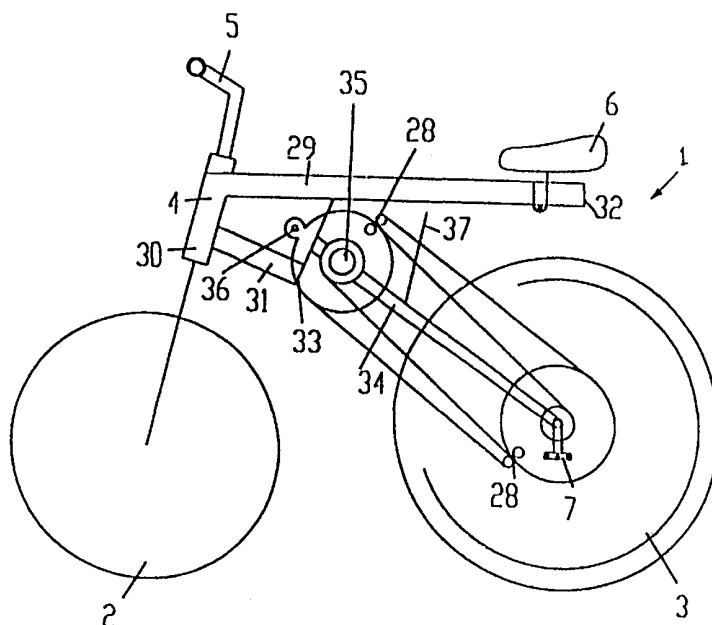




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification<sup>6</sup> : <b>B62M 9/04</b></p>	<p><b>A1</b></p>	<p>(11) International Publication Number: <b>WO 99/33697</b> (43) International Publication Date: 8 July 1999 (08.07.99)</p>
<p>(21) International Application Number: PCT/GB98/03790 (22) International Filing Date: 17 December 1998 (17.12.98) (30) Priority Data: UM-15476 29 December 1997 (29.12.97) PH 98 1 02295.2 19 June 1998 (19.06.98) CN (71) Applicant (for all designated States except US): YONG, Paul [GB/BN]; #6 Block C, Beribi Industrial, Jalan Gadong, Brunei Darussalam (BN). (71)(72) Applicant and Inventor: URCIA, Eduardo [PH/PH]; 985 Sisa Street, Sampaloc, Manila (PH). (74) Agents: SHERRARD-SMITH, Hugh et al.; Appleyard Lees, 15 Clare Road, Halifax, West Yorkshire HX1 2HY (GB).</p>		<p>(81) Designated States: AU, CA, ID, IN, KR, SG, US, VN, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). <b>Published</b> With international search report.</p>

(54) Title: CYCLING APPARATUS



(57) Abstract

A bicycle (1) or other cycling apparatus wherein the first chain (15) from the pedal driven gear (10), located coaxially with the rear wheel (3), terminates in an intermediate gear set (12, 14) and a second chain (9) from said intermediate gear set (12, 14) returns to drive the rear wheel (3). With such an arrangement, it is possible to include additional gear ratios to said cycle and cover a wide range of gear ratios. By situating the pedals (11) around the rear axle, the frame (4) can also be shortened and simplified to provide a small and lighter frame cycle. The frame (4) can be provided partially by a portion of an existing bicycle with modifications to allow conversion from a conventional model.

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**"CYCLING APPARATUS"****BACKGROUND TO THE INVENTION****FIELD OF THE INVENTION**

This invention relates to cycling apparatus and, in particular, although not solely, bicycles and similar apparatus. However, aspects of the invention may be applied to  
5 motorized cycles.

**BACKGROUND TO THE PRIOR ART**

Cycles have been provided in a large variety of forms in the past. The conventional bicycle comprises two wheels supported on a frame. Intermediate of the front and back  
10 wheels is a rotatably mounted set of pedals to drive a chain. The chain itself drives the rear wheel to provide power to the bicycle.

Similar constructions are provided on motor bikes with the pedals replaced by a motor or even three or four wheeled vehicles where the front and rear wheels of the cycle may be replaced with front or rear axles carrying one or more wheels.

In more recent times, it has become desirable to provide bicycles with some gearing  
15 aside from the single ratio available from a gear attached to the pedals to drive the chain and the gear mounted on the rear axle driven by the chain. To do so, bicycles have provided a plurality of gears at each of the ends of the drive chain so that the chain can be manoeuvred by linkages to a variety of sized gears adjacent the pedals and adjacent the rear axle. It is  
20 the ratio between the particular gears at each point which determines the overall gear ratio.

In such traditional bicycles, there is a limit to the available range of gearing provided on such bicycles. With only two axes about which gears can be mounted, the traditional arrangement has involved two gears adjacent the pedal or drive end of the chain and five or even six gears mounted about the rear axle. This provides a total number of ten or twelve

gear combinations. Although extra gears can be accommodated by increasing number of gears at each point, they begin to become unmanageable. The linkages and angle of the drive chain in trying to reach across additional gears increases the problems of such arrangements. Typically, the range of gears provided on such conventional bicycles are in  
5 the order of 1:1 to 4:1.

