squeeze the material therebetween; and

5) drive means for causing the roller assembly to move across the bed parallel to the guide rails.

The drive for the carriage assembly may be by way of an endless belt or wire with mechanically actuated or electrically actuated engagement means for selectively engaging the belt or wire at opposite ends of the straight line movement of the roller assembly so as to cause reversal of the movement of the assembly to produce a reciprocal motion.

Alternatively, the primary drive means for driving the endless belt or wire may itself be reversed at the end of each traverse so as to produce the reciprocal motion of the assembly.

As a further possibility, the carriage assembly may be powered by a flexible drive from a remote motor, eliminating the need for belts or wires, with the motor being reversed at the end of each travel.

In a further alternative arrangement, one of the rollers comprises one of the relatively rotatable members of an electric motor assembly and electric current is supplied

to the electric motor to produce relative rotation of the member so as to produce movement of the carriage and roller assembly. Reversing at the end of each traverse is most simply performed in this arrangement by reversing the flow of electric current to the motor winding.

This last-mentioned arrangement provides a most compact form of device in that no external electric motor is required, but does require the use of a second electric motor, whereas an arrangement in which a single motor is provided for driving the endless belt or wire allows the electric motor to perform other functions, for example, via clutches.

The means for aligning the carriage and roller assembly with the guide means may conveniently comprise further rollers rotatable about axes perpendicular to the main axis of rrotation of the roller assembly, so that the additional rollers engage internal parallel surfaces of the guide rails, the undersides of which are engaged by the laterally extending second roller.

Conveniently, the reversing mechanism comprises a rigid arm attached at opposite ends to a pair of rotatable pins which are mounted for rotation about off-centre axes and clamping stops are provided laterally of the rotatable pin members, and the endless belt or wire is stretched between the rotatable pin members and the stop members so that movement of the wire or belt in one direction will cause the bridging member linking the two eccentrically mounted pins to grip the inside of the belt or wire and trap the latter at one end of the carriage to effect movement of the carriage in the direction in which the belt portion which has been trapped is moving. By providing stop means

external to the carriage which will engage the bridging member at opposite ends of the travel of the carriage, so as to move the bridging member in a rearward direction relative to the movement of the carriage at either end, so the bridging member and eccentrically mounted pin at the one end of the carriage will be moved out of engagement with the belt or wire at that end, the carriage will under its momentum carry on moving, thereby causing the opposite end of the bridging member and the other eccentrically mounted pin to move into engagement with the belt or wire on the return path, so as to cause the carriage to move in the opposite direction, the same as that in which the portion of the belt or wire which is now gripped at the other end of the carriage is moving.

Other forms of reversing mechanism may be employed and the aforementioned mechanism is only given by way of example.

According to a preferred feature of the invention, the toner applicator conveniently comprises a non-ferrous cylindrical member extending axially from the roller assembly, having located therein a rotatable multiple pole magnet, and means is provided for supplying to the external surface of the cylindrical member magnetisable toner medium, eg powder so as to form a toner brush therearound, a drive between the roller assembly and the multiple pole magnet serving to rotate the latter within the housing as the roller assembly moves across the page.

Conveniently the drive means between the multiple pole magnet and the roller assembly is such that irrespective of the direction of movement of the carriage, the multiple pole magnet is rotated in the same direction. This prevents an unwanted build-up of toner powder.

The drive for the multiple pole magnet assembly may be remote from the carriage or may be obtained by a friction drive by virtue of engagement of a roller carried by the carriage and either the sheet material or some other surface over which or under which the carriage moves as it traverses the sheet material. In a preferred arrangement, the multiple pole magnet assembly is mounted on the shaft of an electric motor drive which is contained within the carriage and itself serves as the drive means for causing the carriage to move transversely across the sheet material.

Conveniently, a reversing drive is provided either between the drive to the carriage or between the drive being used by relative movement of the carriage and the sheet material and the drive for the multiple pole magnet assembly, so that the latter always rotates in the same direction.

