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Regulation 3.1(2)

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NOTICE OF ENTITLEMENT

We **W.L. GORE & ASSOCIATES (UK) LTD.**

of **1 Bell Yard, LONDON WC2A 2JP, ENGLAND**

being the Applicant and Nominated Person in respect of Australian Patent Application No. 28096/92 state the following:

Robert Hayhurst; Andrew Miller Allan and Keith Dawson are the actual inventors of the invention the subject of the Application.

The inventors made the invention for and on behalf of the applicant and nominated person in the course of their duties as employees of the applicant.

W.L. GORE & ASSOCIATES (UK) LTD. is the applicant of the basic application listed in the declaration under Article 8 of the PCT.

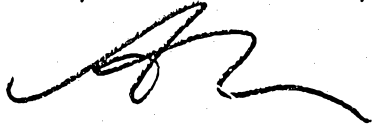
Convention priority is claimed from the following basic application referred to in the declaration under Article 8 of the PCT.

Basic Applicant	Application Number	Application Date	Country	Country Code
W.L. GORE & ASSOCIATES (UK) LTD.	**9122750**	**26 October 1991**	**GREAT BRITAIN**	**GB**

The basic application referred to in the declaration under Article 8 of the PCT was the first application made in a Convention country in respect of the invention the subject of the application.

DATED this 3rd day of May 1995

W.L. GORE & ASSOCIATES (UK) LTD.
By their Patent Attorney



GRIFFITH HACK & CO

OUR REF: P22321B/ADK:em

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(54) Title
OIL TRANSFER COMPONENT

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(74) Attorney or Agent
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(56) Prior Art Documents
EP 450894
EP 137129

(57) Claim

1. An oil transfer component for coating or wiping a roll in a fuser system of a copying machine, which comprises;

a porous polytetrafluoroethylene (PTFE) structure formed from particles of granular-type polytetrafluoroethylene fused together such as to form a porous integral network of interconnected particles.

18. A method of coating or wiping a roll in a fuser system of a copying machine which comprises;

- providing a porous polytetrafluoroethylene (PTFE) structure formed from particles of granular-type polytetrafluoroethylene fused together such as to form a porous integral network of interconnected particles;

.../2

- arranging the porous PTFE structure to be in contact with the roll in said copier fuser system; and

- operating the copying machine such that the porous PTFE structure is effective in coating the roll with oil and/or wiping off excess oil from the roll.

OPI DATE 21/05/93 APPLN. ID 28096/92
AOJP DATE 22/07/93 PCT NUMBER PCT/GB92/01958

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(30) Priority data:
9122750.4 26 October 1991 (26.10.91) GB

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(72) Inventors; and

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(74) Agents: HORNER, Martin, Grenville et al.; Cruikshank & Fairweather, 19 Royal Exchange Square, Glasgow G1 3AE (GB).

(81) Designated States: AU, CA, JP, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, SE).

Published
With international search report.

(54) Title: OIL TRANSFER COMPONENT

(57) Abstract

An oil transfer component for coating a fuser roll (2) in the fuser system of a plain paper copier (or laser printer) employs a porous polytetrafluoroethylene (PTFE) material formed from particles of granular-type polytetrafluoroethylene fused together such as to form a porous integral network of interconnected particles. It is usually in the form of a thin sheet of thickness 50-750 microns, optionally laminated to a backing material. It may be in roll form (6), either dry or pre-loaded with release oil, as a cover wick (20) for an oil reservoir (26), or laminated to a roller (30) or a reservoir material (40). The surface is textured to improve coating and wiping.

OIL TRANSFER COMPONENT

FIELD OF THE INVENTION

The present invention relates to the use of a porous polytetrafluoroethylene structure as an oil transfer component for oiling and/or wiping a fuser roll in a copying machine, which term includes plain paper copying and fax machines and laser printers.

PRIOR ART

In a plain-paper copying machine, toner images applied to the surface of paper or other recording medium are fixated by application of heat and pressure. In certain plain paper copying machines fixation is accomplished by passing the image-bearing recording medium between a hot thermal fixation roll and a pressure roll. When this type of thermal fixation device is used the toner material is directly contacted by a roll surface, and a portion of the toner usually becomes adhered to the roll surface. On subsequent rotation of the roll, the adhered toner material may be redeposited on the recording medium resulting in undesirable offset images, stains, or smears; or in severe cases the recording medium may stick to the adhered toner material on the roll and become wrapped around the roll.