Further developments continuously being made to conventional bicycles are various attempts to reduce the weight of the bicycles. More expensive materials which allow reduced weight frames are being produced at high cost. However, there seems to be little development in producing or simplifying the frame itself or the manner in which the pedal  
10 arrangement is provided.

On conventional bicycles, the pedals are situated forward of the seat with the rear axle some distance behind the seat to accommodate the drive chain between the two. It is necessary to accommodate the pedals and the associated gears around the pedal axis between the front and rear wheels on the frame. This constrains the current design of such frames  
15 and arrangements for such bicycles generally.

#### OBJECT OF THE INVENTION

It is an object of the present invention to provide a cycling apparatus which can overcome some of the disadvantages of the conventional gearing arrangements. It is a further  
20 object of at least a preferred form of the apparatus to provide a simplified frame and arrangement for a bicycle. It is an object that the present invention provide a cycling apparatus which will provide the public with a useful choice.

## SUMMARY OF THE INVENTION

Accordingly, in a first aspect, the invention consists in a cycling apparatus comprising:

- drive means to provide rotational drive about a first axis;
- 5 - at least two gears mounted about a second axis;
- a first drive chain engaged about said first axis and receiving drive therefrom to drive rotation of one of said gears on said second axis;
- a wheel mounted on a wheel axis; and
- a second drive chain receiving drive from said at least second gear about said  
10 second axis and engaging about said wheel axis to drive rotation of said wheel.

Accordingly, in a second aspect, the invention consists in a cycling apparatus comprising:

- a front wheel;
- 15 - a rear wheel;
- a cycle frame mounting said front and rear wheels;
- pedals mounted on a pedal axis; and
- wherein said pedal axis is on or adjacent said rear wheel axis.

The second axis may be at a higher elevation than the wheel axis.

5 The cycling apparatus may include a further wheel spaced from said wheel, which wheels may be in line, and the distance from said wheel axis to the furthestmost portion of the furthestmost gear may be greater than the distance from said wheel axis to the nearest portion of said further wheel.

10 The apparatus may include at least two chain tensioners which may be spaced from each other and one of the chain tensioners may be in the region of the wheel axis and the other may be in the region of the second  
15 axis.

A frame member may extend between said second axis and said wheel axis and the gears, drive chains and wheel may be connected to said frame member. Said frame member may be detachably mounted on a further frame member of  
20 said cycling apparatus.

The present invention includes any combination of the herein referred to features or limitations.

25 Further aspects of this invention will be apparent to those skill in the art upon reading the following description.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention will now be described with reference to the following drawings in which:

- Fig. 1 is a side view of one embodiment of the apparatus;
- Fig. 2 is a front view of the embodiment of Fig. 1;
- Fig. 3 is a cross sectional view through the pedal and rear wheel access of an embodiment of the invention;
- 5 Fig. 4 is a cross sectional view through a second access of an embodiment of the apparatus;
- Fig. 5 is a side view of a portion of a frame of one embodiment of the apparatus; and
- Figs. 6A, B and C are schematic diagrams display the drive arrangement of an embodiment of the apparatus.

10

#### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

This invention and, in particular, the preferred embodiments, will be described with reference to a bicycle. Although a bicycle specifies a two-wheeled vehicle, the invention as described will obviously be applicable in many aspects to three or even four-wheel pedal  
15 driven vehicles.

Additionally, some aspects of the invention may be applied to motor driven vehicles including motor cycles. This is particularly the case for relatively simple cycles with motors mounted.

It should be understood that although frequent reference to the term bicycle is used,  
20 where applicable, this should be used to encompass such other constructions.

Looking at specific preferred embodiments, the general arrangement of a bicycle 1 is shown in Figs. 1 and 2.

In the preferred embodiment, Figs. 1 and 2, bicycle 1 can be seen to be provided with front and rear wheels 2 and 3 mounted on a frame 4. Also mounted on the frame 4 are

handled bars 5 rotatably mounted within the frame 4 and connected to the front view 2 such that rotation of the handle bars 5 rotates the front view in accordance with those fittings of a conventional bicycle. A seat 6 is provided for comfort and, also in accordance with a conventional bicycle, the bicycle is powered through the user applying weight to rotate pedals  
5 7.

This preferred form is principally going to be described with reference to an embodiment in which conventional pedal arrangements 7 are provided. This will typically comprise a pedal on either side of the cycle and substantially 180° out of phase so that weight applied to one pedal in a downward direction will allow the other pedal to lift to the  
10 top of its rotation. Of course, other pedal arrangements or even non-pedal related drive means may be substituted.

To clarify the manner in which the invention operates to assist description of the preferred embodiments, schematic diagrams of both the conventional bicycle and embodiments of this invention are provided in Fig. 6A to 6C. Referring to these figures, the  
15 conventional bicycle can be seen in Fig. 6A. In this conventional arrangement, the rear wheel 3 is rotated by drive applied to a gear, sprocket or other apparatus 8 to receive rotational drive. This means 8 to receive the rotational drive is itself driven by a suitable drive chain 9 or similar. Again, the preferred embodiments of this invention will refer to the use of a chain although this could be substituted for alternative means to drive a related  
20 axle from a distant axle.