The supply of magnetisable toner medium, eg powder, for the applicator may be carried independently of the carriage and supplied thereto via a flexible hose or the like. This arrangement works particularly well in conjunction with a flexible drive for the carriage from a remote motor, as discussed above.

As a further possibility, a respective hopper or reservoir may be located at one or both ends of the carriage path, eg at the end of the guide rails in the preferred embodiment discussed above, with a magnet being provided on the carriage for picking up an appropriate supply of toner as it reaches one or both ends.

Alternatively, toner powder may be carried in a hopper attached to or forming part of the carriage and preferably removable therefrom to allow for refilling or replacement.

Furthermore, the hopper may conveniently be associated with a non-ferrous cylindrical member and rotatable multiple pole magnet therein and a drive connection is provided which is automatically made and broken as the hopper is fitted to or removed from the carriage so that a filled hopper can be supplied as a throwaway component after the contents are used. The hopper and magnet may also be in the form of a single disposable component.

According to a further preferred feature of the invention, where an endless belt is used to transmit linear drive to the carriage, the belt may be formed with holes so as to simulate an endless chain or may be formed with teeth so as to form a so-called toothed belt and wheels or pulleys around which the belt passes are formed with appropriate protrusions or grooves to accommodate the belt and provide a positive drive between the wheels and the belt and a clamping mechanism for clamping the carriage or a part thereof to one portion of the belt as it is moving in one direction or the other is provided with appropriate protrusions or grooves or the like so as to again form a positive lock between the belt and the carriage so as to eliminate slip.

Where a toothed belt is envisaged, the teeth may be formed of generally triangular profile when viewed end on so that the belt section when viewed from the edge can be considered to comprise a series of ramped saw teeth and the angle and direction of ramping is selected so that

jamming of the mechanism for locking the belt onto the carriage utilises the ramp shape to more securely clamp the carriage to the belt.

According to a further aspect of the invention, a mechanism for aligning a main carriage relative to a pair of spaced apart parallel guide rails comprises:-

1) a supplementary carriage carried by the main carriage and carrying thereon means by which the supplementary carriage can be clamped to a portion of an endless belt moving parallel to the guide rails;

2) pin means extending from the supplementary carriage towards the main carriage;

3) a lost motion connection between the supplementary carriage and the main carriage; and

4) V-shaped slots at opposite ends of the main carriage into which the pin means extending from the supplementary carriage can engage to transmit drive to the main carriage, whereby movement of the supplementary carriage in one direction will cause the pin at the forward end of the supplementary carriage (when viewed from the direction of motion thereof) to engage in the V-shaped slot at its end of the main carriage, the inclined walls of the V-shaped slot serving to guide the pin into a unique position relative to the main carriage so that drive is transmitted from the supplementary carriage to the main carriage and reverse movement is obtained by disengaging the supplementary carriage from the belt and re-engaging the supplementary carriage to a point on the belt moving in the opposite direction whereupon the pin at the opposite end of the supplementary carriage will become the leading pin and will enter its V-shaped slot in the main carriage and be aligned therein so as to drive the carriage in the reverse direction.

Where a bridging member is eccentrically mounted on eccentrically mounted pins and the latter are mounted on axles, the two axles may be extended so as to form the said driving pins for the main carriage.

In order to prevent jamming and to limit the force required to push the carriage from one end of the track to the other, it is important that the upper and lower surfaces between which the roller assembly rotates are maintained parallel at all times. At the same time, a constant force must be exerted between the two tracks or rails between which the roller assembly rotates, so as to maintain the desired pressure between the underside of the larger roller and the sheet material on the flat bed.

To this end, a floating upper rail is provided in accordance with a further preferred feature of the invention, opposite ends of the floating rail being pivotally attached to the upper ends of the pivoted arms, the lower ends of which are pivoted at opposite ends of the bed on which the sheet material rests. In order to exert a pressure on the rollers, the end of one of the arms is extended so as to form a thrust arm and a spring means such as a chunk of resilient material such as rubber or a helical spring, is located between the extended arm and a fixed member, preferably rigidly linked to the bed on which the sheet material lies, so as to cause a turning moment about the lower pivot point of that particular arm in a direction so as to reduce the space between the floating rail and the bed on which the sheet material lies.

