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## (54) Fluid applicator wick.

(57) A fluid applicator wick which applies release fluids to a fuser roller adapted to fuse toner images to a copy sheet. The wick includes a fluid retaining material and a covering material. The covering material is in contact with at least one surface of the fluid retaining material and the fuser roller. The covering material (46) has at least a first layer (50) of fibers and a second layer (52) of fibers with a thin, loosely woven layer (56) of material interposed therebetween. At least a portion of the fibers of the first layer of fibers and the second layer of fibers are interlocked with the layer of loosely woven material interposed therebetween. The covering material preferably includes a third layer (54) of fibers, with a second thin, loosely woven layer (58) of material between the second and third layers of fibers.

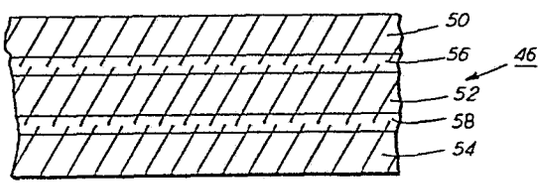


FIG. 3

EP 0 165 719 A1

# FLUID APPLICATOR WICK

This invention relates to a fluid applicator wick particularly, although not exclusively, useful in a fusing system used in an electrophotographic printing machine. The applicator wick is of the kind which includes a fluid retaining material and a covering material disposed in contact with at least one surface of the fluid retaining material. When used in an electrophotographic machine, the applicator wick is used for applying release material to the surface of a fuser member used for permanently affixing toner to a copy sheet.

A typical electrophotographic printing machine employs a photoconductive member that is charged to a substantially uniform potential so as to sensitize the surface thereof. The charged portion of the photoconductive member is exposed to a light image of an original document being reproduced. Exposure of the charged photoconductive member selectively dissappates the charge thereon, in the irradiated areas. This records an electrostatic latent image on the photoconductive member corresponding to the informational at areas contained within the original document. After the electrostatic latent image is recorded on the photoconductive member, the latent image is developed by bringing a developer material into contact therewith. Generally, the developer material comprises toner particles adhering triboelectrically to carrier granules. The toner particles are attracted from the carrier granules to the latent image to form a toner powder image on the photoconductive member. The toner powder image is then transferred from the photoconductive member to a copy sheet. Thereafter, the toner particles are heated to permanently fuse the powder image to the copy sheet.

In order to fuse the toner particles to the copy sheet by heat, it is necessary to elevate the temperature of the toner material to a point at which the constituents thereof coalesce and become tacky. This action causes the toner particles to flow, to some extent, into the fibers or pores of the copy sheet. Thereafter, as the toner material cools, solidification of the toner material occurs causing the toner material to be firmly bonded to the copy sheet.

Herebefore, the toner particles have been permanently fused to

the copy sheet by the simulanteous application of heat and pressure by a pair of rollers. The rollers are in pressure contact with one another with one of the rollers being heated. Fusing of the toner particles takes place when the proper combination of heat and contact pressure are provided. During the operation of the fusing system, the copy sheet with the powder image thereon is passed through the nip between the rollers. Occasionally, toner particles will be offset from the copy sheet to the fuser roll. These toner particles are then subsequently transferred to the surface of the backup roll which is in pressure contact with the fuser roll, during periods of time when no copy sheet passes through the nip. When subsequent copies are advanced through the nip, these residual toner particles adhering to the backup roll and fuser roll may be deposited on the copy sheet, degrading the copy. One approach for minimizing this problem has been to provide an outer layer on the fuser roll made from polytetrafluorethylene, best known by the tradename Teflon which is a trademark of E. I. du Pont de Nemours and Company of Wilmington, Delaware. Various fluid polymer release materials which oxidize or which contain functional groups, can be utilized to prevent offsetting of the toner particles to the fuser roll. In system of this type, a release fluid is applied to the fuser roll by means of a wick. The wick is generally used to dispense silicone oil, a functional siloxane fluid, mineral oil, or one of many other release fluids upon the external surface of the fuser member. By way of example, the fuser wick may be a pad overlying and in contact with the heated fuser roll. Generally, the wick is made from two different layers, a first layer coming into contact with the surface of the fuser roller and metering precise amounts of fluid thereon. The other layer, in contact with the first layer, has high release fluid retention capabilities for supplying the first layer with fluid. Various types of wicks have been devised to meter the release fluid onto the surface of the fuser roller.