Continuing the reference to Fig. 6A, the conventional bicycle is provided with pedals 11 connected to a further gear or sprocket 10. This gear or sprocket 10 drives the chain 9 to in turn rotate the sprocket 8 connected to the rear wheel 3.

In more advanced bicycles, a plurality of gears may be provided about the axis of the gears 8 and 10 as shown. The chain 9 can move between the gears to accommodate different gearing. For simplicity in the explanation of the invention, such additional gears have been neglected for the time being.

5 Referring to Fig. 6B, an alternative drive mechanism in accordance with one embodiment of the invention is shown. In this mechanism, the rear wheel 3 is again mounted on an axle containing a gear, cog, sprocket or similar means 8. This receives drive from the chain 9 which itself is driven by a sprocket 12 in the same manner as the conventional bicycle. However, unlike the conventional bicycle, the sprocket 12 is  
10 interconnected with a further sprocket or gear 14. This second gear or sprocket receives drive from a second drive chain 15. It is the second drive chain 15 which is driven at a further end by a sprocket or chain drive 10 connected to pedals or similar drive means 11.

Looking at the arrangement in Fig. 6B, it can be seen that the power from the pedals 11 undergoes a first change in gear ratio due to the difference in circumference between the  
15 gears 10 and 14. With the gears 14 and 12 being interconnected, rotation of the gear 12 is 1:1 with the gear 14. The drive to the rear wheel 3 can then be further manipulated by the gear ratio between the gear 12 and the final gear 8 on the rear wheel. It can be seen that the apparatus in Fig. 6B provides an intermediate axis on which the gears 12 and 14 are mounted to extend the overall drive chain and accommodate extra gearing.

20 A preferred arrangement for this invention is shown in Fig. 6C. In this arrangement, the gearing and operation of the drive chain are the same as shown in Fig. 6B. The only difference is that the position of the drive gear 10 and pedals 11 has changed to be coincident with the rear axle of the wheel 3. Although coincident and coaxial, the gear 10 and gear 8 are rotationally independent on the axis. Therefore, the pedals 11 can cause rotation of the

gear 10 which drives the chain 15 causing rotation of gear 14. The direct connection between the gear 14 and gear 12 causes rotation of the gear 12 driving rotation of the drive chain 9. The drive chain 9 rotates the gear 8 which, although in the same axis as gear 10, is capable of independent rotation. The wheel 3 can take the drive directly from the gear 8.

5 The gear ratio from the initial drive to the rear wheel is then determined by the ratio of the gears 10 and 14 as well as the ratio of the gears 12 and 8.

Turning to Fig. 3, we can see a cross section through the rear axle to show the general arrangement of the items.

It can be seen that the pedals 11 are connected through their cranks to the axle 16 interconnecting the pedals 11. As with a normal bicycle configuration, the pedals 11 are provided on opposed sides of the cycle.

Connected to the pedals 11 and taking drive from those pedals is the gear wheel 10. This is interconnected with the pedals 11 or axle 16 to rotate directly with those pedals.

The frame of the cycle 4 is interconnected by arms 17 and 18 about the axle 16.

15 Bearings 19 and 20 may be provided to allow rotation of the axle 16 within the mountings of the frame portion 17 and 18.

Also mounted on the axle 16 but rotationally independent therefrom is the gear wheel 8. The wheel 3 may be similarly mounted about the axle 16 but rotationally independent therefrom. The rear wheel 3 may take drive directly from the gear 8 through a direct

20 interconnection between the gear 8 and wheel 3.

Referring to Fig. 4, a cross section is provided of the independent second axis carrying the additional gears not directly driven by the pedals or directly driving the wheel. This gear set includes a first gear 12 mounted on an conventional axle 21 passing through

the frame 4. Again, bearings 22 and 23 may be provided to allow the axle 21 to rotate freely within the frame 4.

Interconnected with the axle 21 and rotationally fixed therewith is at least one or preferably, a set of gears 24. This set of gears 24 may be seen to replace the single gear 14.

5 The use of multiple gears at any point in the drive chain allows a greater number of gear ratios and gear combinations to be provided. As shown in this embodiment, the gear set 24 may comprise a standard gear set typically mounted on the rear axle of a conventional bicycle. Although in such conventional cases, the gear set generally connects directly into the rear wheel. Here it is necessary to key the gear set onto the axle or shaft 21 and an

10 adaptor 25 may provide this facility. Outer nuts 26 and washers 27 if required are provided to complete the arrangement.

Referring to Fig. 1, it can be seen that derailleurs and other alignment and chain length adjusters 28 may be provided wherever a multiple gear set is provided to accommodate changes in the length of the chain and to align the chain between the gears

15 when the selections are made. Again, such apparatus is typical on conventional bicycles and the same fittings can be utilized in the preferred embodiments of this invention.

