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(71) Applicants and
(72) Inventors: **KATZ, Amiram** [US/US]; 15 Beaver Brook Road, Weston, CT 06883 (US). **KATZ, Orly** [IL/US]; 15 Beaver Brook Road, Weston, CT 06883 (US).

(74) Agent: **FATTIBENE, Paul, A.**; Fattibene and Fattibene, 2480 Post Road, Southport, CT 06490 (US).

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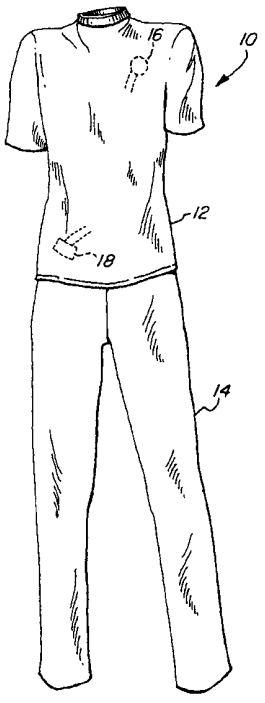
(54) Title: PROTECTIVE GEAR FOR INDIVIDUALS WITH IMPLANTED ELECTRONIC DEVICES AND OTHERS EXPOSED TO HAZARDOUS ELECTROMAGNETIC RADIATION



(57) Abstract: An electromagnetic field shielding garment (10) easily worn for everyday use by an individual for protecting the individual from environmental electromagnetic fields generated by electronic devices encountered daily, such as high voltage wires, anti-theft devices, electrical appliances, and numerous other sources. The electromagnetic field shielding garment (10) is particularly applicable to individuals having implanted electronic medical devices (16, 18) which may be caused to malfunction in environmental electromagnetic fields. The electromagnetic field shielding garment (10) may also prevent any potential harmful effects of long-term exposure to electromagnetic fields. The electromagnetic field shielding garment (10) may be made from a variety of different fabric structures that are easily worked with to make a variety of garments which are comfortable to wear.

WO 01/37286 A1

PROTECTIVE GEAR FOR INDIVIDUALS WITH IMPLANTED ELECTRONIC DEVICES AND OTHERS EXPOSED TO HAZARDOUS ELECTROMAGNETIC RADIATION

FIELD OF THE INVENTION

The present invention relates to protection of individuals from electromagnetic radiation, and particularly to a shielding garment for protecting individuals with implanted electronic devices and other individuals exposed to potentially hazardous electromagnetic radiation.

BACKGROUND OF THE INVENTION

With the increasing use of electronic devices and higher powered distribution systems used in densely populated areas, individuals are often exposed to environmental electromagnetic radiation or fields. With the increasing environmental electromagnetic radiation or fields and the increasing exposure of individuals, there is a risk of harm. There is some evidence that exposure to high doses of electromagnetic radiation or fields originating from such sources as high voltage lines, cellular phones, electric blankets, kitchen appliances, and other electrical devices is potentially dangerous. Environmental electromagnetic fields are particularly dangerous to those individuals having

implanted electronic medical devices, such as cardiac pacemakers and defibrillators; spinal cord stimulators and epidural pumps, used for chronic pain and spasticity management; vagal nerve stimulators, used for seizure control; deep brain stimulators, used for control of movement disorders; insulin pumps, used for diabetes control; and other implantable electronic medical devices. Many of these implanted medical devices are susceptible to electromagnetic radiation or electromagnetic fields produced by electronic devices such as anti-theft surveillance devices, which are widely used in stores, libraries and other locations. Several studies have reported life threatening conditions in individuals having implanted electronic medical devices, due to exposure of theft deterrent devices generating electromagnetic fields. Additionally, many jobs require individuals to be near and around electrically operated equipment generating large amounts of electromagnetic radiation and fields. These job locations generally exceed electromagnetic radiation or field exposure levels indicated as allowable by different organizations.