To counter these problems, materials having good release properties such as silicone rubber or

polytetrafluoroethylene are often used for the roll surfaces. Although improving performance of the thermal fixation devices, use of silicone rubber or polytetrafluoroethylene roll surfaces alone does not eliminate the problem. Another approach is to include release agents with the toner materials, which prevent the toner materials from adhering to the roll surface. These oil-less toners improve the performance of the thermal-fixation devices but again, particularly in the case of high-speed type copying machines, do not completely eliminate the problems associated with toner pick-up and transfer.

Toner pick-up by the rolls can be controlled by coating the surface of at least one of the rolls with a liquid release agent, such as a silicone oil. It is important that the release liquid be applied uniformly and in precise quantities to the surface of the roll. Too little liquid or non-uniform surface coverage, will not prevent the toner from being picked up and redeposited on the roll. On the other hand, excessive quantities of the release liquid may cause silicone rubber roll surfaces to swell and wrinkle, thus producing copies of unacceptable quality.

Devices to uniformly meter and coat a release liquid onto copy machine roll surfaces are described in Japanese laid-open patent No. 62-178992. These devices consist of an oil permeation control layer adhered to a thick porous

material which serves as a wick or reservoir for supplying oil to the permeation control layer. The permeation control layer is typically a porous polytetrafluoroethylene film which has been impregnated with a mixture of silicone oil and silicone rubber followed by a heat treatment to cross-link the silicone rubber. The thick porous material to which the permeation control layer is adhered is typically a porous thermosetting resin foam or a felt of Nomex (Trademark) fibres, glass fibres, carbon fibres, polytetrafluoroethylene fibres, or any other high temperature fibre. Fibres sold under the Nomex trademark are aramid fibres, a type of polyamide.

Conventional plain paper copiers which use silicone oil as the liquid release agent generally comprise a means for coating the silicone oil onto the fuser roll and also a means for wiping the roll to remove undesirable adhered toner, paper dust and other undesirable material. In many cases, the coating and wiping functions are performed by a single device. In one particular type of machine, there is provided a reservoir wick which is generally formed of a Nomex felt, with a cover wick placed over the top of it for metering the flow of oil from the reservoir wick to the fuser roll and also for providing improved wear and distribution characteristics. The cover wick is typically a Nomex fabric. It is found, however, that the cover wick has only a limited lifetime, typically lasting for around 60,000 copies before requiring replacement.

It would be desirable to have a cover wick which lasts as long as the life of the fuser rollers.

In another commonly used type of copying machine, the oil coating and wiping function is provided by a length of felt, typically formed of Nomex or polytetrafluoroethylene fibres. The roll is typically 435 millimetres wide by 1.4 metres long. Whilst the machine is copying, the roll, which is laden with silicone oil, travels past the fuser roll at a speed of about 2cm per hour. This oiling roll applies silicone oil. Also excess toner cleaned from the fuser roll is picked up and carried away on the oiling roll. Typically, the felt of the oiling roll has a weight of 700 grammes per square metre and a thickness of 1.3 milimetres. Due to the physical restraints of the copying machine, this limits the length of material on the oiling roll to about 1.4 metres. It is generally speaking not possible to make satisfactory felts which are lighter than 700 grammes per square metre for this purpose. In practise, it is therefore necessary to replace the oiling roll about every 10 days of operation.

British published patent application 2242431 (9106768.6) discloses a porous polytetrafluoroethylene structure for use as a filter in industrial filtration. The porous polytetrafluoroethylene material is produced by fusing particles of polytetrafluoroethylene such as to form a porous integral network of interconnected particles. The disclosure of this patent specification is

incorporated herein. The specification is particularly concerned with the filtration of aqueous slurries.

It is an object of the present invention to provide an oil transfer component having suitable oil retention characteristics and enhanced mechanical properties which allows a longer lifetime between changes.