Preferably adjustment means is provided for setting up

just the required amount of force on the floating rail so as to cause just the right pressure to be exerted between the roller assembly and the flat bed.

Where a belt or wire drive is provided for the carriage, pulleys are conveniently mounted at opposite ends of the floating rail, and where an outboard drive is provided, this may also be mounted at one end of the floating rail so as to drive one of the pulleys or wheels directly.

In any of the previously described arrangements in which the drive means for the roller assembly is incorporated into and forms part of one of the rollers (typically the larger roller) thereby dispensing with the need for a belt or wire drive, the reversing mechanism can also be dispensed with so reducing the mass and therefore inertia of the carriage assembly provided arrangements are made to interrupt the flow of electrical current to the electric drive means at the opposite ends of the carriage traverse together with an arrangement to produce a reversal of the electric current flow to the electric drive means so as to change the direction of movement of the carriage at the two extremes.

Preferably the switching mechanism controlling the direction of flow of electric current to the drive means operates in synchronism with the movement of the carriage so as to reverse the flow of electric current to the drive means just before each extreme position is reached so that a breaking action is achieved at opposite ends of the carriage traverse in addition to carriage motion reversal.

According to another aspect of the invention, a colour

printer comprises a source of recording material; a memory or a scanner from which can be obtained a plurality of control signals (typically three), the amplitude of which corresponds to the amplitude of the three primary colours in the image stored in the memory or seen by the scanner; electrical circuit means for conveying electrical signals so produced to three or more electrostatic heads mounted on three or more separate carriages, each adapted to be movable transversely across the recording material as the latter passes through the printer; means for moving the carriages in synchronism with each other and with the movement of the recording material; means for synchronising the supply of electrical signals to the electrostatic charging heads for laying down the pattern of charge on a fixing roller or on the recording material; a hopper containing different coloured toner medium associated with or carried by each said carriage; a toner medium applicator associated with each carriage downstream of each electrostatic charging head; and fixing roller means carried by each carriage and rotatable as each carriage moves transversely across the recording material so as to fix in position on the recording material any toner powder deposited by the applicator in advance thereof.

By arranging that the appropriate electrical signals are supplied to the appropriate electrostatic charging heads so that appropriate electrical charges appear on the roller or recording material in advance of each toner applicator, so only the required quantity of the requisite colours of toner are applied so as to build up a colour reproduction of the image in the store of the original document which has been scanned.

The process can be extended to include more than three such colours in order to produce more refined colour reproduction.

One problem associated with most toner systems is that toner powder tends to adhere to the surface of the fixing roller. This can be eliminated or substantially reduced by providing a felt pad to rub against the surface of the or each fixing roller and to impregnate the felt pad with silicon oil.

Although mention has only been made so far of two end stops, which by implication are fixed, the invention is not limited to such an arrangement and movable stops may be provided so that the distance travelled by the carriage between stops, is adjustable. This is a positive advantage when printing columns, or reduced length lines of text in that the printing speed will be substantially increased.

Instead, or in addition, one or more stops may be provided intermediate the extreme ends of the travel, normally positioned out of alignment with the carriage but movable into positions at which they will be engaged by the carriage to allow quick setting up of standard line lengths or column widths.

Although mention has only been made of printing "one line" at a time, it will be appreciated that if the electrical information is in a suitable form, there is no reason why two or more lines of text should not be "printed" simultaneously. It is, of course, necessary that the printing, toning and fixing heads are of appropriate width.