There have been prior efforts to form an electromagnetic shielding garment. For example, U.S. Patent 5,578,359 entitled "Magnetic Shielding Garment For Electro-Biologic Measurements" issuing to Forbes et al on November 26, 1996. Therein disclosed is an electromagnetic shielding garment comprised of amorphous alloy strips or strands woven

together. The garment is used to shield a patient from extraneous electromagnetic radiation to allow sensitive medical measurements to be taken with minimal interference. While this garment is effective for shielding extraneous electromagnetic radiation during sensitive medical measurements, it is not suitable or practical and could not be worn comfortably everyday by an individual as a shield for environmental electromagnetic radiation or fields. Therefore, there is a need for individuals to protect themselves from environmental electromagnetic radiation and electromagnetic radiation fields that may adversely affect their health or that may interfere with the proper operation of an implanted or other electronic device increasingly used in the treatment of medical conditions.

SUMMARY OF THE PRESENT INVENTION

The present invention is a garment for everyday wear made of a material or fabric that provides protection from environmental electromagnetic radiation or fields. A high magnetic permeability material is utilized in a flexible fabric that is lightweight and easily worn. Ferromagnetic compounds or composite materials incorporating carbon fibers may be utilized to form the garment. In one embodiment, the electromagnetic radiation shielding material is layered between a top layer and a bottom layer of fabric. In another embodiment, strands of electromagnetic radiation shielding material are covered by a fiber material and weaved into a garment. In another embodiment, electromagnetic field shielding strands are weaved alternately with fiber strands to form a fabric. Yet another embodiment is a strand made of a composite material containing electromagnetic field shielding material which is weaved into a garment.

Accordingly, it is an object of the present invention to provide a garment that can easily be worn every day by an individual, protecting the individual from environmental electromagnetic radiation and environmental electromagnetic fields.

It is a further object of the present invention to protect individuals having implanted electronic devices from environmental electromagnetic radiation or fields.

It is an advantage of the present invention that the garment is flexible and light and can be worn for everyday use.

It is a further advantage of the present invention that the material can be made into a variety of garments including shirts, pants, gloves, socks, hats, blankets, bedding, or any other clothing or garment worn or placed over an individual.

It is a feature of the present invention that a high magnetic permeability or ferromagnetic material is used in combination with a fiber material.

It is another feature of the present invention that electromagnetic radiation or field shielding materials are blended with fabric materials.

These and other objects, advantages, and features will become readily apparent in view of the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 schematically illustrates garments used for shielding an individual from environmental electromagnetic radiation or fields.

Fig. 2 schematically illustrates a cross section of a portion of a layered garment.

Fig. 3 schematically illustrates a cross section of a strand of material.

Fig. 4 schematically illustrates a plan view of a section of an electromagnetic radiation or field shielding fabric.

Fig. 5 is a schematic cross section of a composite fiber.

Fig. 6 illustrates the use of the present invention in bedding material.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 illustrates the application of the electromagnetic field shielding garment 10 of the present invention to a shirt 10 and pants 14. However, it should be appreciated that the present invention can be applied to any type of garment for use by individuals such as underwear, long johns, briefs, T-shirts, long sleeve or short sleeve, camisoles, boxers, sweaters, parkas, gloves, socks, boots, hoods, goggles, specialty clothing for babies, children, pets, and any other garment that could be worn or used by an individual or animal. The shirt 12 and pants 14 are made from a fabric or material providing electromagnetic radiation or field shielding. The garment provides protection to the wearer from environmental electromagnetic fields. The environmental electromagnetic fields may be generated from a variety of sources such as electrical equipment, electronic anti-theft surveillance devices, high voltage lines, cellular

phones, electric blankets, kitchen appliances, motors, and generators, among numerous other sources using electrical energy or magnetic devices. The electromagnetic field shielding garments of the present invention are particularly applicable to individuals having implanted electronic medical devices, for example a cardiac pacemaker or defibrillator 16 or spinal cord stimulator 18. As the use of implanted electronic devices grows and as the implanted electronic devices use less power and therefore become more sensitive to currents induced by electromagnetic fields, their shielding becomes particularly important. Even relatively low electromagnetic fields may adversely effect and cause improper operation of many implanted electronic devices. Such malfunctions may be life-threatening for many individuals. Accordingly, electromagnetic field shielding garments, to be effectively utilized, must be flexible, lightweight and easily worn for long periods of time. Various materials having a magnetic permeability may be incorporated into electromagnetic field shielding garments utilizing the Faraday cage principal. For example, aluminum and stainless steel may be used, as well as other ferromagnetic compounds. Carbon fibers may also be used with other composite type materials such as fiberglass and plastic. Stainless steel containing fabrics are commercially available in different proportions of stainless steel to fabric, with different weaving, knitting or braiding techniques. The present

