**PCT** WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : A61G 5/10, 5/02

A1

(11) International Publication Number: **WO 97/28775**

(43) International Publication Date: 14 August 1997 (14.08.97)

(21) International Application Number: PCT/IB97/00079

(22) International Filing Date: 5 February 1997 (05.02.97)

(30) Priority Data:

| | | |
|---|---|---|
| 9602655.4 | 9 February 1996 (09.02.96) | GB |
| 9612878.0 | 19 June 1996 (19.06.96) | GB |
| 9612800.4 | 19 June 1996 (19.06.96) | GB |

(81) Designated States: AT, AU, BR, CA, NO, NZ, SG, US, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published

*With international search report.*

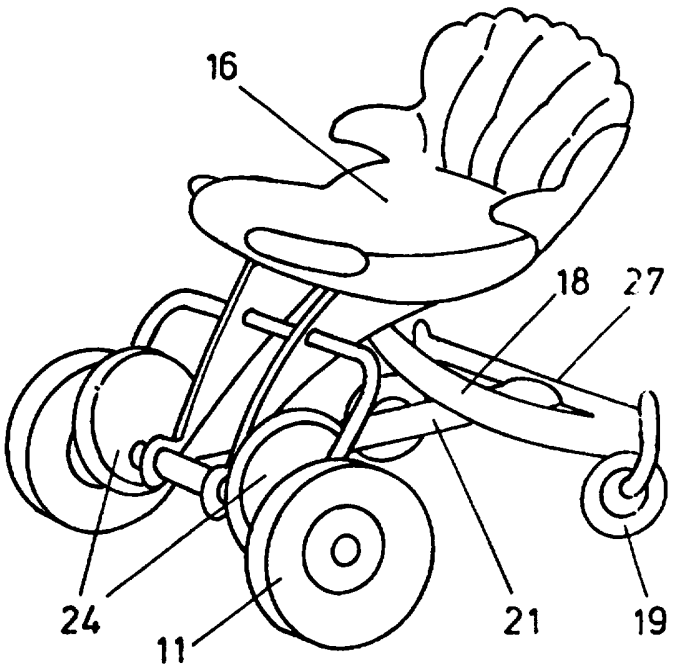
*Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.*

(71)(72) Applicant and Inventor: HALLEWELL, Joan, Elizabeth [GB/GB]; 60 Rosevear Road, Bugle, St. Austell, Cornwall PL26 8PJ (GB).

(54) Title: HANDS-FREE LEG/MOTOR POWERED VEHICLE

(57) Abstract

This vehicle can be controlled and powered by body-weight only to give maximum exercise and continuous good health for the user. A motor can be teamed with physical effort to help or take over altogether. It will be used by those with nonfunctional limbs, the disabled who cannot use arm powered wheelchairs, or ablebodied people who wish to keep their arms free for other purposes and yet still move over pedestrian areas on a vehicle. There are very useful rise and fall mechanisms which place the user in the appropriate posture for the task in hand. It can lower to 40cm and rise to 75cm. It will also fold down and stow away in a car boot, a cupboard, hang up. It has sporting potential for those unable to participate with the vehicles already available. Lightweight materials and lightweight non-spill acid batteries are used.



*FOR THE PURPOSES OF INFORMATION ONLY*

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

| | | | | | |
|---|---|---|---|---|---|
| **AM** | Armenia | **GB** | United Kingdom | **MW** | Malawi |
| **AT** | Austria | **GE** | Georgia | **MX** | Mexico |
| **AU** | Australia | **GN** | Guinea | **NE** | Niger |
| **BB** | Barbados | **GR** | Greece | **NL** | Netherlands |
| **BE** | Belgium | **HU** | Hungary | **NO** | Norway |
| **BF** | Burkina Faso | **IE** | Ireland | **NZ** | New Zealand |
| **BG** | Bulgaria | **IT** | Italy | **PL** | Poland |
| **BJ** | Benin | **JP** | Japan | **PT** | Portugal |
| **BR** | Brazil | **KE** | Kenya | **RO** | Romania |
| **BY** | Belarus | **KG** | Kyrgystan | **RU** | Russian Federation |
| **CA** | Canada | **KP** | Democratic People's Republic of Korea | **SD** | Sudan |
| **CF** | Central African Republic | | | **SE** | Sweden |
| **CG** | Congo | **KR** | Republic of Korea | **SG** | Singapore |
| **CH** | Switzerland | **KZ** | Kazakhstan | **SI** | Slovenia |
| **CI** | Côte d'Ivoire | **LI** | Liechtenstein | **SK** | Slovakia |
| **CM** | Cameroon | **LK** | Sri Lanka | **SN** | Senegal |
| **CN** | China | **LR** | Liberia | **SZ** | Swaziland |
| **CS** | Czechoslovakia | **LT** | Lithuania | **TD** | Chad |
| **CZ** | Czech Republic | **LU** | Luxembourg | **TG** | Togo |
| **DE** | Germany | **LV** | Latvia | **TJ** | Tajikistan |
| **DK** | Denmark | **MC** | Monaco | **TT** | Trinidad and Tobago |
| **EE** | Estonia | **MD** | Republic of Moldova | **UA** | Ukraine |
| **ES** | Spain | **MG** | Madagascar | **UG** | Uganda |
| **FI** | Finland | **ML** | Mali | **US** | United States of America |
| **FR** | France | **MN** | Mongolia | **UZ** | Uzbekistan |
| **GA** | Gabon | **MR** | Mauritania | **VN** | Viet Nam |

# HANDS-FREE LEG/MOTOR POWERED VEHICLE

## Field of this Invention

- Hands-free manoeuvrable vehicle.
- Leg/weight powered motion with motor assisted option.
- For indoor and outdoor commuting over pedestrian areas, around home and work places; at the same time, effectively toning up their physical condition.
- Also, ideally suited to disabled individuals to broaden their independent working capabilities.

