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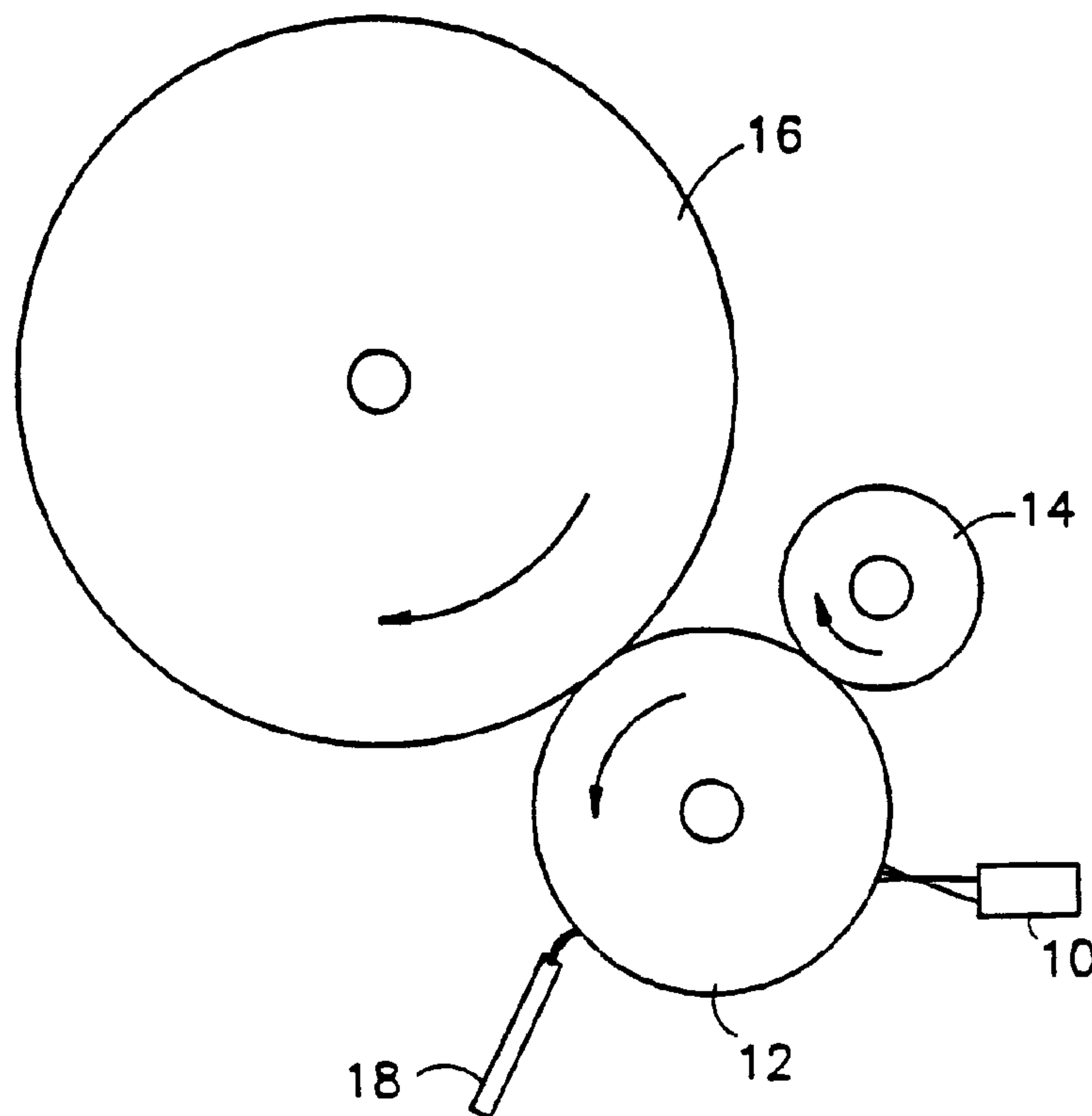
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(54) Titre : ROULEAU RACLEUR POUR SYSTEMES D'IMPRESSION

(54) Title: SQUEEGEE ROLLER FOR IMAGING SYSTEMS



(57) Abrégé/Abstract:

Squeegee apparatus (14) for squeegeeing excess material from a surface (12), from which surface at least a portion of the material remaining after squeegeeing is to be transferred to a second surface (16), comprising a first surface, having a central portion and two end portions having recessed surfaces and having a liquid material thereon at least in said central portion, said surface moving in a given direction at a squeegee region and a second, squeegee surface, urged against at least the central portion of the imaging surface at the squeegee region. In the preferred embodiments of the invention the squeegee apparatus is used in imaging apparatus, preferably utilizing liquid toner.