The invention will now be described by way of example with reference to the accompanying drawings in which:-

Figure 1 is a side elevation of a transverse tracking arrangement for a printing assembly;
Figure 2 is a side elevation of the carriage of the arrangement of Figure 1;
Figure 3 is a plan view from above of the carriage shown in Figure 2;
Figure 4 is a plan view of the lower part of the carriage shown in Figure 2 with the reversing drive mechanism removed;
Figure 5 is a side elevation of the lower part of a complete printing assembly/carriage in accordance with the invention; and
Figure 6 is a plan view from above of the assembly shown in Figure 5.

Detailed description of drawings

In Figure 1 carriage 10 serves as a support for a roller assembly made up of a large diameter roller 12 freely rotatable relative to two equal but smaller diameter rollers 14 and 16 (see Figures 3 and 4) arranged on opposite sides of the large diameter roller 12, and which further includes a drive take-up mechanism (see Figures 2 and 3) for accepting drive from an endless rotating belt 18 (see Figure 1).

The larger diameter roller runs on a base 20 and extends between two parallel rails one of which is shown at 22 which are spaced from and run parallel to the surface 20 and provide running surfaces for the smaller diameter rollers 14 and 16. The parallel rails may be part of a

single structure.

Assuming that the surface 20 can be considered to be stationary, the two rails of which one is shown at 22 must be urged in a direction as indicated by arrow A but at the same time the rails and surface 20 must remain parallel at all times to prevent jamming. To this end a parallel linkage involving two L-shaped levers 24 and 26 supports the rails of which one is shown at 22 above the base 20. The lever 24 is pivoted at 28 to the base 20 and at 30 to the rail 22. A similar connection is provided on the other side to the hidden rail. In a similar manner the lever 26 is pivoted at 32 to the opposite end of the rail 22 and is likewise pivoted at 34 to the opposite end of the base 20. A similar connection at 32 is provided between the lever and the hidden rail.

The rails of which one is shown at 22 provides supports at 36 and 38 for rollers 40 and 42 around which the endless belt 18 extends. One of the rollers is driven by a motor which is conveniently mounted (not shown) to the pair of rails of which one is shown at 22.

A degree of thrust in the direction of arrow A is imparted by means of a resilient block of rubber or like material 44 which is sandwiched between an extension of the lever 26 and a fixed abutment 46 conveniently extending from or forming part of the base 20.

Figure 2 shows in side elevation the complete carriage assembly. The latter comprises two generally triangular plates of which one is shown at 48 between which is located the roller assembly made up of rollers 12, 24 and 16. The rollers are mounted on a common axle 50. The

plates such as 48 are joined as is best seen in Figure 4 by two transversely extending end plates 52 and 54 and these form with the two triangular plates one of which is shown at 48, a rigid framework in which the rollers are mounted. Although not shown in Figure 2, the second triangular plate is visible in Figures 3 and 4 and is designated by reference numeral 49.

The carriage assembly is completed by an upper part which is a generally rectangular framework having two side members 56 and 58 which extend between platforms 60 and 62 at opposite ends thereof. The side plates 56 and 58 are thin and are located on opposite sides of the large diameter roller so as to leave well exposed the smaller diameter rollers 14 and 16 as is best seen in Figure 3.

The platforms 60 and 62 carry two pins which lie on the longitudinal centre line of the framework and which can be seen in Figure 3 at 64 and 66 and the pins extend below the platform to engage in V-shaped apertures 68 and 70 in the two transverse plates 52 and 54 shown in Figure 4. A certain degree of lost motion is provided between the pins of the V-shaped slots and the diameter of the pins is selected so that if the assembly generally designated 72 is moved in the direction of the arrow B in Figure 3, the pin 64 will neatly engage the vertex of the V and accurately align and pull the lower part of the carriage in the direction of the arrrow B.

In the same way, if the direction of thrust is reversed, the pin 66 extending below the righthand end of the upper carriage assembly 72 engages in and nestles neatly into the vertex of the triangular slot 70 so as to provide alignment and pull in the opposite direction to the arrow

B.

It has been found that by using a single-point driving and pivoting position of the type just described, there is little tendency for the rollers 12, 14 and 16 to become jammed between the parallel rails one of which is shown at 22. The carriage follows the pull rather in the manner of a caster wheel.