## Background to this Invention

It might be said that vehicles for the Disabled are designed by persons who do not have to use them. It might also be said that the controls provided for the motorized vehicles take no concern for those who have no hands to use them. There are also commercial users of Buggies or Bicycles which do not give hands-free advantage to anyone in the work place, which is inconvenient and time consuming and the production of a specially designed vehicle for this purpose could reduce the price to disabled users. It is an area well worth developing. This is the purpose of this specification to describe a vehicle which has been designed by a person who has spent over forty years in one.

It is not the purpose of this specification to describe the precise detail of each of the components comprising this "hands-free" vehicle, since the methods and techniques of mechanical and electrical functioning are already in the public domain.

The innovative steps incorporated in the embodiment of this invention lie in the ability of this vehicle to raise, lower, incline or decline the seat facility and to drive forward, reverse or turn in either direction without the use of the hands.

Anyone, able or disabled, who can use their weight onto their thigh, can pump-pedal the vehicle into any required motion. The power units to the wheel on one side are entirely separate from the power units to the wheel on the other side. This means that motion can be in unison, on one side only, or one forward and the other in reverse, achieving a tight about turn. A move used frequently in an "micro environment".

Description

According to the embodiment of this invention, this "hands-free" vehicle comprises three basic elements which are:-

The rise and fall/seat saddle assembly

The leg/pedal, electric motor and reversible wheel assembly

The seat-elevating with rear castors assembly

The fixed drive wheels are positioned appropriately with the leg/pedal, motor assembly which is also the forward half of the seat-elevating assembly.

Within the hubs of the driving wheels which are positioned appropriately with the leg/pedal and motor assembly, are lever controlled, one-way clutch reversing units. The mechanism which activates the seat elevating assembly is an electric or hydraulic ram, horizontally orientated between the front wheels and the rear castors, forming the horizontal side of a triangle. The frame, containing the drives, makes the second side, the third side by the splayed castor legs, which join the front drive frame and the saddle frame at the bearing joint. Thus, the bearing joint and the saddle are projected upwards and back down again - to the desired height - by the lengthening and shortening of the ram. Since reversing is within the wheel units, the motor and the chain and sprocket units have one and the same, one direction only spindle movement. The varying speeds are contained within each power unit. Operation of this "hands-free" vehicle is by leg power only or leg power assisted by electric motor or by motor power only. Sometimes, the terrain is tough and needs dual assistance. Sometimes, the motor cuts out and it is essential to move away from extreme weather conditions or wild life which is threatening our safety. Sometimes, the user is tired. Always, the user needs exercise. The controls are put where the use finds them to be most convenient - the back rest or the arm rests for brakes, gear levers, stop starts or any other control.

Those without the use of their hands, or prefer to use them for other purposes can still have complete and safe control of this low-powered vehicle.

It must, however, be emphasized again that this specification does not describe fittings and fixtures, electronic or electric circuitry or types of pneumatic wheels.

It is the purpose of this specification to register the inventive steps incorporated in the basic concept.

The embodiment therefore comprises front pneumatic or hard (as preferred) wheels which are driven by leg and/or motor power on a one-way moving spindle with the forward/reverse movement by a one-way clutch contained within the hub.

The wheels can free wheel, propel forward or propel in reverse. Additionally, there is provided rear pneumatic or hard castor type wheels which enable the vehicle to be appropriately manoeuvred as desired.

The vehicle is in two halves powerwise, enabling the user to turn. By increasing power to one side, the vehicle will veer to the other side. By stopping one side only with the relevant brake, the vehicle will describe an arc on a radius of its own width. By putting one side only into reverse, the other continuing forward, the vehicle will turn in its own space. Very frequently used. Reversing turns work on the same principal.

The front wheel axles are suitably supported on ball or roller bearings and carry in a pivotal or fulcrum form the leg and pedal frame assembly. Between the front wheel axles and the rear castor carrier bar and sited in a horizontal plane, is provided a hydraulic or electric actuator or actuators. Longitudinal extension of the actuator/s will cause the seat assembly to descend and so place it at any desired position convenient to the user.

Fulcrumed on the rear axle is a pair of curved lifters which join, through the tree way bearing joint, onto the leg and pedal front frame. These two acting against each other, as the actuator shortens, push equally upwards on the central bearing joint which rises higher. The saddle is pivotally anchored to the same central bearing joint, so rises too. The front leg frame has an "L" shape away from the main joint which provides a rest for the seat/saddle when more erect. Rollers fixed towards the back of the seat frame eventually, when the seat declines, make contact with the curved lifters - levelling the seat.

A specific embodiment of this invention will now be more particularly described by way of example only, with reference to the accompanying drawings in which : -

Very obviously, in schematic views as shown in Figure 1 only the basic elements are indicated; and in view 1b the seat assembly has been omitted entirely.

The gear boxes 20. are merely indicated on the composite pictorial view 1d . No detail of the battery packs involved are given. It can be seen from the side view 1c that when the lifters 17, 18 are moved by the electric actuator 21. Against the front leg frame by the common use of the ball or roller bearing joint 22 (also shared by the seat ball or roller joint) which elevates the seat/saddle element 18. With each of the front wheels 11 is provided an electric motor which rotates the spindle in one direction only, at varying speeds including off. The wheels 11 have within their hubs one-way clutches to run forward or be reverse controlled by a lever conveniently placed. This motor will not exceed 4 mph. It can run with the pedal power, which uses the same spindle 12, 13. The push/pedal element is shown in detail drawing Figure 4, also Figure 2. All movements of the vehicle 10 are controlled by any part of the body i.e. elbows, back etc. readily available to the user.

Reference to Figure 2, View 2a, which is a part view of the front wheel. The position of the legs and feet 25 are indicated forward of the leg rest 26. The front leg frame 15 is shown pivotal on the front wheel 11 axle, and the ball or roller bearing 22, attached to the upper corner of the front leg frame 15.