ABSTRACT

Squeegee apparatus (14) for squeegeeing excess material from a surface (12), from which surface at least a portion of the material remaining after squeegeeing is to be transferred to a second surface (16), comprising a first surface, having a central portion and two end portions having recessed surfaces and having a liquid material thereon at least in said central portion, said surface moving in a given direction at a squeegee region and a second, squeegee surface, urged against at least the central portion of the imaging surface at the squeegee region. In the preferred embodiments of the invention the squeegee apparatus is used in imaging apparatus, preferably utilizing liquid toner.

1                   **SQUEEGEE ROLLER FOR IMAGING SYSTEMS**2                   **FIELD OF THE INVENTION**

3                   The present invention relates to squeegeeing using  
4 moving squeegee rollers and more particularly to squeegee  
5 rollers for imaging apparatus employing liquid toners.

6                   **BACKGROUND OF THE INVENTION**

7                   In processes for developing images on a photoconductor  
8 in imaging machines, especially those employing liquid toner  
9 or developer, images or layers of liquid toner are often  
10 squeegeed in order to remove excess liquid or excess toner  
11 from the image or the layer. This is generally done by  
12 urging a squeegee roller (or another moving squeegee  
13 surface) together with the surface supporting the image or  
14 layer. The squeegee roller surface rides on the image or  
15 layer supporting surface and the two surfaces move in the  
16 same direction, generally at the same velocity. When the  
17 supporting surface is a roller coated with liquid toner  
18 concentrate this surface typically contacts or is in close  
19 proximity with a photoreceptor, such as a selenium drum or  
20 an organic photoconductor, which carries the latent image to  
21 be developed. Such systems are disclosed in Patent  
22 publications WO 93/01531 and WO 94/16364.

23  
24                   Alternatively, a squeegee is utilized to remove  
25 excess carrier liquid from an already developed image on a  
26 photoreceptor or other surface. One such use of a squeegee  
27 roller is described in U.S. Patent 5,028,964.

28  
29                   In the system described in WO 94116364, a toner  
30 injector injects a quantity of liquid toner onto a rotating  
31 developer roller. A (preferably electrified) squeegee roller  
32 is urged against the developer roller and compacts and  
33 concentrates the liquid toner by removing a portion of the  
34 liquid therefrom to form a substantially uniform layer of  
35 concentrated liquid toner on the developer roller. During  
36 the squeegee operation excess toner and excess carrier

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1 liquid removed from the layer are carried toward the ends of  
2 the squeegee roller and "run" around the end of the rollers  
3 and onto the edge of the developer roller.

4       A photoreceptor containing a latent image is brought  
5 into operational association with the developer roller to  
6 develop the latent image by the selective transfer of all  
7 or a portion of the concentrated liquid toner layer formed  
8 on the developer roller. Excess liquid toner and carrier  
9 liquid removed from the toner which is carried along the  
10 edge of the roller have a tendency to contaminate the edges  
11 of the image developed on the photoreceptor and to form  
12 strips of liquid toner on the photoreceptor which are later  
13 transferred to a final substrate.

14                   SUMMARY OF THE INVENTION

15       The present invention seeks to provide a solution to  
16 such edge contamination in an imaging machine such as a  
17 copier or printer.

18       In one aspect of the invention a recessed surface such  
19 as a beveled surface is provided at the edges of a developer  
20 surface, such as the surface of a developer roller or  
21 developer belt. The end of the developer surface, which may  
22 be contaminated by excess toner, is thus not in contact with  
23 the photoreceptor to which the remainder (the central  
24 portion) of the developer surface selectively transfers the  
25 layer of liquid toner formed on the developer surface. Any  
26 excess (untransferred) liquid toner present on the developer  
27 surface, including the material at the end of the surface,  
28 is removed from the surface after it leaves the  
29 photoreceptor surface at a cleaning station which can be of  
30 any suitable design.