SUMMARY OF THE INVENTION

Generally speaking, the present invention envisages the use of a porous polytetrafluoroethylene material such as disclosed in GB 2242431 for use as an oil transfer component for coating or wiping a fuser roll in a copying machine. The material is able to withstand the high temperatures (around 200°C) encountered and has excellent mechanical properties and durability in this application.

Specifically, one aspect of the invention provides an oil transfer component for coating or wiping a fuser roll in a copying machine which comprises a porous polytetrafluoroethylene structure formed from particles of granular-type polytetrafluoroethylene fused together such as to form a porous integral network of interconnected particles.

In order to act as an oil transfer component, the porous polytetrafluoroethylene (PTFE) structure will generally include a support means for supporting the structure within the copying machine. In the case of a cover wick, the support means may be in the form of a

frame or pair of parallel rods extending along either side of the cover wick strip. Alternatively, the porous polytetrafluoroethylene structure may be laminated to a reservoir material acting as a support structure. The porous polytetrafluoroethylene structure may also be provided in the form of a roll or may be applied onto a roller formed of an oil reservoir material (such as a foam as disclosed in Japanese 62-178992 or a porous ceramic) which is optionally covered by a felt cover. Generally, the porous polytetrafluoroethylene structure is in the form of a sheet material, typically of a thickness in the range 50 microns to 750 microns, particularly 100 to 400 microns, and especially 200 to 500 microns.

The porous polytetrafluoroethylene structure is hydrophobic but has a high affinity for liquid release agents such as silicone oil. Where the oil transfer component is to be used for coating the fuser roll, it will generally be supplied pre-loaded with release oil. Typically, the oil will constitute 20 to 80% by weight of the total weight of the oil transfer component, particularly 40 to 60% by weight. In order to provide such oil retention capacities, the porous polytetrafluoroethylene structure usually has a specific gravity of 0.8 to 1.8, typically 0.9 to 1.2. In comparison, pure non-porous PTFE typically has a specific gravity of 2.16.

Preferably, the porous polytetrafluoroethylene

structure does not include any filler materials, since these are generally of mineral origin and tend to be of an abrasive nature which would damage the fuser rolls.

In order to improve the wiping abilities of the oil transfer component, it is preferred that the porous polytetrafluoroethylene structure have a slightly uneven surface texture. This surface texture can be obtained by spraying onto a smooth substrate in order to produce the porous PTFE structure. After spraying and heat treating, the porous PTFE may be peeled from the substrate to yield a sheet material which is smooth on the side which was adjacent the substrate and textured on the other side as a result of the spray technique. In use the textured surface is placed adjacent the photocopier roll.

The surface texture could also be provided by spraying onto a substrate carrying an embossed pattern of ridges, valleys, indentations, protrusions etc. such that the textured surface is provided on the side of the sheet facing the substrate.

Other methods could also be used to provide a surface texture on the porous PTFE structure, such as by pulsing the laydown of the material, e.g. by using a vibrating doctor-blade. Alternatively, the surface of the PTFE could be mechanically embossed e.g. by passage through the nip of embossing rollers.

In another embodiment, the texture is provided by applying a fabric of suitable material (e.g. a Nomex

fabric) over the PTFE surface.

The surface texture acts to scrape unused material off the surface of the copier roll and to carry it away in the depressions in the textured surface pattern.
The porous polytetrafluoroethylene structure of the present invention provides excellent wear characteristics in comparison to conventional materials and does not shed fibres. In the case of an oiling roll, the porous polytetrafluoroethylene structure can be provided much thinner than conventional felts, which allows much longer lengths to be used, whilst maintaining the same oiling and wiping characteristics. There is also reduced frictional drag on the rollers.

The porous polytetrafluoroethylene structure may be produced as described in patent specification GB 2242431. It is particularly preferred to form the structure from a mixture of particles of different grades of granular-type polytetrafluoroethylene. As is well known, PTFE is produced in two distinct types so-called "granular PTFE" and so-called "fine powder PTFE". These materials have quite different properties and the present invention is concerned with the former. A particularly useful product for use in the present invention comprises 40 to 60% of Teflon (Trademark) resin grade 7A; and 40 to 60% of Teflon resin grade 9B. Teflon resin grades 7A and 9B are available from Du Pont Speciality Polymers Division, Wilmington, U.S.A. The porous polytetrafluoroethylene

structure is usually prepared by spraying onto a substrate, such as a ceramic tile or sheet of metal.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Embodiments of the present invention will now be described by way of example only.