It will be obvious from the view shown on Figure 5 that any upward or downward movement of the seat saddle element 16, is caused by the retraction of the actuator or its extension as required. The actuator 21 is shown in a horizontal position between the front leg frame 15 and the rear castor wheel 19, carrier bar 27, thus drawing them closer together. The saddle-like nature of the seat 16, gives the user a healthier posture. While the knees slope downwards and grip the foresaddle, providing a natural upright and straight back, which is much more comfortable.

At the same time knee pads set on each side of the front saddle lay on a support bar which pivots from the rear saddle. From the front of the thigh pad is linked a drive rod descending down to the sprocket assembly, shown on Figure 2, in both 2a and 2b. This drive rod can be pumped down to turn the central free wheel sprocket one to two inches. This rod is held firmly to the free wheel sprocket by a roller bearing bridge holder. The free wheel sprocket is fixed by a spindle to a fixed chain bearing sprocket approx. 3" or appropriately sized. The encircling chain drops to another free wheel encircled sprocket which is fixed to the main front wheel. The free sprockets are approx. 2" dia. A one inch stroke from the drive rod will take the 12" main wheel a full revolution (or any other appropriately ratio sprockets may be used).

This action works in one direction to the spindle as also the electric motor, relying on the one-way clutch mechanism for forward and reverse movements in the wheel hub. A simple arrangement which gives versatile working possibilities for the user such as have not been available previously. Referring now to Figure 3, there are shown separate views of the principal components comprising the frame of the vehicle 10.

It must here again be emphasised that the drawing does not represent actual design characteristics but merely indicates the functional principles.

It can be seen that View 3b, shows the rear wheels 19 to be preferably strong castors to give good support since the thrust of body weight will be directed to the carrier bar 27 (Figure 1 View 1d) lifters 17,18. Which ever direction the castors turn, the axle should always be outside the body weight to ensure stability. A point not always adhered to on present models 14 (Figure 1 View 1a) and 15. The leg support frame combines as one main front frame. 15 leg frame extends over the main bearing joint 22 (Figure 6 shows detail) and to the rear sufficiently to make carrying struts to hold the weight of the seat 16 element which joins the main bearing joint 22, as also the two lifters 17, 18, which join the main bearing joint situated at the top end of the main leg frame 15.

The other two ends of the lifters splay outwards to the rear castors and join the carrier bar 27, with pivotal joints.

The front frame also joins the front axles 12,13, with pivotal joints. Between the front wheels 11 and the rear castors 19. There is to be found a horizontally placed actuator, electrically powered with two light-weight batteries on either side of the end joining the carrier bar 27.

The seat element has a roller bar or bars placed beyond the bearer struts on 15 leg frame. These ca rest on the lifters 17, 18, when the seat has been lowered, sufficient for the seat rollers 29 to make contact with the said lifters and to level the seat again. The seat saddle can have within its abilities its own rise and fall adjustment and swivel mechanism. These allow the seat under limited circumstances to rise to a "conversation height of 30" and the ability to turn to or beside tables etc for close up contact, where conditions are difficult (not illustrated).

The important features of infinitely adjustable posture control by moving the rear wheel assembly 19 towards or away from the front 11 assembly is uniquely incorporated as the principal aspect of this embodiment.

Referring now to Figure 3, there are shown separate views of the principal components comprising the vehicle 10.

It must here again be emphasised that the drawing does not represent actual design characteristics but merely indicates the functional principals. Very obviously, all pivotal fulcrums would be provided with appropriate ball or roller bearing assemblies to reduce friction and all the components comprising the vehicle 10 would be constructed in reinforced plastic material where appropriate or in suitable metal where necessary.

It can be seen that the concept herein described introduces aspects of change in hands-free vehicle and wheelchair design which offer considerable advantages for those persons wishing or forced by circumstance to spend many hours / years in the sitting or reclining posture, but enabling them to perform tasks as well as giving them mobility.

It is considered this submission is sufficient to register the concept.

CLAIMS

CLAIM 1.

THIS IS A VEHICLE WITH SEVERAL ESTABLISHED UNITS COMBINED IN A UNIQUE WAY TO PROVIDE A VEHICLE CAPABLE OF LIFTING AND LOWERING THE USER TO ANY DESIRED HEIGHT, ALSO THE USERS CAN PROPEL THEMSELVES IN ANY DIRECTION BY THEIR OWN BODYWEIGHT OR STRENGTH WHEN ALL FOUR LIMBS ARE NOT FUNCTIONING WELL , OR NEEDED FOR OTHER PURPOSES,, A MOTOR IS ALSO PROVIDED TO ASSIST THE BODY ,IF NEEDED, OR IT CAN TAKE OVER THE POWERING ALTOGETHER CLAIM 1 OF CLAIM 1.

THE FRAME HAS FOUR BASIC PARTS.

1. THE FRONT WHEEL FRAME WITH SEAT SUPPORT EXTENDERS WHICH ALLOW THE SEAT TO RECLINE FOR MOTOR TRAVEL PRIMERILY. THIS FRAME CARRIES ON EACH SIDE ENTIRELY SEPARATE PROPULTION CAPABILITIES,CONTROLES, AND MOTOR UNITS WHICH CAN OPERATE ON ONE SIDE ONLY, OR IN UNISON , OR IN OPPOSITE DIRECTIONS AT THE SAME TIME.
2. THE REAR CASTERED FRAME COSISTING OF TWO SPLAYING LEGS TO RIGHT AND LEFT FROM THE MAIN BEARING JOINT LOCATED HIGH ON THE FRONT WHEEL FRAME, CENTRAL AND PIVOTAL. DECENDING TO THE CASTER BAR BETWEEN THE TWO REAR CASTER WHEELS WHICH ASLO CARRIES THE ACTUATOR BOX.
3. THE ACTUATOR IS HORIZONTAL AND FUNCTIONS BETWEEN THE FRONT MAIN WHEELS AND THE REAR CASTERED WHEEL BAR.