31       In a second aspect of the invention, in which a  
32 squeegee roller is used to compress and concentrate a liquid  
33 toner image already formed on an imaging surface such as a  
34 photoreceptor, the photoreceptor is provided with a beveled  
35 edge which is not in contact with a final substrate (or an  
36 intermediate transfer member) during transfer of the

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1 compressed image thereto. The excess liquid or toner at the  
2 edges of the photoreceptor is removed therefrom together  
3 with any untransferred portions of the image at a cleaning  
4 station which can be of any suitable design.

5 There is thus provided, in accordance with a preferred  
6 embodiment of the present invention, imaging apparatus  
7 including:

8 an imaging surface, having a latent electrostatic image  
9 formed thereon, which moves in a given direction at a  
10 development region;

11 a developer surface, preferably the surface of a  
12 developer roller, having a central portion and at least one  
13 recessed, preferably beveled, end, the central portion being  
14 urged against the imaging surface and moving therewith at a  
15 development region; and

16 a squeegee surface, preferably the surface of a  
17 squeegee roller, urged against at least the central portion  
18 of the developer surface at a squeegee region, prior to the  
19 development region.

20 Preferably, the squeegee surface is formed with end  
21 portions which mate with the recessed ends of the developer  
22 surface.

23 In a preferred embodiment of the invention, the  
24 apparatus further comprises a toner injector which deposits  
25 a quantity of liquid toner onto the developer surface prior  
26 to the squeegee region. Preferably the apparatus includes a  
27 developer surface cleaning station which removes excess  
28 toner from the developer surface after it leaves the  
29 development region.

30 There is further provided, in accordance with a  
31 preferred embodiment of the invention, imaging apparatus:

32 an imaging surface, preferably an imaging drum, having  
33 a central portion and two recessed, preferably beveled, ends  
34 and having a liquid toner image formed on said central  
35 portion, which moves in a given direction at a squeegee  
36 region;

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1 a squeegee surface, preferably the surface of a  
2 squeegee roller, urged against at least the central portion  
3 of the imaging surface at the squeegee region.

4 Preferably, the squeegee surface is formed with end  
5 portions which mate with the recessed ends of the imaging  
6 surface.

7 Preferably the apparatus includes an imaging surface  
8 cleaning station which removes excess toner from the imaging  
9 surface after it leaves the squeegee region.

10 There is further provided, in accordance with a  
11 preferred embodiment of the invention, squeegee apparatus  
12 for squeegeeing excess material from a surface from which  
13 surface at least a portion of the material remaining after  
14 squeegeeing is to be transferred to a second surface  
15 comprising:

16 a first surface, preferably the surface of a drum,  
17 having a central portion and two recessed, preferably  
18 beveled, ends and having a liquid material thereon at least  
19 in said central portion, which moves in a given direction at  
20 a squeegee region; and

21 a squeegee surface, preferably the surface of squeegee  
22 roller, urged against at least the central portion of the  
23 imaging surface at the squeegee region.

24 Preferably, the squeegee surface is formed with end  
25 portions which mate with the recessed ends of the first  
26 surface.

27 BRIEF DESCRIPTION OF THE DRAWINGS

28 The present invention will be understood and  
29 appreciated more fully from the following detailed  
30 description, taken in conjunction with the drawings in  
31 which:

32 Fig. 1 is a generalized illustration of a portion of  
33 imaging apparatus constructed and operative in accordance  
34 with a preferred embodiment of the present invention;

35 Fig. 2 is a generalized illustration of a portion of  
36 the apparatus of Fig. 1 characteristic of the prior art;

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1        Fig. 3 is a generalized illustration of a portion of  
2 the apparatus of Fig. 1 constructed and operative in  
3 accordance with a preferred embodiment of the present  
4 invention; and

5        Fig. 4 is a simplified schematic illustration of  
6 another embodiment of the invention.

7            DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

8        Reference is made to Fig. 1 which is a generalized  
9 illustration of a portion of an imaging machine constructed  
10 and operative in accordance with a preferred embodiment of  
11 the present invention. Only those portions of the imaging  
12 apparatus necessary to illustrate the invention are included  
13 in Fig. 1, the other parts of the apparatus being entirely  
14 conventional and very well known in the art.