US-A-3 745 972 describes a fusing system including a heated fuser roller and a backup pressure roller. An applicator roller conveys a thin film of silicone oil from a pan to a wick. The wick includes a Teflon layer contacting the heated fuser roll and a Nomex layer contacting the applicator roll.

US-A-4 083 322 discloses a fusing system including a heated fuser

roller and a backup roller. A wick assembly comprises a Nomex layer, a wool layer, and a porous wiper pad. The wiper pad contacts the fuser roll with the Nomex roller engaging both the wiper pad and an applicator roll. The applicator roll rotates in an oil reservoir. The wool layer contacts the surface of the Nomex layer opposed to the wiper pad. Both the Nomex layer and wool layer meter oil to the wiper pad which passes oil to the fuser roll.

US-A-4 309 957 describes a wick for applying release fluids to a fuser roller. The wick includes a layer of fibrous Teflon needled into a layer of Nomex. The Teflon layer contacts the surface of the fuser roller with the Nomex layer engaging an applicator roll disposed in an oil reservoir.

US-A-4 336 766 discloses a two ply wick. One layer of the wick is relatively thick with the other layer being relatively thin. The thick layer feeds oil to the thin layer contacting the fuser roll. Both layers are made from Nomex.

The present invention is intended to provide a fluid applicator wick with good fluid applying properties and with extended working life. The invention accordingly provides a fluid applicator wick of the kind specified which is characterised in that the covering material comprises at least a first layer of fibers and a second layer of fibers with a thin, loosely woven layer of material being interposed between said first layer of fibers and said second layer of fibers with at least a portion of the fibers of said first layer of fibers and said second layer of fibers being interlocked with said layer of loosely woven material interposed therebetween.

Pursuant to another aspect of the features of the present invention, there is provided an apparatus for substantially permanently fusing a toner image to a sheet. A backup roll is operatively associated with a fuser roll to define a nip through which the sheet with the unfused toner powder image thereon passes to fuse the toner image to the sheet. A wick meters oil onto the fuser roll from the oil reservoir. The wick has an oil retaining material in communication with an oil reservoir. The covering material has one surface thereof contacting at least one surface of the oil retaining material with the other surface thereof contacting the fuser roll to meter oil thereon. The covering material has at least a first layer of

fibers and a second layer of fibers with a thin loosely woven layer of material interposed therebetween. At least a portion of the fibers of the first layer and the second layer are interlocked with the layer of loosely wovern material interposed therebetween.

Other aspects of the present invention will become apparent as the following description proceeds and upon reference to the drawings, in which:

Figure 1 is a schematic, elevational view depicting a fusing apparatus incorporating the features of the present invention therein;

Figure 2 is an enlarged, fragmentary, sectional elevational view showing the fluid applicator wick used in the Figure 1 fusing system; and

Figure 3 is an enlarged, fragmentary, sectional elevational view illustrating the cover of the Figure 2 applicator wick.

Inasmuch as the art of electrophotographic printing is well known, the various processing stations employed in the printing machine and their operation will be described briefly hereinafter.

An exemplary electrophotographic printing machine includes a belt have a photoconductive surface deposited on a conductive substrate. The belt advances successive portions of the photoconductive surface to various processing stations disposed about the path of movement thereof. Initially, a portion of the belt passes through a charging station. At the charging station, a corona generating device charges the photoconductive surface of the belt to a relatively high, substantially uniform potential. Thereafter, the charged portion of the photoconductive surface is advanced through the imaging station. At the imaging station, an original document is positioned on a transparent platen. Lamps flash light rays onto the original document. The light rays reflected from the original document are transmitted through a lens forming a light image thereof. The lens focuses the light image onto the charged portion of the photoconductive surface to selectively dissipate the charge thereon. This records an electrostatic latent image on the photoconductive surface which corresponds to the informational areas contained within the original document disposed upon the platen. Thereafter, the belt advances the electrostatic latent image recorded on the photoconductive surface to a development station. At the development station, a magnetic brush development system transports the