Again referring to Fig. 1, it can be seen that a relatively simple frame mechanism can be provided. With the drive means in the form of the pedals being mounted substantially about the rear axle, there is no need for the positioning of a pedal set intermediate of the

20 front and rear wheels. It is possible to significantly shorten the bicycle and remove the lower frame members which are regularly provided merely to carry the pedal set. Instead, a simple triangle frame as shown in Fig. 1 can be provided.

As shown in Fig. 1, the frame 4 may comprise an upper bar 29 holding the seat 6. The handle bar column 30 can be connected to a downwardly angled tubular member 31

directed towards the rear axle of the bicycle. So far, the members provided are identical to those on the conventional bicycle. In fact, it is possible to simply cut a conventional bicycle at the ends of the members 29 and 31 as shown by ends 32 and 33 respectively to provide the front portion of the frame, front wheel and steering column. The additional portions can then be provided by means of a single member 34 carrying the second axis gear set 35 and connected to the rear wheel 3. It may be desirable to pivotally mount the member 34 to the tubular member 31 with the connection 36. A pivotable mounting in this region can be used in conjunction with a shock absorber or similar flexible support 37 between the upper bar 29 and the angled bar 34. This shock absorber or flexible support 37 can maintain the arrangement of the cycle while providing some damping against bumps or similarly shocks through the frame.

Turning to Fig. 5, a further arrangement is shown. In this arrangement, the steering column 30 and first angled portion 31 can accommodate receipt of a plug 38 to interconnect the bar 34 directly into the portion 31. A support directly to the upper member 29 can be provided via fitting 39.

As shown in this preferred form, a quick release hitch 40 allows access to the central core 41 which would carry the spindle and gear set for the gears at this region. The quick release mechanism may allow a rapid change of gear sets for different circumstances.

Thus it can be seen that the apparatus provides a cycling apparatus having a drive axis, an axis carrying a set of gears to increase or decrease the ratio of the gears and a third axis carrying the rear wheel. Although the first and third axes may be coincident, they are rotationally independent to perform their own functions. The use of coincident axes in this preferred embodiment allows a shorter cycle to be provided and a simplified frame mechanism.

The additional gears provided by the second axis gear set allows conventional apparatus to perhaps double the gear ratios provided on a standard bicycle. Instead of an overall gear ratio of ten gears engine from a ratio of 1:1 to a ratio of 4:1, the present apparatus may provide some twenty different gear combinations ranging from, for example,  
5 1:0.5 to 8:1.

The simplified frame may allow substantially lighter cycling apparatus and the arrangement of the pedals coincident with the rear axle is likely to provide the pedals more directly beneath the seat 6 or even behind the seat 6 if desired. This might allow greater flexibility in designing cycles and the correct riding positions for greater speed or economical  
10 effort.

Specific items mentioned in this description should be considered to incorporate all known equivalents or substitutes where required. References made in the singular may include the plural where applicable and the invention itself is not to be constrained by the description of the preferred embodiments. Instead, the invention is defined in the appended  
15 claims.

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

20 All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated

otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

- 5 The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

CLAIMS

1. A cycling apparatus comprising:
- drive means to provide rotational drive about a first axis;
  - 5 - at least two gears mounted about a second axis;
  - a first drive chain engaged about said first axis and receiving drive therefrom to drive rotation of one of said gears on said second axis.,
  - a wheel mounted on a wheel axis; and
  - a second drive chain receiving drive from said at least second gear about said  
10 second axis and engaging about said wheel axis to drive rotation of said wheel.
2. A cycling apparatus as claimed in claim 1 wherein said first, second and wheel axis are substantially parallel to each other.
- 15 3. A cycling apparatus as claimed in claim 2 wherein said first and wheel axis are substantially coincident or adjacent one another.
4. A cycling apparatus as claimed in claim 3 wherein said first and second drive chains are provided on opposed sides of a frame of said cycling apparatus.
- 20 5. A cycling apparatus as claimed in claim 2 wherein said drive means comprises at least a pair of pedals with each of said pair of pedals situated on an opposed side of a frame for said cycling apparatus.

6. A cycling apparatus comprising:
- a front wheel;
  - a rear wheel;
  - a cycle frame mounting said front and rear wheels;
  - 5 - pedals mounted on a pedal axis; and
  - wherein said pedal axis is on or adjacent said rear wheel axis.
7. A cycling apparatus as claimed in claim 6 wherein said cycle frame comprises a steering column support and front forks to support said front wheel; an upper member  
10 to carry a seat adjacent the top of the frame; and a downwardly angled member extending from said steering column support and terminating at said rear wheel axle to support both said rear wheel and said pedal assembly.
8. A cycling apparatus as claimed in claim 7 wherein an additional member is connected  
15 to said upper member and said downwardly angled member.
9. A cycling apparatus as claimed in claim 8 wherein said additional member is capable of flexible or compressive movement to provide some absorbing of shocks through the frame.
- 20 10. A cycling apparatus as claimed in any of claims 6 to 9 in which said pedal axis is substantially vertically downwards from a said seat on said cycling apparatus.