15        A liquid toner injector 14 injects liquid toner or  
16 liquid toner concentrate onto a counter-clockwise rotating  
17 developer roller 12. A clockwise rotating squeegee roller 10  
18 is urged against the developer roller 12 at a squeegee  
19 region 50.

20        In a preferred embodiment of the invention, squeegee  
21 roller 10 is electrified to compress the liquid toner layer,  
22 spread by toner injector 14, and to remove excess toner by  
23 the squeegee action. Squeegee roller 10 thus concentrates  
24 the liquid toner and forms a layer thereof on the developer  
25 roller as it leaves the squeegee region. Alternatively, any  
26 of the apparatus shown in the aforementioned publications WO  
27 93/16364 or WO 93/01531 may be used to form the layer of  
28 liquid toner concentrate on developer roller 12.

29        Developer roller 12 is brought into operational  
30 juxtaposition with a photoreceptor drum 16 which has a  
31 latent image formed thereon at a development region 52, the  
32 latent image having image areas at a first potential and  
33 background areas at a second potential. Developer roller 12  
34 is electrified to a potential between the first and second  
35 potentials such that at least a portion of the liquid toner  
36 layer thereon is selectively transferred from the developer

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1 roller to the image areas of the photoreceptor. Such  
2 development is described in the aforementioned WO 93/16364  
3 or WO 93/01531.

4 A cleaning station 18, downstream of development region  
5 52, removes toner and carrier liquid which is not  
6 transferred to the photoreceptor. While cleaning station 18  
7 is shown as comprising only a squeegee blade, it may consist  
8 of any of the many cleaning stations known in the art and  
9 may include a roller or rollers, a brush or brushes and/or a  
10 supply of carrier liquid.

11 Reference is now made to Fig. 2, which shows a  
12 combination of squeegee roller 10 having edges 20, developer  
13 roller 12 having edges 22 and photoreceptor 16 as known in  
14 the prior art.

15 As described above, squeegee roller 10 is urged against  
16 developer roller 12 to form a layer of concentrated liquid  
17 toner comprising charged toner particles and carrier liquid,  
18 on developer roller 12; liquid toner or liquid toner  
19 concentrate having been supplied to either or both rollers  
20 prior to their coming into contact or at the point of  
21 contact. Developer roller 12 is brought into operational  
22 juxtaposition with photoreceptor drum 16 which has a latent  
23 image formed thereon, the latent image having image areas at  
24 a first potential and background areas at a second  
25 potential. Developer roller 12 is electrified to a potential  
26 between the first and second potentials such that at least a  
27 portion of the liquid toner layer thereon is selectively  
28 transferred from the developer roller to the image areas of  
29 the photoreceptor.

30 During the squeegee action on the layer of liquid  
31 toner, excess liquid toner and carrier liquid migrate to the  
32 edges 20 and 22 of squeegee roller 10 and developer roller  
33 12 respectively. As squeegee roller 10 and developer roller  
34 12 rotate, the excess toner collected at edge 22 is  
35 transferred to the surface of photoreceptor 16 and  
36 contaminates it.

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1       Reference is now made to Fig. 3, which is a generalized  
2 illustration of a portion of an imaging machine constructed  
3 and operative in accordance with a preferred embodiment of  
4 the present invention. Fig. 3 shows a squeegee roller 10', a  
5 developer roller 12' and a photoreceptor drum 16, all of  
6 which rotate together. The general functions of these  
7 elements are the same as those of the corresponding elements  
8 in the prior art device shown in Fig. 2, however the  
9 developer roller and, preferably, the squeegee roller are  
10 shaped so as to avoid the problems of the prior art systems  
11 as described above.

12       In the embodiment of Fig. 3, developer roller 12' has  
13 beveled ends 26. Preferably, squeegee roller 10' is formed  
14 with ends 24 which conform to edges 26 such that the entire  
15 surface of the developer and squeegee rollers are in contact  
16 and the entire surface of the developer roller is squeegeed  
17 by the squeegee roller. As shown in Fig. 3, ends 24 and 26  
18 are cone shaped such that end 24 of squeegee roller 10'  
19 forms a diverging cone whereas the beveled end 26 of  
20 developer roller 12' forms a converging cone.