The attached Figures show schematically various conventional fuser roll arrangements as used in photocopying machines, fitted with oil transfer components according to the present invention.

Figure 1 shows a conventional PTFE-covered fuser roll 2 and a silicone rubber covered roll 4, which are oiled and wiped by an oil-containing oiling roll or web 6 of porous PTFE wound on a spool 8, which passes around pressure rollers 10, 12 onto take-up spool 14.

Figure 2 shows a similar arrangement, except that oil is applied to the porous PTFE oiling roll or web by means of an oil supply mechanism 16.

Figure 3 shows a conventional PTFE covered fuser roll 2 and silicone rubber covered roll 4 to which silicone oil is applied by oil supply mechanism 16, reservoir wick 26, and cover wick 20. The cover wick is formed of porous PTFE and is supported on a pair of rods 22, 24.

Figure 4 shows use of a roller 30 to deliver oil onto the conventional PTFE-covered fuser roller 2. Alternatively, it may contact the silicone rubber covered roller 4. The roller has a porous PTFE covering. The

roller may be pre-oiled, or oil may be supplied into the centre of the roller by an oil supply mechanism.

Figure 5 shows a laser printer arrangement. An oil-containing felt 40 in channel 42 applies oil to a conventional PTFE-covered fuser roll 2. The felt has a porous PTFE covering laminated thereto. Specific Examples of the invention will now be described.

Example 1 (Cover Wick)

(1) An oiling assembly for the fuser rolls in a conventional Kodak Ektoprint 850 photocopier comprises a reservoir formed of 1600 gms per square metre Nomex felt of thickness approximately 16mm, and a cover wick comprising a Nomex felt of 400 gms per square metre fitted with side bars for locating the cover wick against the fuser roll (i.e. in the manner of Figure 3).

(a) The cover wick was removed and a strip of porous polytetrafluoroethylene sheet material of thickness 380 microns, porosity approximately 50% and density 1 gm per c.c. adhered to the side bars across the Nomex felt, such as to contact the fuser roller in use. The porous polytetrafluoroethylene material comprise 50% Teflon grade 7A and 50% Teflon grade 9B produced according to Example 1 of patent specification GB2242437. The Kodak Ektoprint 850 photocopying machine was run continuously for seven days before the machine was stopped and the cover wick inspected. In that period, about 120,000 copies had been

produced. When the wick was inspected, there was no damage to the porous polytetrafluoroethylene sheet and no fibre shed. Thereafter the machine continued to run and produced a total of about 300,000 copies before the PTFE cover wick failed mechanically by tearing at the side bars. A conventional wick usually lasts for 160-220,000 copies.

(b) In a further test, the conventional cover wick was replaced by the same porous PTFE material, but in this case the porous PTFE sheet was adhered using a gravure printed polyimide adhesive (Mitsubishi A310) pattern to a woven glassfibre fabric. The polyimide adhesive is capable of withstanding temperatures of 180-200°C. The photocopier produced 1,000,000 copies before the cover wick failed.

(2) A further trial was carried out using a Xerox 5046 photocopier in which a porous PTFE sheet as described above was adhered to a woven Nomex Scrim to produce a cover wick. The adhesive was a polyimide adhesive (Mitsubishi A310) in a gravure printed pattern. The cover wick was still intact when changed together with the fuser roller after having made 350,000 copies. A conventional woven Nomex cover wick is usually capable of producing 60,000 copies only.

Example 2 (Oiling Roll)

A conventional Siemens ND2 photocopying machine

comprises an oil-containing oiling roll which oils the fuser roll with silicone oil and also wipes it clean (in the manner of Figure 1). The conventional roll is formed of 700 gms per square metre PTFE felt, of thickness 1.3 mm, 435 mm wide and 1.4 metres long. The felt is wound on bakelite spools and the roll has an overall diameter of approximately 63 mm., which represents the maximum allowed according to the photocopying machine construction. The oiling roll is advanced at a rate of 2 cm per hour of copying operation, which delivers 1.06 grams/hour to the fuser roll. Typically, the roll requires to be changed three times a month.

