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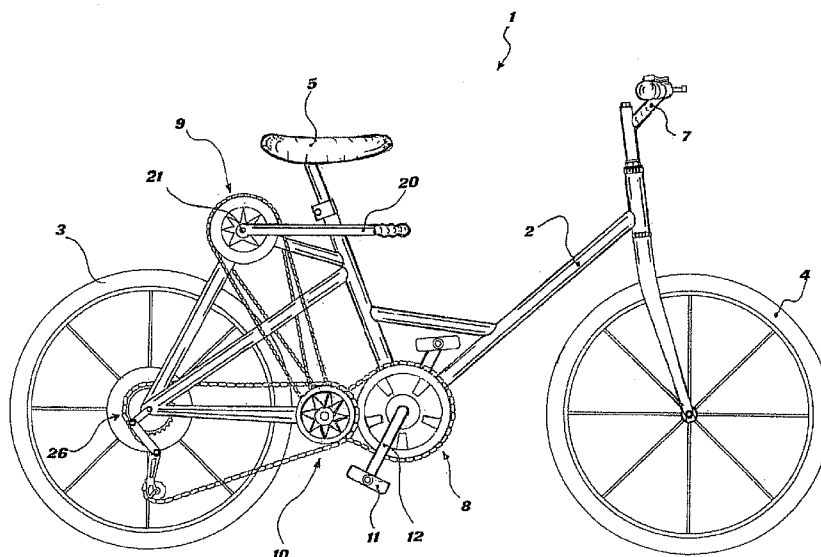
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(54) Title: HUMAN POWERED VEHICLE



**FIG.1**

(57) Abstract: The present invention refers to a human powered vehicle. In particular, the present invention lies within the field of cycles, having two or more wheels, allowing a user to transmit to the driving wheels a power definitely higher compared to the case of a traditional bicycle.

## HUMAN POWERED VEHICLE

### DESCRIPTION

The present invention refers to a human powered vehicle. In particular, the present  
5 invention lies within the field of cycles having two or more wheels.

As is known, such vehicles, regardless of the number of wheels, are generally driven by pedals operated from the user by his/her lower limbs.

However, the energy that thus can be transmitted and therefore converted into mechanical energy to be used for motion is relatively little, compared to the potential a  
10 human being might express.

This is due essentially to two factors. On the one hand, the traditional-type push thrust, exerted by feet alone, exploits merely a fraction of the body muscles and therefore of the user's potential abilities.

On the other hand, the mechanical system for converting muscular energy into  
15 mechanical energy, i.e. the pedals/cranks system, is not particularly effective, having to comply with structural limitations due to sizes and the relationship of said sizes with human limb sizes.

In other words, pedal cranks, by having to be of a given length in order to be moved by legs, require very high efforts in order to be able to apply forces of a certain  
20 importance and therefore develop powers of a certain importance.

Object of the present invention is to overcome the above-disclosed problems, and this is attained by a human powered vehicle as defined by claim 1.

The present invention, by overcoming the problems of the known art, entails several evident advantages.

25 In particular, the present invention allows the user to transmit to the driving wheels a power definitely higher compared to the case of a traditional bicycle.

Moreover, by being able to make the vehicle advance both by action of the lower limbs and action of the upper limbs, as well as of both in conjunction, the user could advantageously find various pace modes also allowing him/her to temporarily rest the  
30 legs or arms, though always continuing to move.

These and other advantages, along with the features and the operation steps of the present invention, will be made apparent in the following detailed description of preferred embodiments thereof, given by way of example and not for limitative purposes. Reference will be made to the figures of the annexed drawings, wherein:

- 5        -        Figure 1 is a side view of a vehicle according to a first embodiment of the present invention;
- Figure 2 is a schematization of the propulsion and drive system of the vehicle of Figure 1;
- Figure 2A illustrates the motion of some parts of the vehicle of Figure 1;
- 10       -        Figure 3 is a perspective view of a vehicle according to a second embodiment of the present invention;
- Figure 4 is a schematization of the propulsion and drive system of the vehicle of Figure 3;
- Figures 4A, 4B, 4C and 4D illustrate the motion of some parts of the vehicle of Figure 3;
- 15       -        Figure 5 is a perspective view of a vehicle according to a third embodiment of the present invention;
- Figure 6 is a schematization of the propulsion and drive system of the vehicle of Figure 5;
- 20       -        Figure 7 is a perspective view of a vehicle according to a fourth embodiment of the present invention;
- Figure 8 is a schematization of the propulsion and drive system of the vehicle of Figure 7;
- Figure 9 is a perspective view of a vehicle according to a fifth embodiment of the present invention; and
- 25       -        Figure 10 is a schematization of the propulsion and drive system of the vehicle of Figure 9.