21       As in the prior art, excess liquid toner and carrier  
22 liquid, which is squeegeed from the layer of liquid toner  
23 formed on the developer roller, migrate to the ends of the  
24 rollers. However, unlike the ends of developer roller 12  
25 shown in Fig. 2, the ends of developer roller 12' are not in  
26 contact with the surface of photoreceptor 16 and liquid is  
27 thus not transferred to the photoreceptor from the ends of  
28 the developer roller, the amount of beveling being  
29 sufficient to avoid contact of the liquid on the ends 26  
30 with photoreceptor 16.

31       It is to be appreciated that different cone angles may  
32 be employed as long as the cone angle and length of the  
33 bevel is sufficient to avoid contact of the liquid on the  
34 end of the developer roller with the photoreceptor surface.

35       Generally speaking, for proper squeegee action one or  
36 both of rollers 10' and 12' should be of a resilient

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1 material such as an elastomer, or have a resilient coating.

2       The present invention, while illustrated for a  
3 particular preferred embodiment, is also suitable for any  
4 squeegeeing situation in which the squeegeed material on a  
5 first surface is to be transferred to a further surface and  
6 the transfer of excess material at the edges of the first  
7 surface is to be avoided.

8       One such situation is illustrated in Fig. 4, in which  
9 an imaging surface 30, for example a photoreceptor roller,  
10 has a developed image comprising charged toner particles and  
11 carrier liquid formed thereon. Imaging surface 30 is formed  
12 with beveled ends. A squeegee surface such as a squeegee  
13 roller 32, preferably having ends which match the bevel on  
14 the imaging surface, is urged against the imaging surface  
15 and is preferably electrified to compress and concentrate  
16 the image and to remove carrier liquid therefrom. The amount  
17 of carrier liquid which may be on the non-image portions of  
18 the imaging surface is also reduced by the action of the  
19 squeegee. Such squeegee action on images is described in the  
20 aforementioned U.S. Patent 5,028,964.

21       The thus-removed carrier liquid migrates to the edge of  
22 rollers 30 and 32. When the photoreceptor comes in contact  
23 with a further surface 34, such as a final substrate or an  
24 intermediate transfer member, to which the image is to be  
25 transferred, this liquid, which may contain some toner  
26 particles, may be transferred to the surface 34.

27       In this embodiment of the invention, the ends of  
28 imaging surface 30 are beveled such that liquid at said ends  
29 is not transferred to further surface 34. Preferably, the  
30 ends of squeegee roller 32 are formed to mate with the  
31 beveled edges of imaging surface 30.

32       While the invention has been shown using the preferred  
33 beveled cone shaped ends, other end shapes, such as  
34 undercuts (i.e., a smaller diameter at the ends) on the  
35 developer roller 12' of Fig. 3 or the imaging surface 30 of  
36 Fig. 4 can be used.

**SUBSTITUTE CLAIMS**

1. Squeegee apparatus for squeegeeing excess material from a first surface, from which first surface at least a portion of the material remaining after squeegeeing is to be transferred to a third surface, comprising:

a first surface, having a central portion and two end portions having recessed surfaces and having a liquid material thereon at least in said central portion, said first surface moving in a given direction at a squeegee region; and

a second, squeegee surface, urged against at least the central portion of the first surface at the squeegee region.

15

2. Imaging apparatus comprising:

a first, imaging, surface, having a central portion and two end portions having recessed surfaces and having a liquid toner image formed on said central portion, which imaging surface moves in a given direction at a squeegee region; and

20

a second, squeegee, surface, urged against at least the central portion of the imaging surface at the squeegee region.

25

3. Apparatus according to claim 1 or claim 2 wherein the first surface is the surface of a roller.

4. Apparatus according to claims 1, 2 or 3 wherein the squeegee surface is the surface of a squeegee roller, wherein the squeegee surface moves together with the

30

## **SUBSTITUTE CLAIMS**

first surface at the squeegee region.