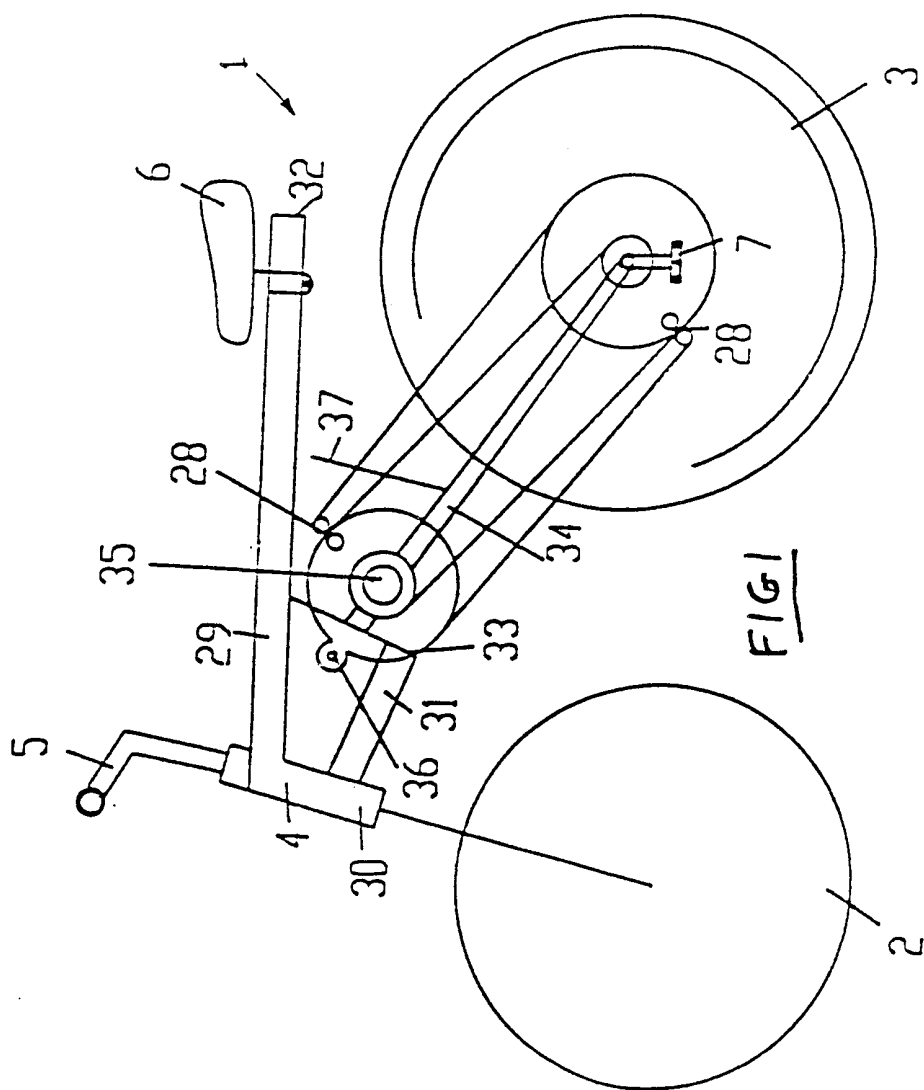
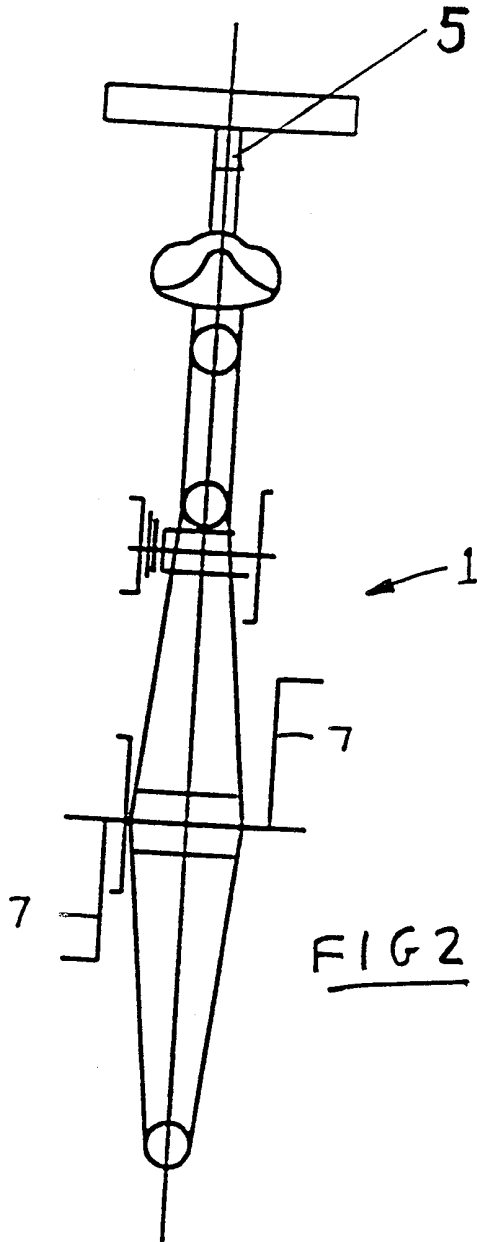