THESE THREE PARTS TOGETHER FORM A TRIANGLE TO THE CANTILEVERED SEAT EXTENDERS SO THAT WHEN THE HORIZONTAL SIDE SHORTENS OR EXTENDS THE BEARING JOINT AT THE TOP OF THE TRIANGLE RISES AND FALLS , RECLINES AND DECLINES THE SEAT .

4. THE SEAT SADDLE IS PIVOTALLY JOINED TO THE MAIN BEARING JOINT WHICH IT SHARES WITH THE REAR CASTER FRAME, THIS PIVOTAL LINK IS AT THE FRONT END OF THE SADDLE WHILE THE SEAT IS RESTING ON THE EXTENDED ARMS OF THE FRONT WHEEL FRAME UNTIL CONNECTING WITH THE SPLAYED CASTER LEGS AND LEVELED AGAIN WHEN FRAME IS LOWERING THE SADDLE HAS TWO THIGH PADS, ONE EACH SIDE, PIVOTALLY JOINED TO THE REAR OF THE SEAT , A BACKREST TO SUIT THE USER IS ATTACHABLE. THIS SADDLE HAS ITS OWN RISE AND FALL MECHANISM TO ADD EXTRA HEIGHT WHEN REQUIRED.

CLAIM 2.

THE SPROCKET AND CHAIN, OR GEARS AND BELTS, TRANSMISSION UNITS. THE DRIVE ROD IS LINK JOINED UNDER THE THIGH PAD AND IN LINE WITH THE BODY WEIGHT ,ABOVE, TO DEPRESS DOWN THE ROD AGAINST THE SIDE OF A FREEWHEEL SPROCKET,THROUGH A HOLDING PIECE, WHICH IS FIXED TO , AND TURNS, A LARGER CHAINED SPROCKET WHICH IS CHAIN LINKED TO ANOTHER FREEWHEEL WHICH IS FIXED TO ,AND TURNS, THE MAIN WHEEL THUS ALLOWING THE DRIVE ROD TO PUSH MINIMALLY DOWN FROM THE THIGH PAD ONTO THE SPROCKET UNIT AND RISE AGAIN, THIS SMALL PUMPING ACTION WILL TURN THE MAIN WHEEL A FULL REVOLUTION AND ACTIVATE THE VEHICLE THROUGH VARIOUS COMBINATIONS OF MOVES WITH OR WITHOUT THE MOTOR.BECAUSE THE SPINDLE TURNS IN ONE DIRECTION ONLY AS TOO THE SPROCKET AND CHAIN UNIT, AND THE MOTOR TOO THIS MEANS THE MOTOR POWER CAN BE GRADUALLY ADDED TO HELP THE PUMP ACTION OR TAKE OVER ALTOGETHER.

ANY REVERSE ACTION IS CONTAINED WITHIN THE "ONE WAY CLUTCH" HUB OF THE MAIN WHEELS EITHER INDEPENDENTLY OF EACH OTHER OR IN UNISON OR IN OPPOSITE DIRECTIONS. WITH OR WITHOUT THE USE OF BRAKES..