Drive is transmitted between the endless belt and the upper carriage part 72 by causing the belt to become trapped between an eccentrically mounted disc 74 mounted upon the platform 60 and the side wall 56 or between a similar eccentrically mounted disc 76 mounted on the platform 62 and the opposite side wall 58. To this end the endless belt is arranged to pass through the upper carriage part 72 as shown by the two dotted lines 18a and 18b. If the section of belt 18a is moving in the direction of the arrow C, there will be a tendency for the eccentrically mounted disc 76 to be drawn further into meshing engagement with the belt section 18a and the latter will become squeezed and nipped between the eccentrically mounted disc 76 and the side wall 58.

The two eccentrically mounted discs are themselves further pivotally mounted to a freely mounted link 78 whose ends protrude beyond the opposite ends of the carriage assembly. By providing stops (not shown) at opposite ends of the travel as defined by the rails one of which is shown at 22, so the leading end of the link 78 (depending on the direction of travel) will strike the stop which in turn will cause a sharp rotation of the eccentrically mounted discs in opposite directions, thereby causing the opposite disc (ie the one at the opposite end of the

assembly) to rotate into engagement with the belt on the opposite side and cause the carriage assembly to begin to travel in the opposite direction assuming that the belt continues to rotate as before.

Figures 5 and 6 illustrate how the carriage assembly shown in Figures 1 to 4 includes on one side of the carriage assembly a gearbox with reversing drive mechanism in a triangular housing designated by reference numeral 80. The gearbox output shaft 82 has mounted thereon a multiple pole magnet 84 which rotates within a brass or aluminium cylindrical housing 86. A hopper shown in dotted outline in Figure 5 containing toner powder and designated by reference numeral 88 is located above the cylindrical housing 86 to cause toner powder to be deposited on the surface of the cylinder 86. By employing appropriate powder (ie magnetisable powder) so a cylindrical brush of powder is found to be set up around the surface of the cylindrical member 86 and by arranging that this just brushes the surface on which the roller 12 runs, so it will be found that toner can be deposited onto the surface of the sheet paper trapped between the roller 12 and the surface 20.

An electrostatic charging head 94 is contained in a housing 96 which extends outboard of the roller 86 and is joined to the gearbox by an arm 98. A sheet of paper (not shown) is fed, by a suitable mechanism, between the roller 12 and the surface of the base 20 in a direction transverse to the movement of the carriage assembly 10 with the paper moving relative to the carriage in a direction such that the paper first passes under the charging head 94 and then under the toner applicator brush and thereafter under the roller 12. An electrostatic

pattern of a letter or numeral (for example) will attract toner from the toner brush 86 and the toner will then be fixed in position due to the squeezing action of the paper between the roller 12 and the base 20. The paper is advanced by the mechanism at each end of the path movement of the carriage.

The head 94 comprises an array of conductive pins to which high voltage is supplied selectively so as to define different patterns which may correspond with letters and numbers.

The voltage signals are supplied to the conductive pins via a flexible supply lead from suitable apparatus which may include a keyboard with a processor for converting keyed signals into an appropriate combination of pin voltages. Alternatively, the pins may be energised form a scanner which scans a document to be copied and "reads" the latter, signals being produced that, when converted to energising voltages applied to the pins of the head 94 cause the latter to lay down a charge pattern equivalent to the image being read.

The pins may be a linear array and are energised sequentially to build up a character for example as the charging head passes across the paper.

The gearbox 80 is preferably driven directly from the shaft 50 so that rotation of the roller 12 automatically rotates the toner applicator.

In order to further prevent jamming, disc-like members are freely rotatably mounted about vertical axles at opposite ends of the lower carriage assembly as denoted by members

90 and 92. The two discs have diameters which are commensurate with the spacing between the two rails of which one is shown at 22 so that when being driven by the belt, one rail is engaged by one of the discs such as 90 and the other by the disc 92. The engagement of the discs and running engagement between the discs and the rails compensates for any turning torque due to the off-centre engagement of the belt with the carriage assembly.