The present invention will hereinafter be described in detail making reference to the above-indicated figures.

- 30       In particular, Figures 1 to 2A refer to a first embodiment of a vehicle according to the present invention.

According to such first embodiment, a human powered vehicle 1 is substantially made in the form of a traditional bicycle. Therefore, it comprises a frame 2 which bears two wheels 3, 4. Of those, the rear wheel 3 is a drive wheel, whereas the front wheel 4 is a steering wheel.

5       The frame 2 also bears a driver's seat 5, in particular a saddle for the user, and a steering system 7, rotatably mounted and connected to the front wheel 4.

The vehicle 1 provides first propulsion means, generally denoted by number 8, apt to be operated from the user by his/her lower limbs.

10       In particular, such first propulsion means comprises a pedals and pedal cranks mechanism, for the rotation of a drive shaft 17.

A detailed description of such a pedal mechanism is not deemed necessary, it being certainly known to a person skilled in the art and therefore within his/her reach. It will merely be mentioned that the mechanism, by rotation of the drive shaft 17, sets in rotation a pinion 13, e.g. toothed. The pinion, by a chain, sets in rotation a  
15       corresponding rotating member 14, directly or indirectly connected to the drive wheel.

In the example in the figure, the rotating member 14 is mounted on a second shaft 18, and then connected to the drive wheel by a further pair of crown gears 15, 16.

20       According to the invention, the vehicle 1 further comprises second propulsion means, generally denoted by number 9 in the figure, apt to be operated from the user by his/her upper limbs.

Specifically, such second propulsion means 9 comprises a mechanism operable by one or more alternating motion hand operable levers.

In particular, the vehicle is equipped with two hand operable levers 20, each of which comprises a respective bar hinged at one end to said frame at a hinge point 21.

25       As illustrated in Figure 2A, each of such bars is mounted so as to be able to be moved by a rotation around said hinge point 21, of a predetermined angle  $\alpha$ , alternately in two opposite ways.

30       The system then provides a mechanism for converting the alternating motion of the hand operable lever 20 into a rotating motion applicable, directly or indirectly, to the drive wheel 3.

According to such first embodiment, said converting mechanism comprises, for each of the levers 20, a pair of crown gears. One of said gears is mounted on the axis of rotation of the lever around said hinge point, the other one is splined onto the shaft 18. The two gears are then connected to each other by a belt or a chain.

5        Advantageously, one of the belts or chains related to the two hand operable levers 40 is crossed, as clearly visible in Figure 1, with respect to the other one.

This results in one of the two levers transmitting motion when moved one way, the other lever transmitting motion when operated the opposite way. This, by moving in an alternating manner the levers, allows to always have one lever engaged to transmit  
10       motion to the wheel, and therefore greater continuity in the thrust.

Alternatively, the converting mechanism may take on different forms, e.g. it may comprise a tie-rod connected between said lever and a rotating member which transmits motion to the drive wheel.

In any case, the kinematic mechanism is preferably equipped with a freewheel. A  
15       freewheel is a mechanism allowing free rotation of the member onto which it is mounted along a direction of rotation, while it drags said member into rotation in the opposite direction.

Therefore, evidently the motion of the lever 20 is converted into rotary motion of the shaft 18 which, by being connected to the drive wheel, produces a rotation thereof.

20       Hence, power developed from the user by the levers 20, and transmitted to the drive wheel 3, adds up to that developed always from the user by the classic pedals, and that anyhow is transmitted to the drive wheel 3.

It has to be understood that the two hand operable levers 20 may be independent from each other and therefore could be operated the one independently of the other,  
25       even individually, according to user's preferences.

Next figures 3, 4 and 4A refer to a second embodiment of a vehicle according to the present invention.

According to such second embodiment, a vehicle 31 is made in the form of a three-wheeled human powered vehicle.

30       In particular, the vehicle 31 comprises a frame 32, two rear drive wheels 33 and a front steering wheel 34.

The vehicle 31 comprises first propulsion means apt to be operated from a user by his/her lower limbs, and second propulsion means apt to be operated from the user by his/her upper limbs.