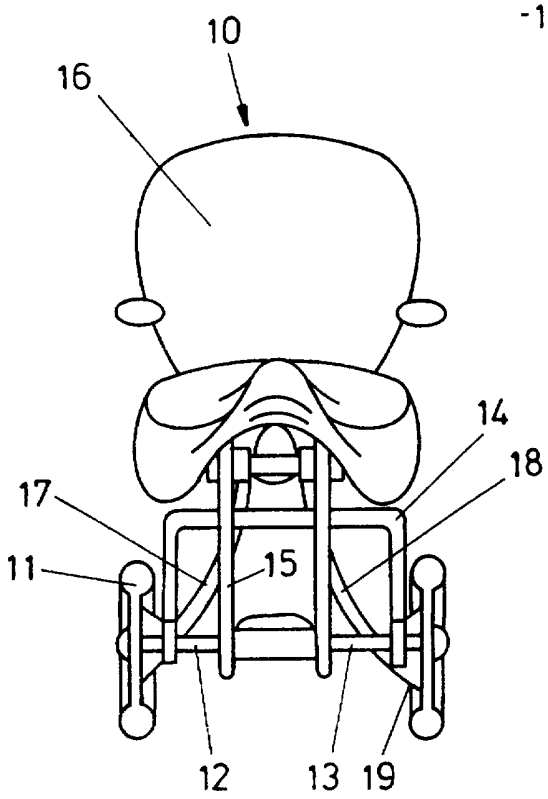



FIG. 1a

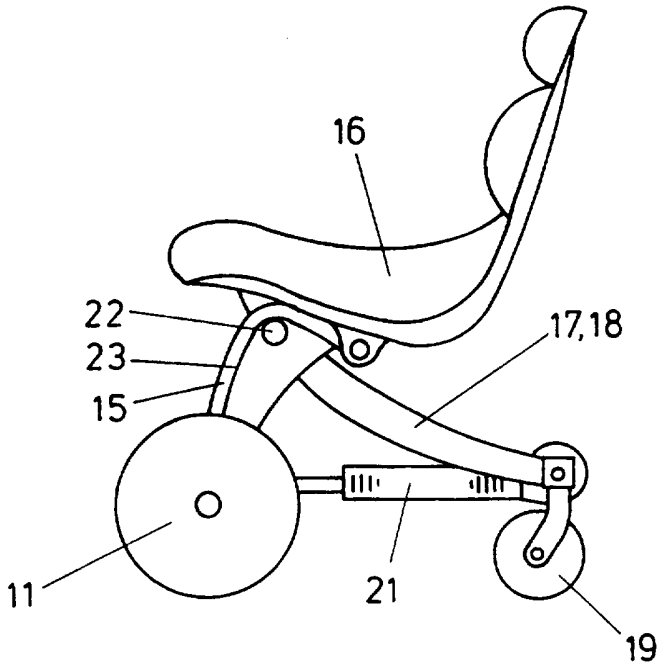



FIG. 1c

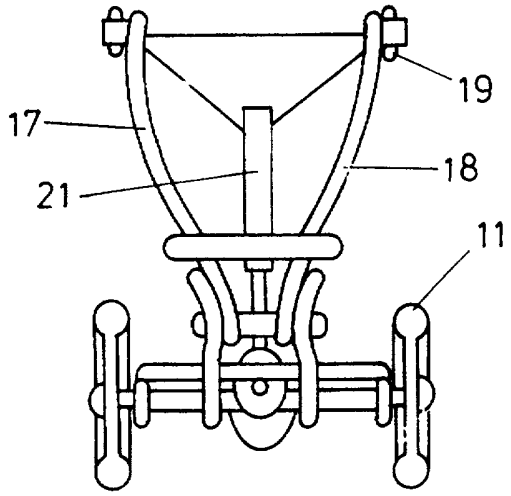
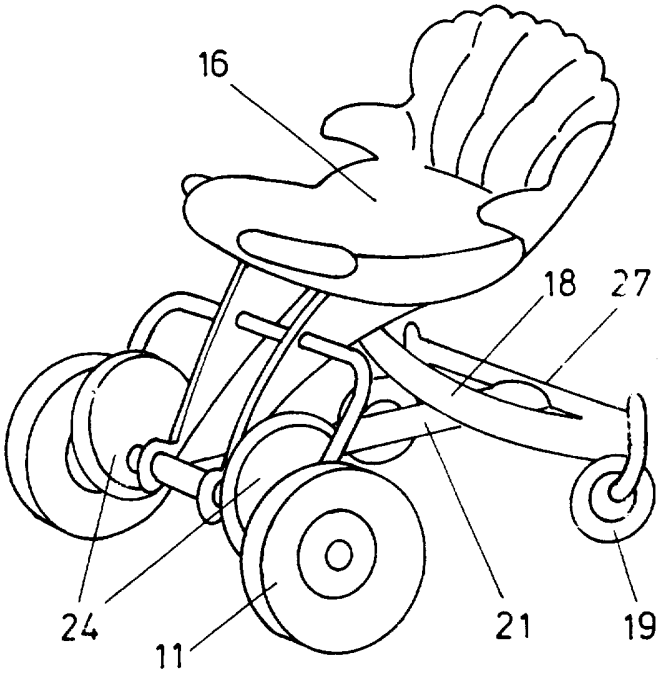