invention, by utilizing a combination of various fabrics traditionally used in the clothing industry with various other high magnetic permeability materials or substances, can be designed and manufactured into normally appearing wearable garments that can be used day to day. The electromagnetic field shielding garments of the present invention can be utilized not only for protecting patients with implanted electronic devices or individuals subject to environmental exposure of electromagnetic fields, but also for protecting patients undergoing chemotherapy, radiation therapy or other immunosuppressive treatments, that might be more prone to the potential hazardous effects of electromagnetic fields. Additionally, the present invention may be used by military, police, and security forces as a defense against potential use of high electromagnetic fields as weapons against human staff and their equipment. Additionally, the present invention is particularly applicable to pregnant women, including their developing fetuses, and in the protection of infants, toddlers, and developing children. Pets, farm animals and livestock may also be protected against the adverse effects of environmental electromagnetic fields.

Fig. 2 is a schematic cross section of a layered electromagnetic field shielding garment. A top layer 22 of a conventional material such as cotton, wool, nylon, rayon, polyester, or other fabrics used in the garment industry, is placed over an electromagnetic field shielding material 24

such as a material having a high magnetic permeability, ferromagnetic material, or an electrically conductive material such as stainless steel, aluminum, copper, or carbon. A bottom layer of material similar to that of the top layer 22 is then used to sandwich the electromagnetic field shielding material 24. This layered structure provides a thin flexible material that can easily be used and processed in making a garment that can be comfortably worn by an individual.

Fig. 3 is a schematic cross section of a fiber or covered strand 28 that may be used in making an electromagnetic field shielding fabric from which garments may be made. A conventional fiber material 30 covers an electromagnetic shielding material 32. The covered strand 28 may be used in conventional manufacturing processes to manufacture fabric to make different electromagnetic field shielding garments.

Fig. 4 schematically illustrates a section of electromagnetic field shielding fabric 34 made from alternating fibers of electromagnetic field shielding fibers 36 and conventional fibers 38. The electromagnetic field shielding fibers 36 may be made of any material having a high magnetic permeability or a ferromagnetic material. The conventional fibers 38 may be made of any conventional natural or synthetic material such as cotton, wool,

polyester, nylon, rayon or other known material used in the garment industry.

Fig. 5 is a schematic cross section of a composite fiber or a strand 40. The composite fiber 40 is impregnated with an electromagnetic field shielding substance or material 42. The electromagnetic field shielding material 42 may be impregnated during manufacture of the composite fiber 40 or the composite fiber 40 may be impregnated with a solution containing high concentrations of electromagnetic field shielding substances.

It should be appreciated that other equivalent means may be utilized for forming electromagnetic field shielding fabrics which can be made into different garments worn by individuals for protecting them from electromagnetic fields. Many different combinations of materials or fabrics having different weaves which are woven, knitted, or braided with different combinations of both natural and synthetic fibers, may be utilized in different combinations to achieve the desired electromagnetic field shielding. The use of other conventional fiber materials renders the shielding garments of the present invention to be easily worked and comfortably worn by individuals during day-to-day activities, while continuously shielding them from environmental electromagnetic radiation fields.

Fig. 6 schematically illustrates the application of the present invention to bedding. A bed 44 has an individual 48

lying therein covered by an electromagnetic field shielding blanket 46. The electromagnetic field shielding blanket 46 may be incorporated or utilized in combination with a conventional electric blanket placed there over in order to shield the individual 48 from electromagnetic fields generated by the electric blanket. It should be appreciated that many other types of coverings or bedding such as sheets, pillow cases, mattress pads, and others could be made of an electromagnetic shielding material to protect an individual from the hazardous effects of electromagnetic fields.

Accordingly, the present invention provides a flexible, easily worn, electromagnetic field shielding garment that can be worn every day by individuals, protecting them from the ever increasing environmental electromagnetic fields present in today's society. The present invention is particularly applicable to those individuals having implanted electronic medical devices as well as to pregnant women with developing fetuses and infants, toddlers and developing children.