In addition to the above, a further degree of squeeze or nip between the roller 12 and the surface 20 can be obtained by providing a thin layer of foam or similar resiliently deformable material on the surface 20 having on its upper surface a flexible metal film such as foil firmly bonded to the foam or other material. This may be in addition to or instead of the resilience imparted by the block of rubber such as 44.

To use the embodiment, a user first fills the hopper with toner, and makes any necessary adjustment to the downward pressure exerted on the carriage by the rails 22. As charging head 94 passes over the paper, the conductive pins in the latter are selectively energised and a strip bearing a pattern of electrostatic charges is built up on the paper. As the paper is advanced, that strip reaches the toner cylinder 84 and toner is transferred to the paper in a manner controlled by the charge pattern. Toner particles are attracted to the charged areas on the paper to which they adhere and are then subsequently 'fixed' by the roller 12 as it passes across the paper. As can be appreciated from the drawings, toning occurs in strips across the width of the paper just ahead of the transverse path across the paper followed by the roller 12.

A more detailed description of a photocopier in which the present invention may be incorporated is found in PCT Specification No WO 83/01692 (PCT/GB 82/00309).

Claims

1. An electrostatic printer for producing an image on a surface comprises a carriage carrying a toner applicator, a fixing roller, and upstream of the toner applicator an electrostatic printing head adapted to lay down an electrostatic charge image on the fixing roller or on the surface as the head moves across the surface, the toner applicator serving to discharge toner medium onto the electrostatic charge image to which the toner medium adheres and the fixing roller serving to fix the toner medium in position due to pressure as the latter rolls across the surface.

2. A printer according to claim 2, wherein the electrostatic printing head is adapted to form an electrostatic charge image on the surface of dielectric material.

3. A printer according to claim 2, wherein the printing head is capable of working in both directions of movement relative to the surface, being supplied with information in an appropriate form.

4. A printer according to claim 3, further comprising at least one buffer memory from which information is supplied to the printing head.

5. A printer according to claim 1, wherein the toner applicator comprises a non-ferrous cylindrical housing with rotable magnet means located therein, with drive means being provided for rotating the magnet means, means also being provided by supplying magnetisable toner medium to the external surface of the cylindrical housing.

6. A printer according to claim 5, wherein the cylindrical housing extends axially from a roller assembly including the fixing roller.

7. A printer according to claim 5, wherein a hopper for containing toner medium is carried by the carriage, being located directly vertically above the cylindrical housing.

8. A printer according to claim 5, wherein a respective toner medium hopper is located at one or both ends of the carriage path, with a magnet being provided on the carriage for picking up an appropriate supply of toner as it reaches one or both ends.

9. A printer according to claim 5, wherein the drive means are arranged to cause rotation of the magnet means in a constant direction.

10. A printer according to claim 1, further including a cleaning pad carried by the carriage for contacting and cleaning the cylindrical surface of the fixing roller.