FIG. 1b

FIG. 1d



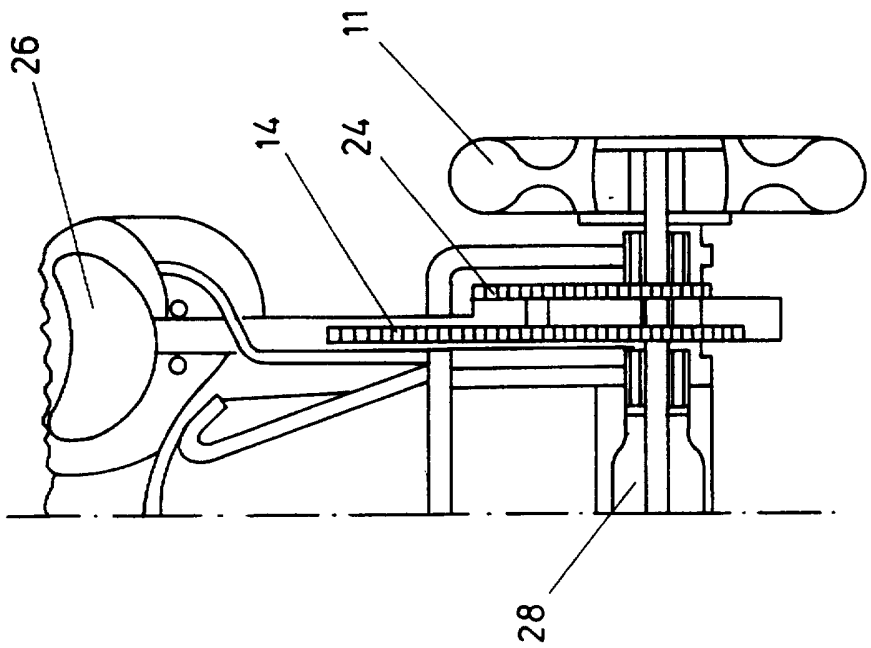



FIG. 2b

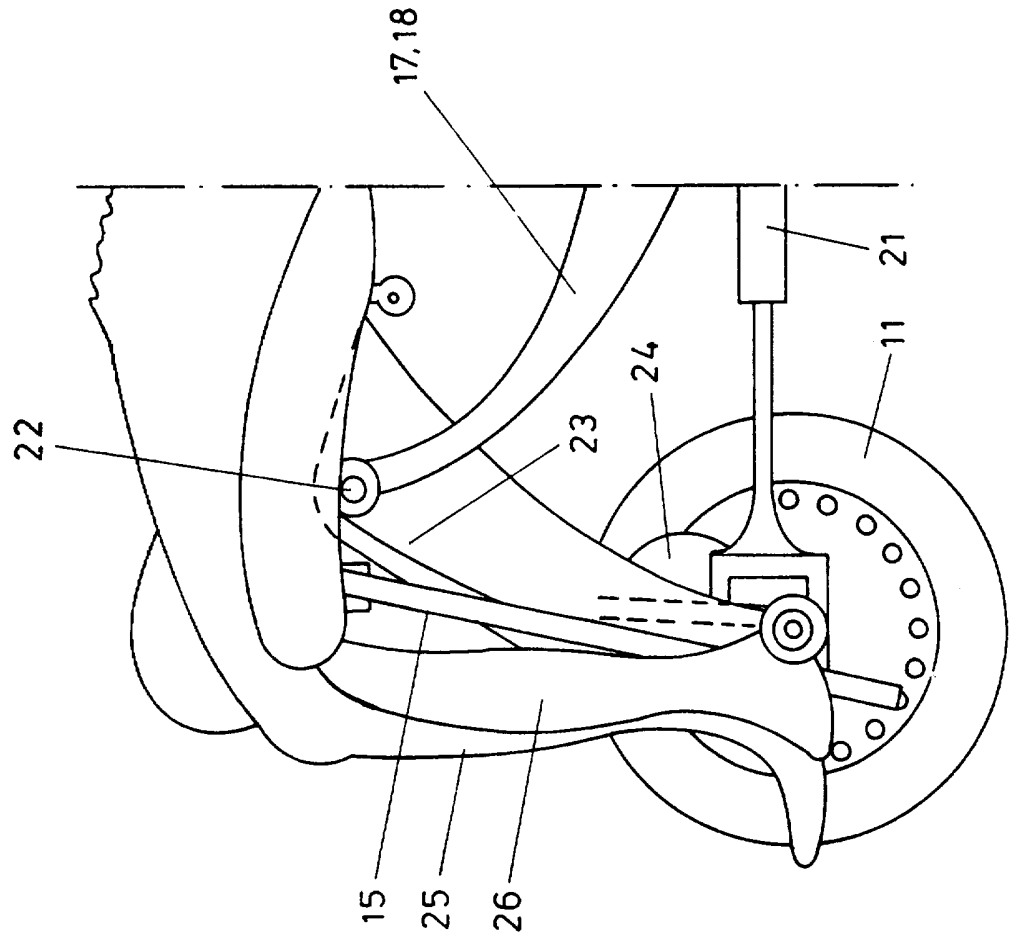



FIG. 2a

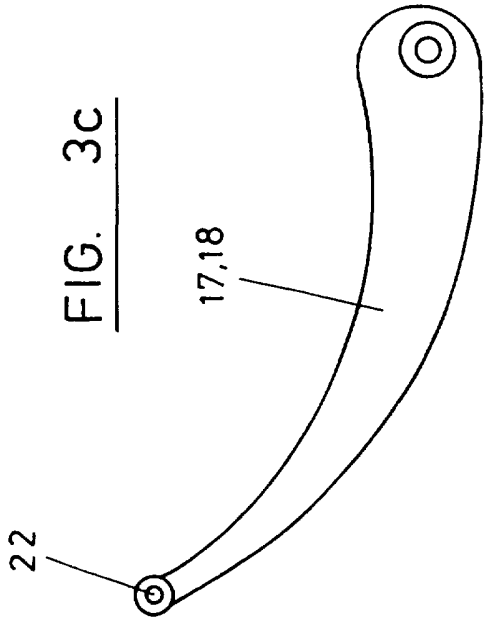



FIG. 3c

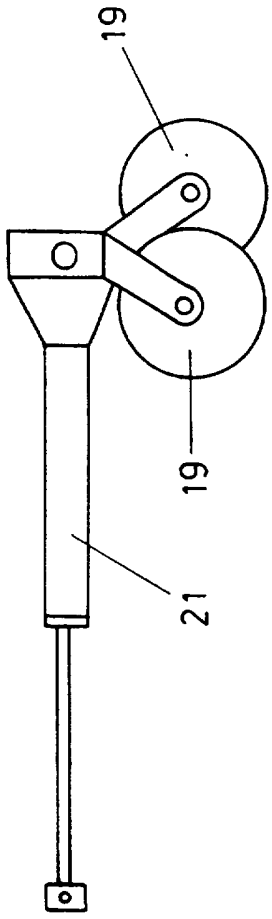