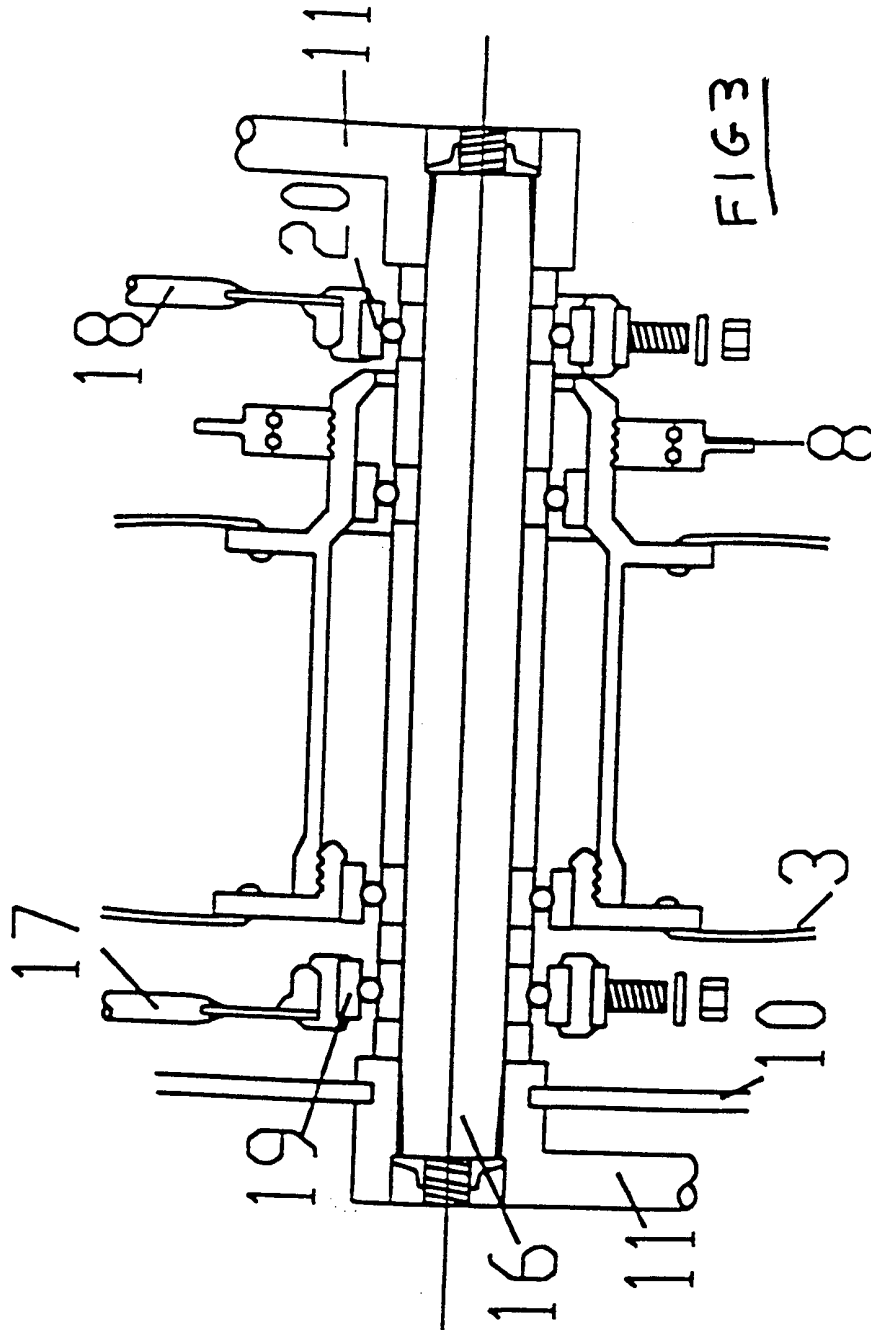