According to the invention, the conventional roll was replaced by a roll of porous polytetrafluoroethylene material (of composition given in Example 1) having the same width. The porous polytetrafluoroethylene material had a thickness of 375 microns, a weight of 375 gram/m^2, and a length of 4.2 metres for the same 63 mm diameter roll. This is three times as long as the conventional roll. The oiling roll was advanced at 2 cm per hour of copying operation. The roll contained 0.8 grams/cc of silicone oil and provided 1.6 grams/hour to the fuser roller.

In the tests, the porous polytetrafluoroethylene material transferred oil well and wiped well and produced prints of consistently high quality. There was no apparent wear nor shedding of material. It is therefore

possible to obtain at least three times the lifetime from an oil retention roll of the present invention (up to 30 days of operation) as opposed to the conventional material.

Example 3 (thin oiling web)

Certain Cannon, Xerox, Minolta and Konica photocopiers use a thin web of Nomex and polyester having a weight of 25-35 grams/m^2 and a thickness of 0.060 - 0.080 mm (in the manner of Figure 1). A length of 10 - 13 m of the web is wound onto a metal core (roll diameter 31.5mm) and impregnated with an average of 31 grams/m^2 of silicone oil. The web is advanced at about 2mm per minute of copier operation, delivering 0.018 grams/min of oil to the fuser roll.

(a) According to the invention, the standard web may be replaced by a shorter length of porous polytetrafluoroethylene film of the composition of Example 1. The film has a weight of 125 grams/m^2 and a thickness of 0.125 mm. The final diameter of the roll (31.5mm) allows 7.2m of film to be wound onto the core. The film holds twice as much oil as the conventional web, and is therefore advanced at half the speed i.e. 1mm/min. This provides an increased lifetime for the film of 120 hours, compared to a lifetime of 96 hours for the conventional web. The film also has better oil retention properties, eliminating any oil drops; and gives good toner and paper

dust adsorption. Higher fusing temperatures may be used, and there is reduced frictional drag.

(b) In another embodiment of the invention, the standard thin web in a Xerox photocopier was replaced by a PTFE film of composition as in Example 1. The thickness was 0.13mm. Its lifetime was found to be about four times as long as that of the conventional web.

(c) In another embodiment, a conventional web of layers of polyester and Nomex in a Siemens ND2 photocopying machine was replaced by a sheet of PTFE as in Example 1 having a layer of woven Nomex fabric bonded to the front face thereof (i.e. the face in contact with the fuser roll). The material performed well and had a lifetime at least three times as long as the conventional web.

Example 4 (Laser Printers)

Conventional laser printers use as the oil supply and wiping mechanism a square section length of Nomex felt, typically 2 cm x 2 cm x 40 cm (see Figure 5). Such Nomex felts conventionally suffer from fibre shed and may run dry through lack of oil towards the end of their working life.

An oil transfer component according to the present invention was produced by laminating a surface sheet of porous polytetrafluoroethylene as used in Example 1 over the surface of the Nomex felt. The life of the component

was 250,000 copies in comparison to 80,000 with the conventional component.

This material may also be impregnated with oil for use as a coating/wiping component on a laser printer, or may be used dry as a wiper.

CLAIMS

1. An oil transfer component for coating or wiping a roll in a fuser system of a copying machine, which comprises;
a porous polytetrafluoroethylene (PTFE) structure formed from particles of granular-type polytetrafluoroethylene fused together such as to form a porous integral network of interconnected particles.

2. A component according to claim 1 wherein the porous PTFE has a specific gravity of 0.8 to 1.8.

3. A component according to any preceding claim wherein the porous PTFE has a specific gravity of 0.9 to 1.2.

4. A component according to any preceding claim wherein the porous PTFE is substantially free of filler materials of mineral origin.

5. A component according to any preceding claim wherein the porous PTFE structure has an uneven surface texture on a surface adapted in use to contact the roll in said fuser system.