5. Apparatus according to claims 1, 2, 3 or 4 wherein  
the squeegee surface is formed with end portions which  
5 mate with the recessed end surfaces of the first surface.

6. Apparatus according to any of claims 1, 2, 3, 4 or 5  
wherein the recessed end portions comprise beveled, cone  
shaped surfaces.

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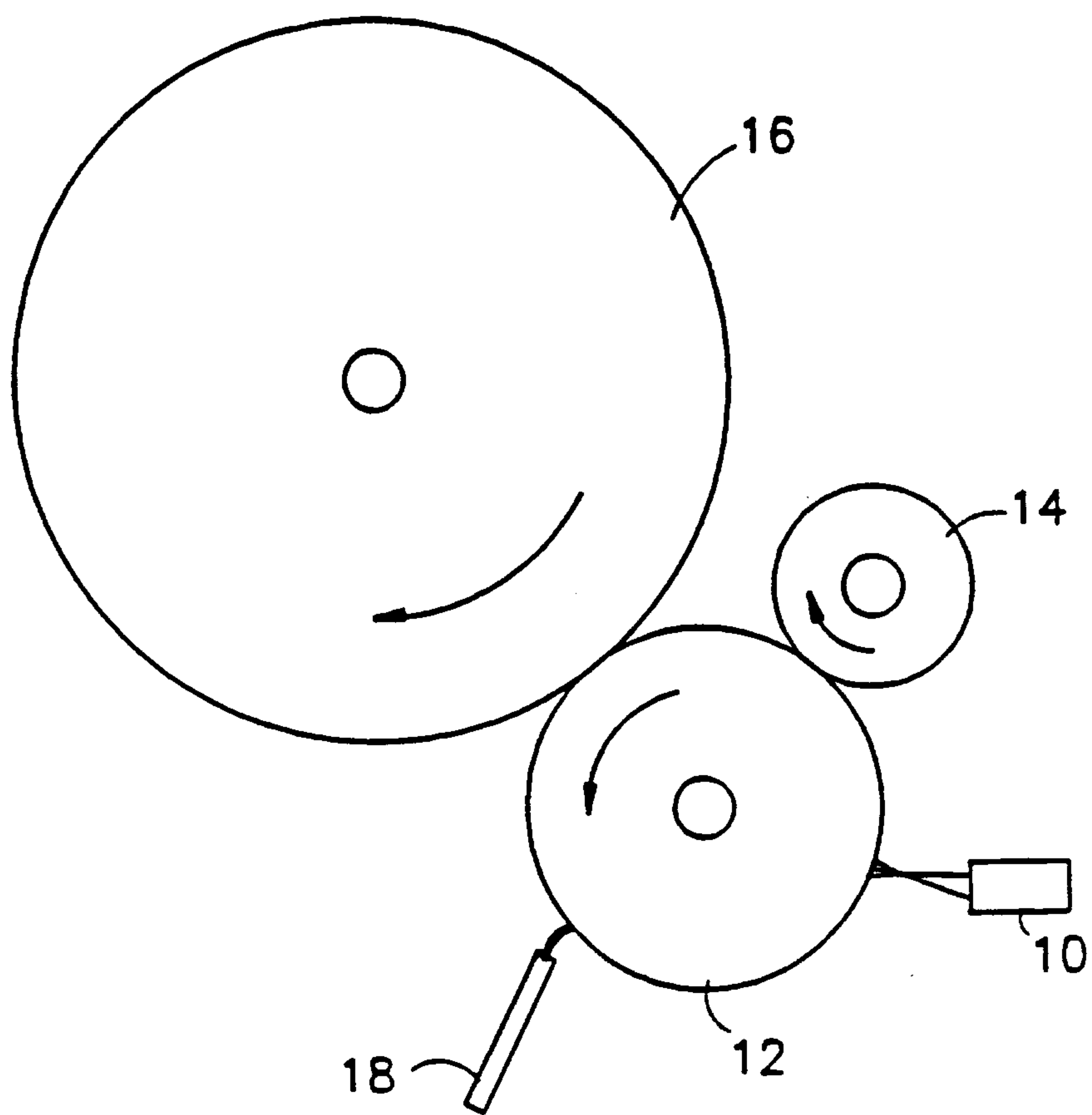


FIG. 1