FIG 1





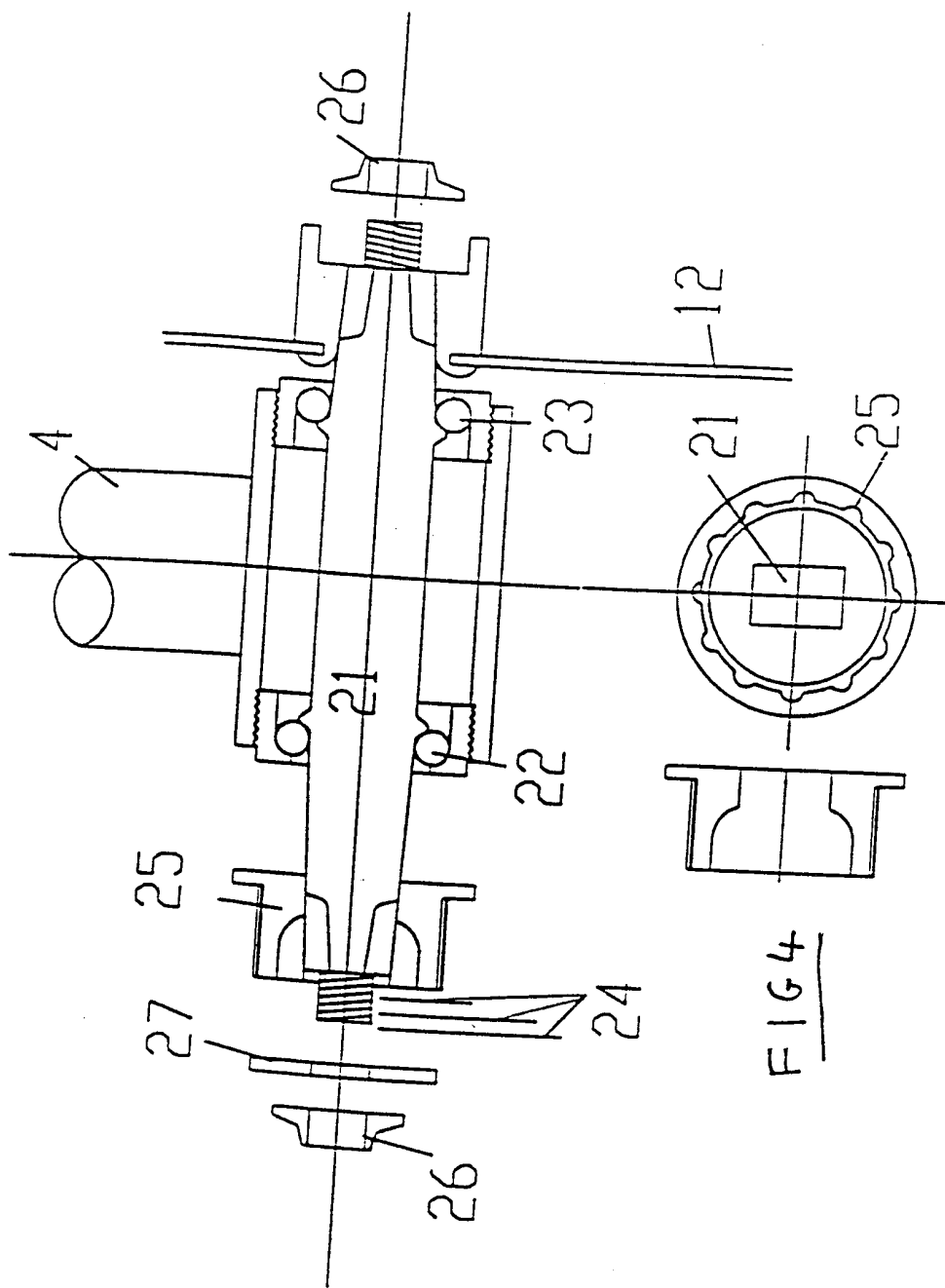
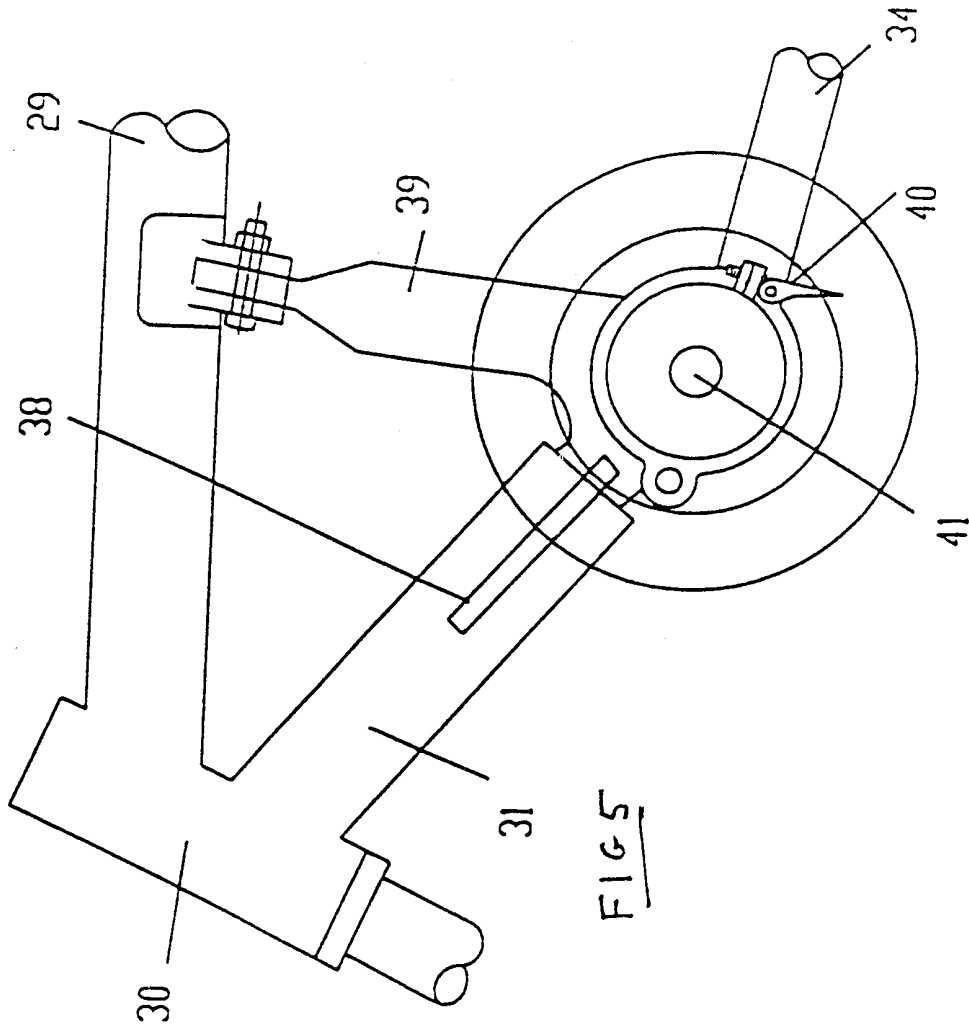