6. A component according to any preceding claim wherein the PTFE component has been produced by spray deposition.

7. A component according to any preceding claim wherein the porous PTFE structure is in the form of a sheet material.

8. A component according to claim 7 wherein the PTFE sheet material is laminated to a woven or non-woven backing fabric.

9. A component according to claim 7 or 8 wherein the PTFE sheet material has a thickness of 50 to 750 microns.

10. A component according to any preceding claim which is pre-loaded with release oil.

11. A component according to claim 10 wherein the release oil comprises 20 to 80% by weight of the component.

12. A component according to any preceding claim in the form of a roll of sheet material.

13. A component according to any of claims 1 to 11 in the form of a cover wick.

14. A component according to any of claims 1 to 11 in the form of a roller having an outer layer of said porous PTFE material.

15. A component according to any of claims 1 to 11 which comprises an oil reservoir material having laminated thereto the porous PTFE material.

16. An oil transfer component for coating or wiping a roll in a fuser system of a copying machine, which comprises;
a porous polytetrafluoroethylene (PTFE) structure formed from particles of granular-type polytetrafluoroethylene fused together such as to form a porous integral network of interconnected particles;
the porous PTFE being substantially free of filler materials of mineral origin; and the porous PTFE structure having an uneven surface texture on a surface adapted in use to contact the roll in said fuser system.

17. A copying machine which comprises an oil transfer component for coating or wiping a roll in the fuser system thereof, said oil transfer component comprising a porous polytetrafluoroethylene (PTFE) structure formed from particles of granular-type

polytetrafluoroethylene fused together such as to form a porous integral network of interconnected particles.

18. A method of coating or wiping a roll in a fuser system of a copying machine which comprises;

- providing a porous polytetrafluoroethylene (PTFE) structure formed from particles of granular-type polytetrafluoroethylene fused together such as to form a porous integral network of interconnected particles;
- arranging the porous PTFE structure to be in contact with the roll in said copier fuser system; and
- operating the copying machine such that the porous PTFE structure is effective in coating the roll with oil and/or wiping off excess oil from the roll.

19. Use of a porous polytetrafluoroethylene (PTFE) structure formed from particles of granular-type polytetrafluoroethylene fused together such as to form a porous integral network of interconnected particles for the manufacture of an oil transfer component for coating or wiping a roll in a fuser system of a copying machine.

20. An oil transfer component substantially as herein described with reference to any one of Examples 1 to 4, or Figures 1 to 5.

21. A method of coating or wiping a roll in a fuser system of a copying machine, substantially as herein described with reference to any one of Examples 1 to 4.

22. A copying machine which comprises an oil transfer component for coating or wiping a roll in the fuser system thereof, the oil transfer compound comprising a porous PTFE structure formed from particles of granular type PTFE fused together such as to form a porous integral network of interconnected particles, said copying machine being substantially as herein described with reference to any one of Examples 1 to 4.

DATED this 3rd day of May 1995
W.L. GORE & ASSOCIATES (UK) LTD.