developer mixture of carrier granules and toner particles into contact with the electrostatic image recorded on the photoconductive surface. The toner particles are attracted from the carrier granules to the electrostatic latent image forming a toner powder image on the photconductive surface of the belt. After development, the toner powder image is advanced to a transfer station. At the transfer station, a copy sheet is moved into contact with the toner powder image. A corona generating device sprays ions onto the backside of the copy sheet to attract the toner powder image thereto. After transfer, the copy sheet advances to the fusing station. At the fusing station, the copy sheet passes between a heater fuser foll and a backup roll with the toner powder image contacting the heated fuser roll. In this manner, the toner powder image is permanently fused to a copy sheet. The detailed structure of the fusing apparatus employed in the fusing station will be described hereinafter with reference to Figures 1 through 3, inclusive. After exiting the fusing station, the copy sheet advances to a catch tray where the operator removes the completed copy therefrom.

For a general understanding of the features of the present invention, reference is made to Figures 1 through 3, inclusive, of the drawings. In the drawings like reference numerals have been used throughout to designate identical elements. Figure 1 schematically depicts the fusing apparatus of the present invention. It will become evident from the following discussion that this fusing apparatus is equally well suited for use in a wide variety of printing machines, and is not necessarily limited in its application to the particular embodiment depicted.

Referring now to Figure 1 of the drawings, the fusing apparatus includes a heated fuser roll, indicated generally by the reference numeral 10, and a backup roller, indicated generally by the reference numeral 12. A temperature sensor 14 contacts the exterior circumstantial surface of fuser roller 10. Preferably, temperature sensor 14 is a thermistor wherein the resistance thereof varies as a function of the detected temperature. The output signal from temperature sensor 14 is a voltage. Fuser roller 10 is composed of a hollow tube 16 having a thin covering 18 thereon. A heat source 20 is disposed interiorly of tube 16. Tube 16 is made from a metal material having the desired heat

conductivity characteristics. By way of example, aluminum, copper and other metals having a high thermal conductivity are suitable for use as a tube. Preferably, covering layer 18 is made from silicone rubber. Heating element 20 is preferably a halogen lamp. Lamp 20 is connected to sensor 14 through a controller. Backup roller 12 has a relatively thick layer of silicone rubber 22 on metal tube 24. Backup roller 12 is mounted rotatably on bracket 26. Bracket 26 is actuated by a controller to pivot so as to press backup roller 12 into contact with fuser roller 10 to define a nip therebetween through which the copy sheet passes. Switch 28 detects the presence or absence of the copy sheet in the fusing apparatus and indicates the status thereof to the controller. Rollers 10 and 12 remain spaced from each other whenever fusing is not occurring. When fusing is occurring, roller 12 pivots so as to press against fuser roller 10. Backup roller 12 and fuser roller 10 are adapted to rotate during the fusing operation so as to advance the copy sheet therethrough. Heat source 20, which may be a halogen lamp, or infared lamp, amongst others, is located internally of fuser roller 10. A lubricating assembly, indicated generally by the reference numeral 32, applies a thin film of silicone oil to silicone layer 18 of fuser roll 10 to prevent offsetting of toner particles thereto. Lubricating assembly 32 includes a fluid applicator wick, indicated generally by the reference numeral 34, having a portion thereof in oil reservoir 36 for receiving silicone oil therefrom. Fluid applicator wick 34 includes a covered material 46 contacting a fluid retaining material 48. The covering material has one surface thereof engaging fuser roll 10 and is adapted to meter silicone oil thereon. Preferably, the covering material of the fluid applicator wick has low friction and good wear properties with little tendency to accumulate molten toner, as well as thermal stability at elevated temperatures. Frame 44 holds both fluid retaining material 48 and covering material 46 of fluid applicator wick 34 in their operative positions. Inasmuch as covering material 46 is exposed to dirt, accumulation, and wear, it is designed to be a replaceable component. It has been found that a limiting factor in the life of the covering material is the degredation and wear that occurs from contact with the rotating fuser roll. As the covering material wears, fibers are pulled from the surface thereof accumulating on the backup roller and downstream copy sheets.

Ultimately, this wear of the covering material can result in an accumulation of a fluff of material extending from the surface thereof and sometimes protruding into the entrance path of the copy sheet. To extend the life of the covering material, it is necessary to eliminate these wear problems.