FIG 4



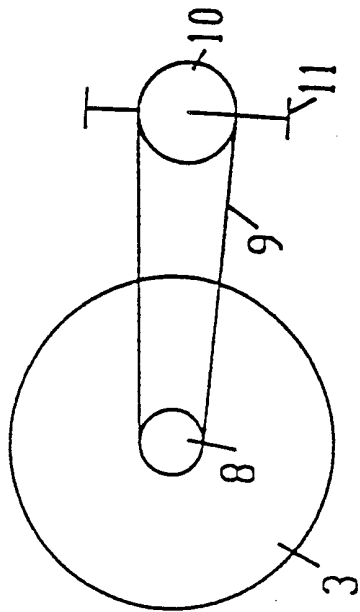


FIG 6A

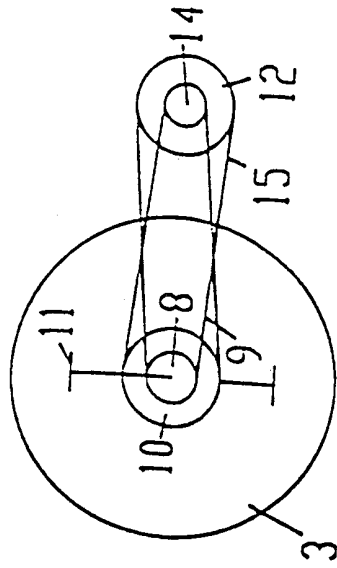


FIG 6C

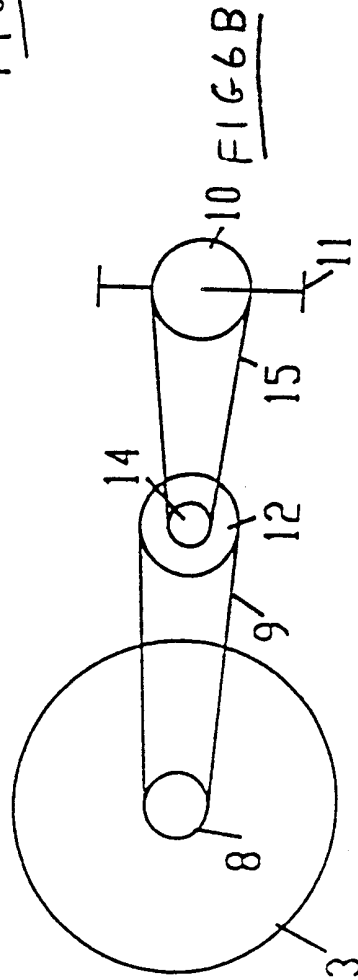


FIG 6B

# INTERNATIONAL SEARCH REPORT

International Application No <b>PCT/GB 98/03790</b>
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**A. CLASSIFICATION OF SUBJECT MATTER**  
**IPC 6 B62M9/04**

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 B62M**

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.
X	FR 966 149 A (MAIRE) 2 October 1950	1-3,5,6,10
Y	see figures	4
A	---	7,8
Y	FR 346 953 A (HÄRTEL) 17 February 1905 see figures	4
X	EP 0 154 118 A (TOUR MECCANICA SRL) 11 September 1985	6-8,10
A	see figures	3,9
X	BE 502 473 A (BOURGOIN) 30 April 1951	6,10
A	see the whole document	3,7,8
X	FR 922 168 A (GRÉGOIRE) 2 June 1947 see figures	1,2,5
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Further documents are listed in the continuation of box C.       Patent family members are listed in annex.

\* Special categories of cited documents :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"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</p> <p>"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</p> <p>"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.</p> <p>"&amp;" document member of the same patent family</p>
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Date of the actual completion of the international search <b>11 March 1999</b>	Date of mailing of the international search report <b>24/03/1999</b>
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Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer <b>Goeman, F</b>
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# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/GB 98/03790

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 92 10394 A (BOLAND GERARD) 25 June 1992 see figures -----	1,2,5

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 98/03790

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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FR 346953	A		NONE	
EP 0154118	A	11-09-1985	JP 60179378 A	13-09-1985
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