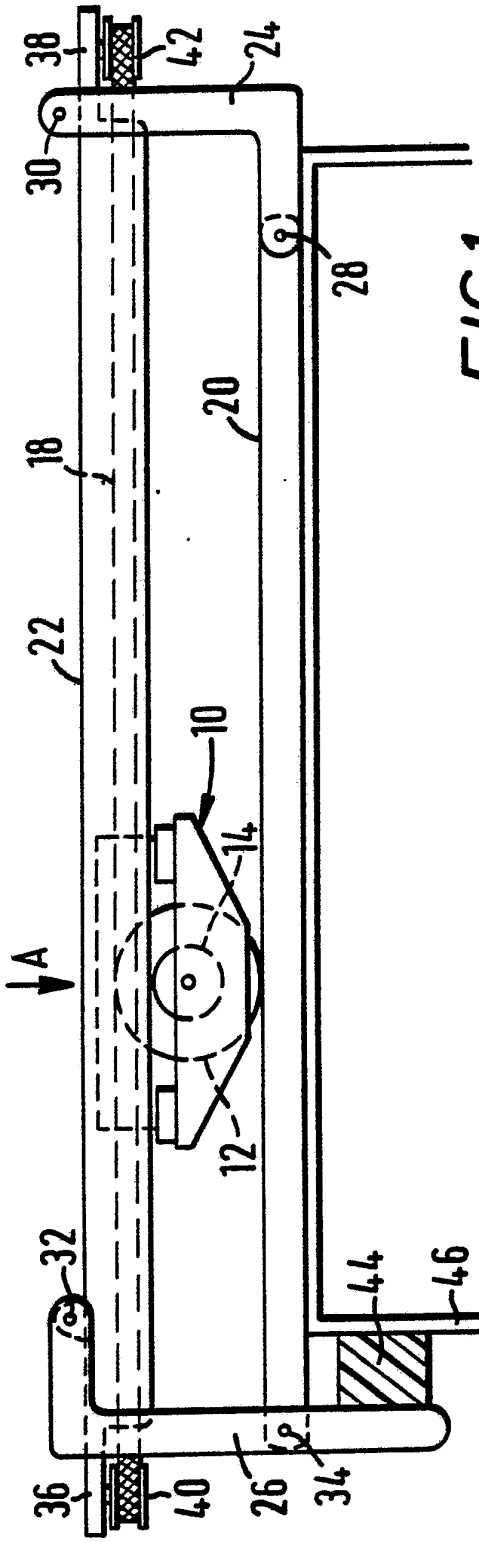

FIG.1

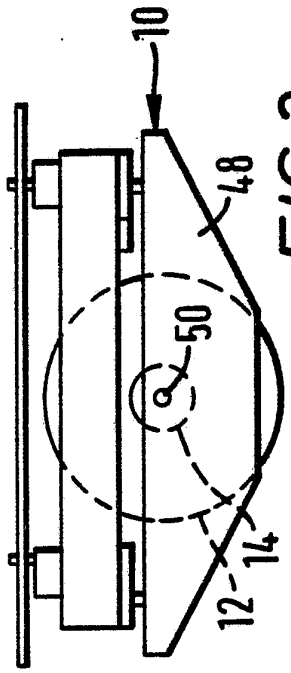

FIG.2

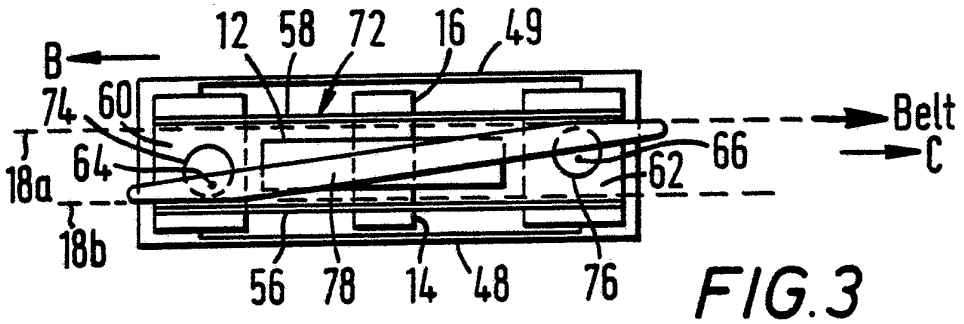

FIG.3

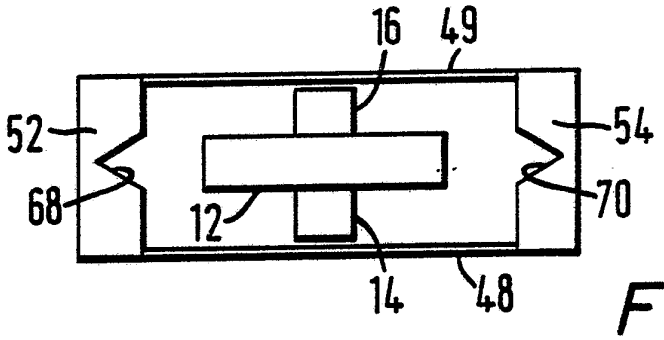

FIG.4

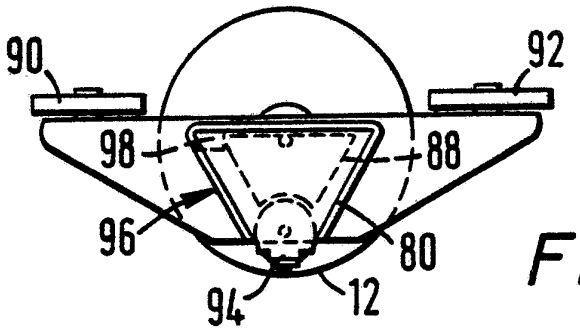

FIG.5

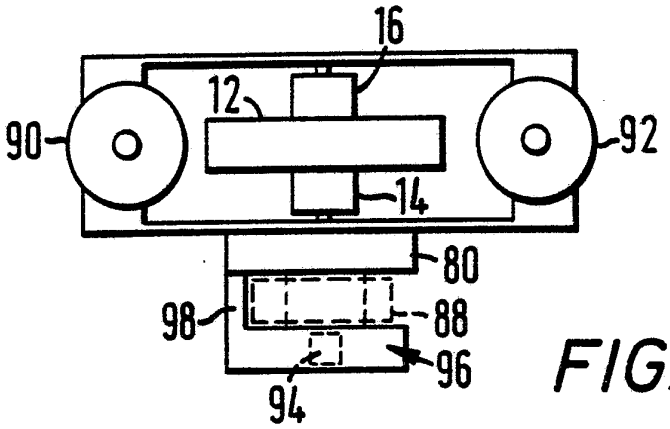

FIG.6

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 83/00188

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[3]: G 03 G 15/32; 15/09; B 41 J 3/18; G 03 G 15/20

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
IPC[3]	G 03 G 15/32; G 03 G 15/09; B 41 J 3/18; B 41 J 3/16; G 03 G 15/24; G 03 G 15/28; G 03 G 15/08 G 03 G 15/20

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
X	WO, A, 81/01120 (MARSHALL) 30 April 1981 see page 7, line 8 - page 9, line 18; figures 1,2	1,2,4
P,X	WO, A, 83/01692 (PAYNE) 11 May 1983 see page 11; claims 12-14; figures 1,2 cited in the application	1,2,4-6
A	US, A, 3811766 (ROBINSON, Jr.) 21 May 1974 see column 7, line 25 - column 9, line 46; figures 4,5	1,2,4,5
A	US, A, 3990393 (SILVERBERG) 9 November 1976 see column 11, line 61 - column 12, line 45; figures 10A,10B	1,2,4,5
A	GB, A, 1603863 (SIGN ELECTRONICS LTD.) 2 December 1981 see the entire document cited in the application	1,2,4,5

* Special categories of cited documents: [15]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search [1]	Date of Mailing of this International Search Report [2]
25th October 1983	14 NOV. 1983
International Searching Authority [1]	**Signature of Authorized Officer [20]**
EUROPEAN PATENT OFFICE	G.L.M. Kruydenberg

Form PCT/ISA/210 (second sheet) (October 1981)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/GB 83/00188 (SA 5551)

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 08/11/83

The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO-A- 8101120	30/04/81	EP-A-	0044306	27/01/82
		GB-A-	2082507	10/03/82
WO-A- 8301692	11/05/83	EP-A-	0091937	26/10/83
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		FR-A-	2037795	31/12/70
		CH-A-	521614	15/04/72
		GB-A-	1296417	15/11/72
		BE-A-	747127	10/09/70
		SE-B-	361749	12/11/73
US-A- 3990393	09/11/76	None		
GB-A- 1603863	02/12/81	FR-A-	2394838	12/01/79
		DE-A-	2827081	21/12/78
		US-A-	4372695	08/02/83