Turning now to figure 2, there is shown an enlarged, fragmentary, sectional elevational view of fluid applicator wick 34. Fluid applicating wick 34 has covering material 46 contacting fluid retaining material 48. Covering material 46 is a composite material and will be described hereinafter, in greater detail, with reference to Figure 3. By way of example, fluid retaining material 48 may be made from polyester, Teflon, or Nomex. Teflon and Nomex are trademarks of E. I. du Pont de Nemours and Company of Wilmington, Delaware. Nomex is an aramid, i.e. a highly aromatic polyamide fiber, such as a copolymer of meta-phenylenediamine and isophaloyd chloride. One skilled in the art will appreciate that any other suitable material may be employed which retains oil therein in the desired amount.

Referring now to Figure 3, there is shown the detailed structure of covering material 46. Covering material 46 includes three relatively thick layers of fiber batts 50, 52, and 54 with a thin, loosely woven gauze-like cloth 56 and 58 interposed between each layer of fiber batts. Thin loosely woven cloth 56 and 58 is known as a scrim. Fiber batt layer 50 and fiber batt layer 52 have a thin gauze-like layer of loosely woven cloth 56 interposed therebetween. Similarly, fiber batt layer 52 and fiber batt layer 54 have a thin gauze-like layer of loosely woven cloth 58 interposed therebetween. After each of the layers are assembled in juxposition with one another, the entire covering material is needle punched. The fibers of the layers of fiber batts are interlocked with the fibers of the loosely woven layer of cloth interposed therebetween. A typical prior art needling apparatus is disclosed in U.S. Patent Number 3,112,552 issued to Smith II on December 3, 1963. The needling apparatus described therein includes a plurality of barbed needles which are adapted to penetrate the composite covering material and then be withdrawn therefrom. The barbed needles are designed to alternately lift and press the fibers between the layers so as to entangle them with one another.

Thus,the barbed needles cause the fibers of fiber batt layers 50 and 52 to be interlocked with the thin, loosely woven cloth layer 56 interposed therebetween. Similarly, the needling operation also causes the fibers of fiber batts 52 and 54 to be interlocked with loosely woven cloth 58 interposed therebetween. Fiber batt layers 50, 52 and 54 may be made from any suitable synthetic materials including a polyester, Teflon, i.e. polytetrafluorethylene, Nomex or natural fibers, such as wool, or any other fiber or blends thereof which are suitable for metering silicone oil. Similarly, the scrim, i.e. the loosely woven gauze-like layers of cloth 56 and 58 interposed between fiber batts 50 and 52, and 52 and 54, respectively, may also be made from any suitable synthetic fibers including polyester, Teflon, i.e. polytetrafluorethylene, or Nomex or natural fibers, such as wool, or any other fibers or blends thereof. It has been found that the covering material of the present invention meters precise quantities of silicone oil from the fluid retaining material to the fuser roll while having significantly improved wear resistance and extended life. A covering material, having the layers of fiber batts and the thin loosely woven cloth layers interposed therebetween made from Nomex, is believed to have a life of approximately two times that of the conventional covering material, i.e. of about 250,000 copies when used in an electrophotographic printing machine.

In recapitulation, it is clear that the improved covering material has a plurality of layers of fiber batts with a thin, loosely woven gauze-like cloth layer interposed between the layers of fiber batts with the fibers of the fiber batt layers being interlocked with the thin loosely woven cloth interposed therebetween by a needling process. A covering material made in the foregoing manner has significantly reduced wear than covering materials hereinbefore employed.

CLAIMS:

1. A fluid applicator wick (34), including:

a fluid retaining material (48); and

a covering material (46) disposed in contact with at least one surface of said fluid retaining material,

characterised in that the covering material comprises at least a first layer (50) of fibers and a second layer (52) of fibers with a thin, loosely woven layer (56) of material being interposed between said first layer of fibers and said second layer of fibers with at least a portion of the fibers of said first layer of fibers and said second layer of fibers being interlocked with said layer of loosely woven material interposed therebetween.

2. A wick according to claim 1, wherein said first layer (50) of fibers includes polyester, polytetrafluorethylene, aramid or wool fibers.

3. A wick according to claim 1 or claim 2, wherein said second layer (52) of fibers includes polyester, polytetrafluorethylene, aramid or wool fibers.

4. A wick according to any one of claims 1 to 3, wherein said layer (56) of loosely woven material includes polyester, polytetrafluorethylene, aramid or wool fibers.