Additionally, although the preferred embodiments have been illustrated and described, it will be obvious to those skilled in the art that various modifications may be made without departing from the spirit and scope of this invention.

What is claimed is:

1. A garment functioning to shield a user from environmental electromagnetic fields comprising:

a fabric; and

an electromagnetic field shielding material combined with said fabric,

whereby when worn the user is shielded from environmental electromagnetic fields.

2. A garment as in claim 1 wherein:

said fabric is selected from the group of cotton, wool, nylon, rayon, and polyester.

3. A garment as in claim 1 wherein:

said electromagnetic field shielding material is selected from the group of stainless steel, aluminum, copper or carbon.

4. A garment as in claim 1 wherein:

said electromagnetic field shielding material is made of a ferromagnetic material.

5. A garment as in claim 1 wherein:

said electromagnetic field shielding material is made of an electrically conductive material.

6. A garment as in claim 1 wherein:

said electromagnetic field shielding material is made of a high magnetic permeability material.

7. A garment as in claim 1 wherein:

said fabric material is interwoven with said electromagnetic shielding material.

8. A garment as in claim 1 wherein:

said fabric material covers said electromagnetic shielding material.

9. A garment functioning to shield a wearer having an implanted electronic medical device from environmental electromagnetic fields minimizing electromagnetic interference received by the implanted medical device while maintaining comfort to the wearer comprising:

a flexible high magnetic permeability fabric providing a shield from environmental electromagnetic fields,

whereby life threatening malfunctions in the implanted electronic medical device caused by the environmental electromagnetic fields are prevented.

10. A garment as in claim 9 wherein:

said flexible high magnetic permeability fabric comprises a high magnetic permeability material interwoven with a fiber material.

11. A garment as in claim 10 wherein:

said fiber material is selected from the group of cotton, wool, nylon, rayon, and polyester.

12. A method of shielding a wearer from environmental electromagnetic fields comprising the steps of:

placing on the wearer a garment comprising an electromagnetic field shielding material;

exposing the wearer to the environmental electromagnetic fields.

13. A method of shielding a user comprising the steps of:

implanting an electronic medical device in the user, said electronic medical device controlling a critical bodily function;

shielding the implanted electronic medical device from an environmental electromagnetic field with a wearable garment comprising an electromagnetic field shielding material,

whereby potentially fatal malfunctions of the implanted electronic medical device due to interaction with the environmental electromagnetic field are prevented.

14. A method of shielding an individual having an implanted electronic medical device from environmental electromagnetic fields comprising the steps of:

placing on the individual a garment having an electromagnetic field shielding material positioned to shield the implanted electronic medical device,

whereby the individual is protected from malfunctions of the implanted electronic medical device as a result of environmental electromagnetic fields.