By their Patent Attorneys
GRIFFITH HACK & CO

28096/92

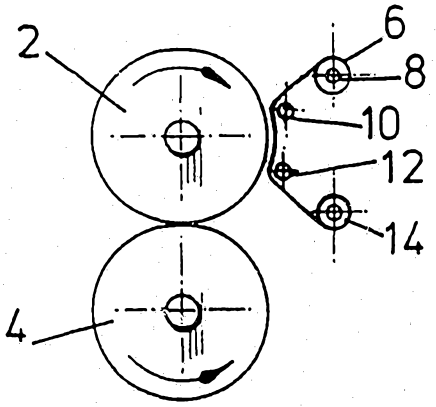

FIG.1

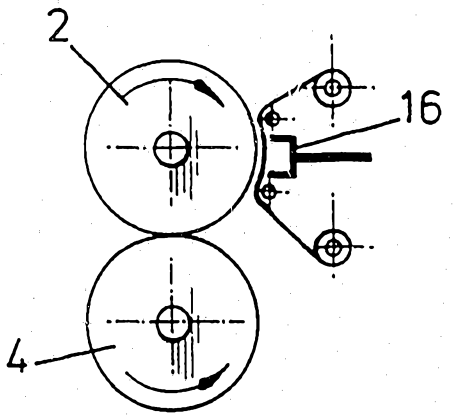

FIG.2

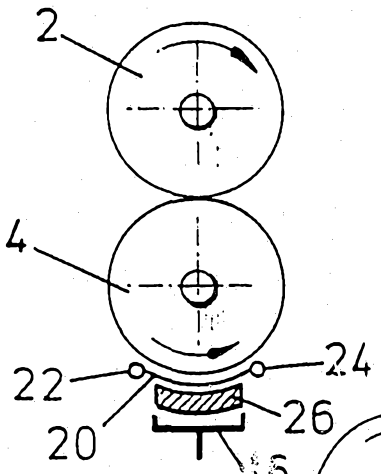

FIG.3

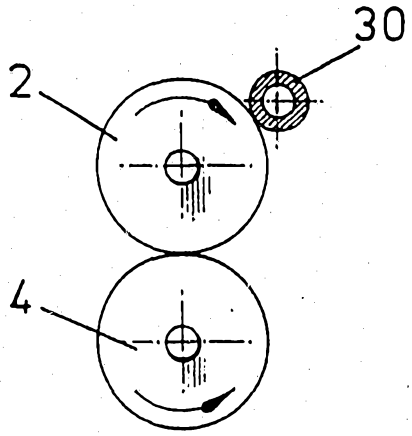

FIG.4

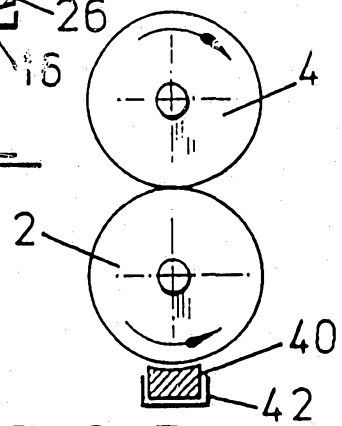

FIG.5

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 92/01958

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

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

Int.Cl. 5 G03G15/20

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	G03G ; C08J

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
Y	EP,A,0 450 894 (W.L. GORE & ASSOCIATES (UK) LTD) 9 October 1991 see claims 1-5,9 see page 3, line 31 - line 32	1-7,9, 10,16-19
Y	EP,A,0 137 129 (SUMITOMO INDUSTRIES LTD) 17 April 1985 see claim 1	1-7,9, 10,16-19
A	EP,A,0 240 834 (SIEMENS A.G.) 14 October 1987 see claims 1,3	1-6,9, 10,16-19
A	EP,A,0 183 903 (SUMITOMO) 11 June 1986 see claims 1-5	1-10,13, 15-19

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° Special categories of cited documents :[10]

"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	Date of Mailing of this International Search Report
25 JANUARY 1993	10 FEB 1993
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	VOGT C.

Form PCT/ISA/210 (second sheet) (Jan

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	EP,A,0 174 474 (SUMITOMO ELECTRIC INDUSTRIES) 19 March 1986 see claims 1,2,10 ---	1-6,9, 10,13, 15-19
A	DE,B,1 199 972 (MONTECATINI) 2 September 1965 * claim * ---	1
A	PATENT ABSTRACTS OF JAPAN vol. 14, no. 296 (P-1067)26 June 1990 & JP,A,20 91 672 (SUMITOMO ELECTRIC IND LTD) 30 March 1990 see abstract ---	1-7,12, 14
A	DATABASE WPIL Section Ch, Week 0486, Derwent Publications Ltd., London, GB; Class A04, AN 86-023696 [04] & JP,A,60 244 365 (SUMITOMO ELEC IND KK) 4 December 1985 see abstract ---	1-7,11, 16-19
A	US,A,4 047 885 (HAUMAN,JR.) 13 September 1977 -----	1,12,14, 16-19

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

GB 9201958
SA 65810

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information. 25/01/93

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A-0450894	09-10-91	None	
EP-A-0137129	17-04-85	JP-A- 60021079	02-02-85
		DE-A- 3474868	01-12-88
		US-A- 4633805	06-01-87
EP-A-0240834	14-10-87	None	
EP-A-0183903	11-06-86	JP-A- 61004090	09-01-86
		US-A- 4668537	26-05-87
EP-A-0174474	19-03-86	JP-A- 61061663	29-03-86
DE-B-1199972		None	
US-A-4047885	13-09-77	None	