5. A wick according to any one of claims 1 to 4, wherein at least some of the fibers of said first layer (50) of fibers and said second layer (52) of fibers are interlocked with said layer (56) of loosely woven material by the process of needling.

6. A wick according to any one of claims 1 to 5, further including:

a third layer (54) of fibers; and

a second layer (58) of thin, loosely woven material interposed between said second layer (52) of fibers and said third layer (54) of fibers with at least a portion of the fibers of said second layer of fibers and said

third layer of fibers being interlocked with said second layer of loosely woven material interposed therebetween.

7. A wick according to claim 6, wherein said third layer (54) of fibers includes polyester, polytetrafluorethylene, aramid or wool fibers.

8. A wick according to claim 6 or claim 7, wherein said second layer (58) of loosely woven material includes polyester, polytetrafluorethylene, aramid or wool fibers.

9. A wick according to any one of claims 6 to 8, wherein at least some of the fibers of said second layer (52) of fibers and said third layer (54) of fibers are interlocked with said second layer (58) of loosely woven material by the process of needling.

10. An apparatus for substantially permanently fusing a toner image to a sheet, including:

a fuser roll (10);

a back-up roll (12) operatively associated with said fuser roll to define a nip through which the sheet with the unfused toner image thereon passes to fuse the toner image to the sheet;

an oil reservoir (36); and

a fluid applicator wick (34) according to any one of claims 1 to 9, the wick being arranged to meter oil onto said fuser roll (10), the fluid retaining material (48) being in communication with said oil reservoir (36), and the covering material (46) having one surface thereof in contact with said fuser roll to meter oil thereon.

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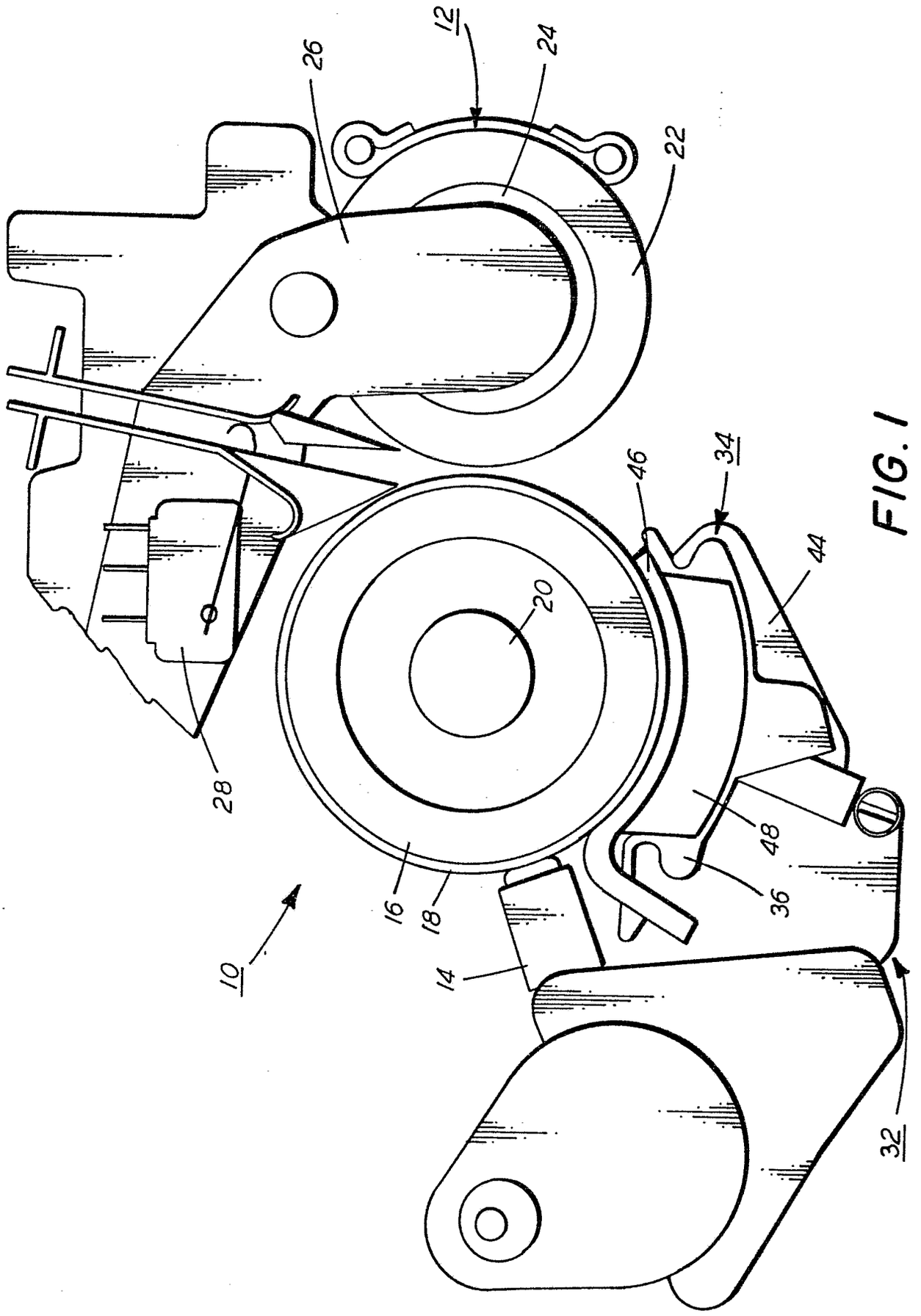