FIG. 3d

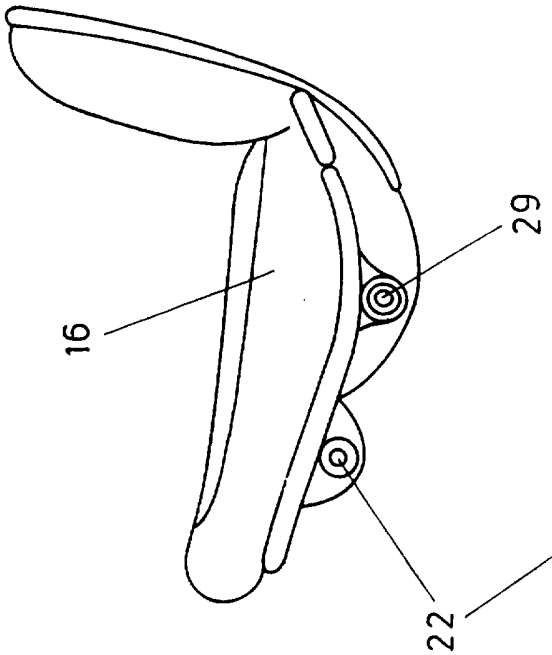



FIG. 3a

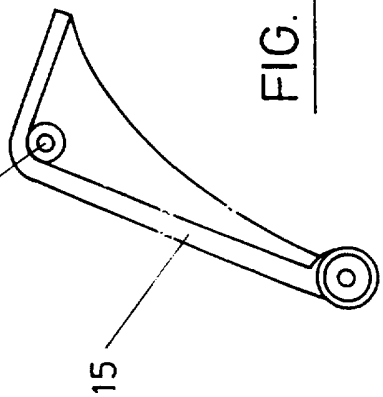



FIG. 3b

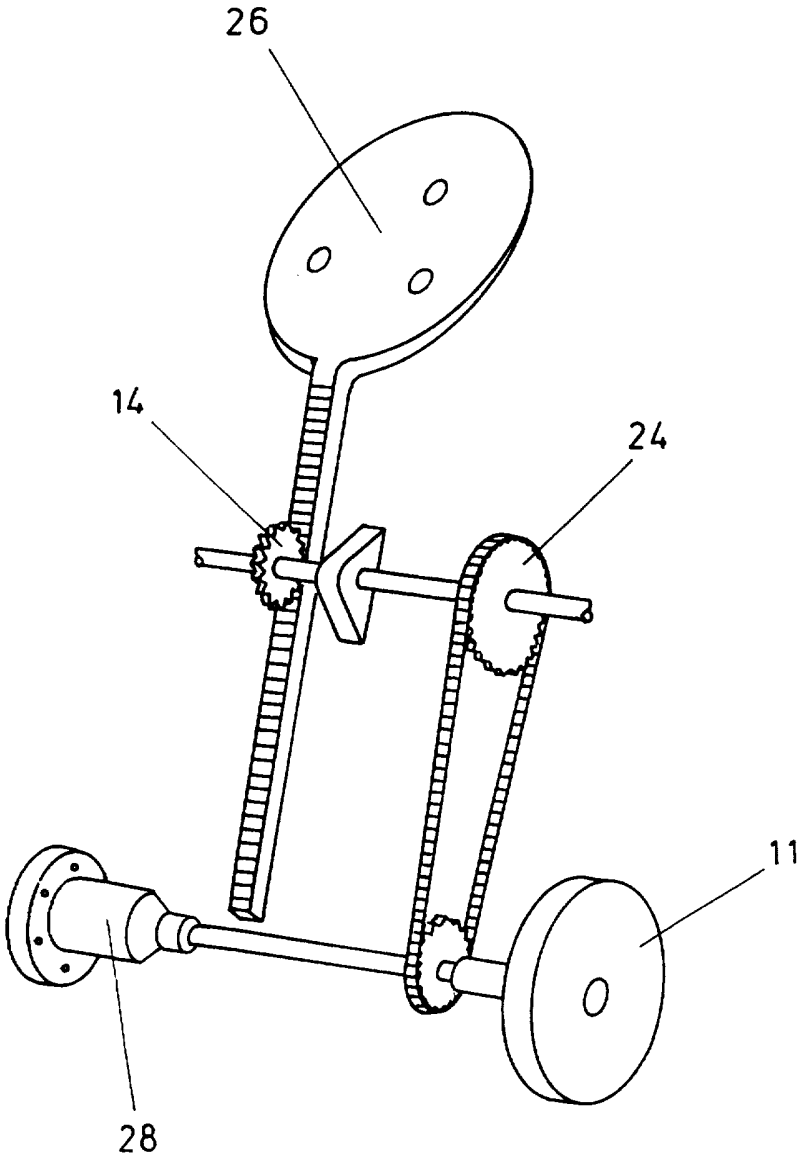
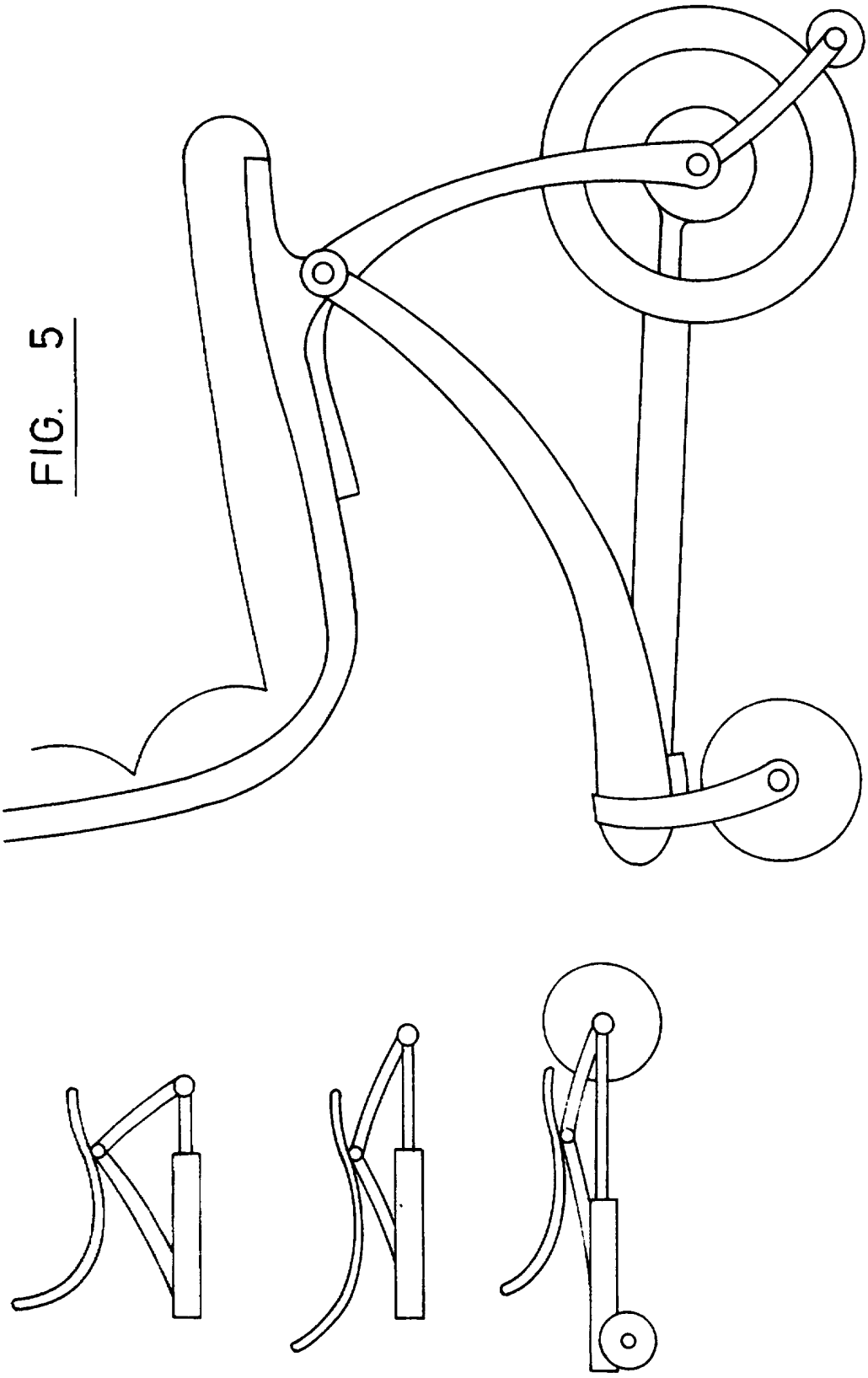