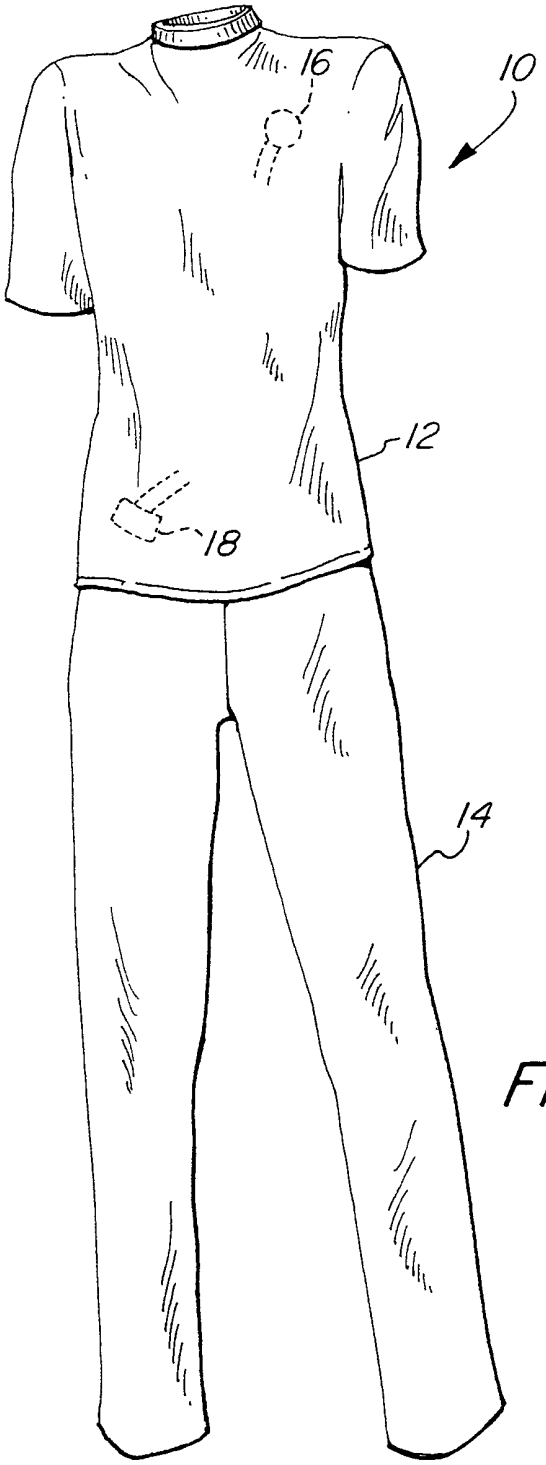


FIG. 1

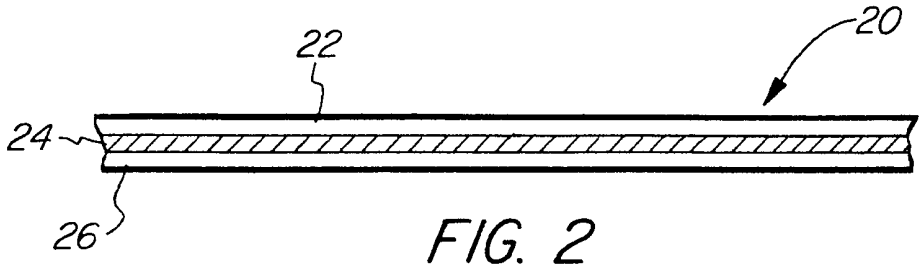


FIG. 2

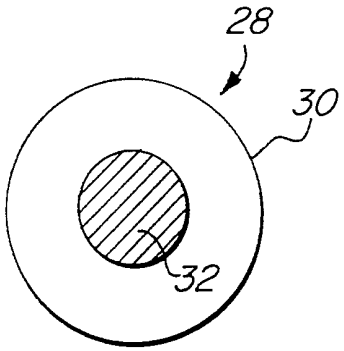


FIG. 3

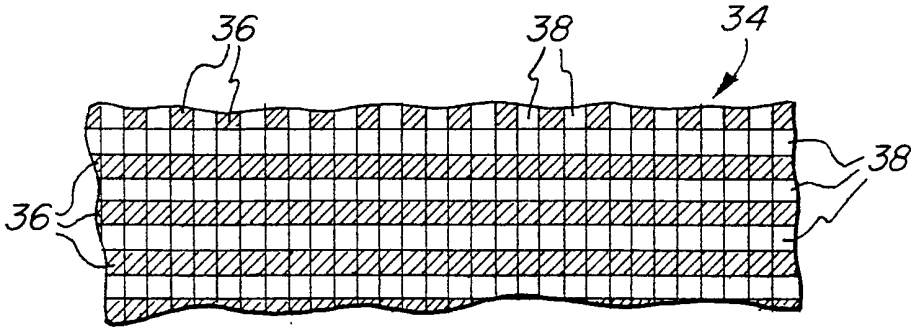


FIG. 4

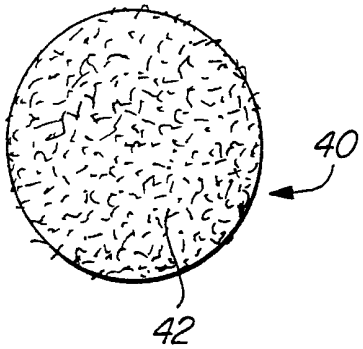


FIG. 5

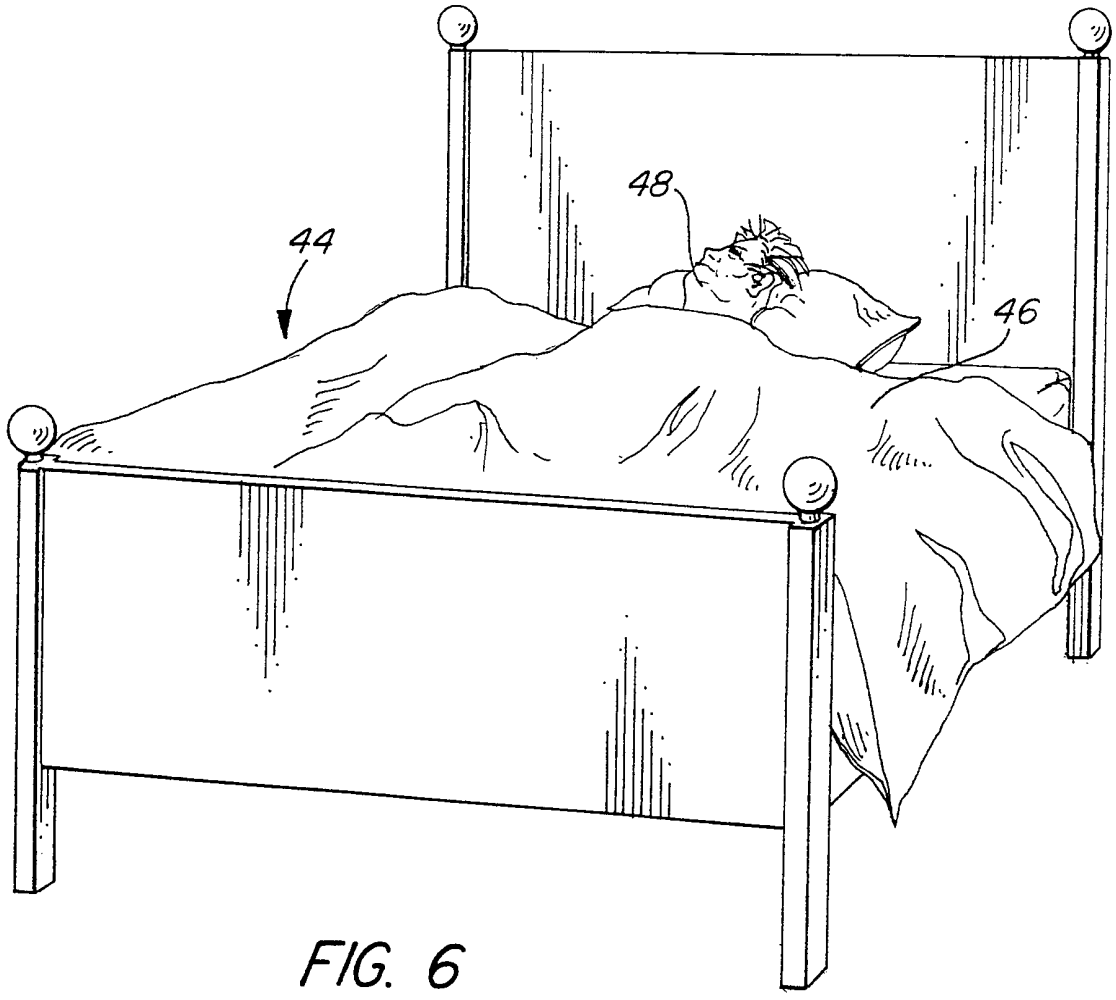


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/31304

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :G21F 3/02
US CL :2/456

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 2/455, 463, 464, 466, 467, 69; 250/516.1; 442/131; 139/425R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3,039,172 A (EGAN) 19 June 1962, col. 1, lines 13-19 and col. 3, lines 27-66.	1-12
X	5,578,359 A (FORBES et al) 26 November 1996, col. 2, lines 54-55 and col. 3, lines 18-31.	1,4-10,12
X	US 5,115,140 A (RODRIGUEZ) 19 May 1992, col. 3, lines 47-56.	1-6,8-12
X	US 5,882,242 A (HARDY) 16 March 1999, col. 3, lines 19-22.	1-7,9-12
X	US 5,103,504 A (DORDEVIC) 14 April 1992, col. 4, lines 34-40.	13,14

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"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
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"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
"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)	"&"	document member of the same patent family
"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		

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