FIG. 1

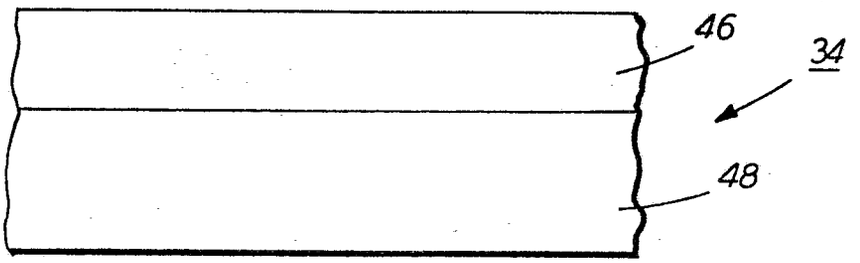


FIG. 2

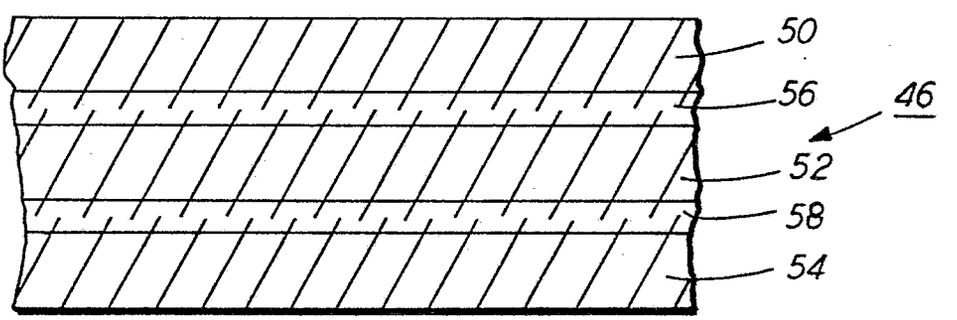


FIG. 3

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# EUROPEAN SEARCH REPORT

0165719 Application number

EP 85 30 3619

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int Cl 4) |
|---|---|---|---|
| Y | US-A-4 407 219 (DELLEVOET) * Column 4, lines 29-40; figures 1,2 * | 1-5,10 | G 03 G 15/20 |
| D,Y | US-A-4 309 957 (SWIFT) * Column 7, line 62 - column 8, line 55; figures 1,4 * | 1-5,10 | |
| A | XEROX DISCLOSURE JOURNAL, vol. 4, no. 2, March/April 1979, page 165, Stamford, US; J.A. SWIFT: "Wick for dispensing fuser oil" * Whole document * | | |
| A | XEROX DISCLOSURE JOURNAL, vol. 8, no. 3, May/June 1983, page 241, Stamford, US; T.F. SZLUCHA: "Fabric wick cover" * Page 241, lines 9-12 * | 1,5,6, 9 | TECHNICAL FIELDS SEARCHED (Int. Cl.4) |
| D,A | US-A-4 336 766 (MAHER et al.) * Figure 2 * | 1 | G 03 G 15<br>B 05 C 1 |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 27-08-1985 | CIGOJ P.M. |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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P : intermediate document

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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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