FIG. 4

FIG. 5



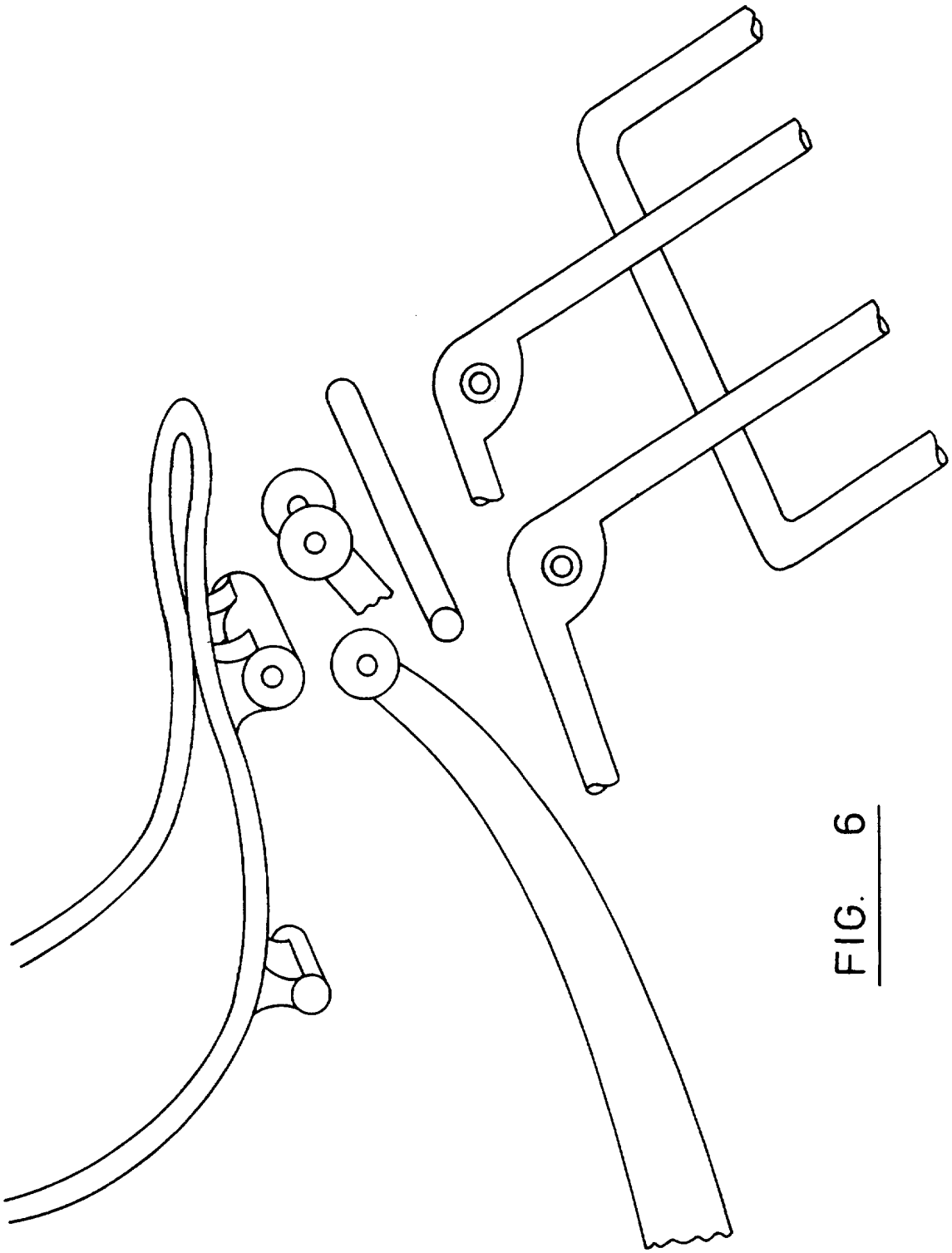


FIG. 6

# INTERNATIONAL SEARCH REPORT

Inten ıal Application No
PCT/IB 97/00079

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61G5/10 A61G5/02

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)
IPC 6 A61G

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | WO 94 06389 A (JOUK) 31 March 1994<br>see page 4, line 3 - line 6; figure 2 | 1 |
| A | US 3 762 703 A (GIBBS) 2 October 1973<br>see column 5, line 10 - line 34; figures 8-10 | 1,2 |
| A | FR 598 700 A (CHOQUENET) 22 December 1925<br>see the whole document | 1,2 |

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"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 when the document is taken alone

"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

1

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 9 June 1997 | 18. 06. 97 |
| Name and mailing address of the ISA<br>European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. ( + 31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax ( + 31-70) 340-3016 | Authorized officer<br>Godot, T |

Form PCT/ISA/210 (second sheet) (July 1992)

# INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern al Application No
PCT/IB 97/00079

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| WO 9406389 A | 31-03-94 | FR 2695813 A | 25-03-94 |
| US 3762703 A | 02-10-73 | NONE | |
| FR 598700 A | 22-12-25 | NONE | |