As above-described in connection with the first embodiment, such second  
5 propulsion means comprises a mechanism operable by one or more alternating motion hand operable levers 50.

The operation of such first and second propulsion means is substantially equal to what already described in connection with the corresponding means of the first embodiment; therefore, it is not deemed necessary to repeat every detail herein.

10 Advantageously, as above-indicated for the first embodiment, for one of the hand operable levers 50 there may be provided the presence of a belt or chain, mounted crossed to obtain the above-described advantages. Alternatively, for each one of the two levers, independent of each other, also a dual converting mechanism may be provided, so that the corresponding hand operable lever 50 be always in engagement,  
15 regardless of the direction of rotation imparted by the user.

Figure 4 clearly illustrates the scheme of the kinematic mechanism and supports the reader in understanding its operation.

Unlike what described above in connection with the first embodiment, in the vehicle 31 also the first propulsion means comprises a mechanism operable by one or more  
20 alternating motion pedal operable levers 40.

In particular, each of the pedal operable levers 40 comprises a respective bar hinged at one end to the frame at a hinge point 41 and apt to be moved by a rotation around said hinge point 41, of a predetermined angle, alternately in two opposite ways.

Therefore, in this case as well it is required a mechanism for converting the  
25 alternating motion of the pedal operable lever 40 into a rotating motion applicable to the driving wheels 33.

According to said embodiment, the converting mechanism comprises a tie-rod connected between the pedal operable lever 40, e.g. by 42 a half crown 43, and a respective rotating member 44 apt to transmit the motion, directly or indirectly, to a  
30 drive wheel.

Advantageously, the rotating member 44 may comprise a freewheel.

The tie-rod 42, besides contacting the rotating member 44 and setting it in rotation, has one end connected to the frame 32 by an elastic element 45, e.g. a spring. Said elastic element serves to return the pedal operable lever 40, after operation from the user, to bring it again into an operative position, ready to be operable again.

5 For this embodiment as well, it is to be understood that the two pedal operable levers 40 are independent of each other and therefore could be operated the one independently of the other one, even individually, according to the user's preferences.

According to said embodiment, the vehicle 31 further comprises a steering system operable by limited pivoting of the driver's seat 50 by means of a mechanism with tie-  
10 rods and/or transmission means connected between the seat 50 and the steering system. One example of a possible operation of the steering system is schematically illustrated in Figures 4B, 4C, 4D.

The pivoting of the seating plane of the driver's seat 50 causes an opposite action on two sheathed cables connected thereto; one cable retracts, whereas the other one  
15 extends.

At the other end, the two sheathed cables are fixed to an element rigidly connected to the steering gear, in a position such that the opposite motion of the cables causes a rotation thereof and therefore a rotation of the steering gear itself.

Next Figures 5 and 6 refer to a third embodiment of a vehicle according to the  
20 present invention.

Such third embodiment differs from the second one only in that the human powered vehicle 61 is made in the form of a four-wheeled vehicle.

From the standpoint of the technical features, all that has been described so far for the preceding embodiments holds true for vehicle 61.

25 Next Figures 7 and 8 refer to a fourth embodiment of a human powered vehicle according to the present invention.

According to such fourth embodiment, a vehicle 71 is made in the form of a three- or four-wheeled human powered vehicle.

Unlike what described in connection with the second and the third embodiment, the  
30 vehicle 71 provides that the first propulsion means, i.e. that operated from the user by his/her lower limbs, be made in the most classic form of a pedals and pedal cranks

mechanism that, by pinion, crown and chain, imparts a rotary motion to a drive shaft that, directly or indirectly, sets in rotation the driving wheels.

Finally, Figures 9 and 10 refer to a fifth embodiment of a human powered vehicle according to the present invention.

5 According to such fifth embodiment, a vehicle 81 is made in the form of a three- or four-wheeled human powered vehicle.

The vehicle 81 provides that the first propulsion means, i.e. those operated from the user by his/her lower limbs, be made by pedal operable levers. However, unlike what seen so far, said levers are hinged to the frame in a point set substantially below the  
10 driver's seat and extend toward the front portion of the vehicle. This results in a slightly different driving position, from which the user to a greater extent towers above the pedal operable levers and therefore may reasonably impart them a greater force, by being able to bear thereon with his/her full weight.

The present invention has hereto been described with reference to preferred  
15 embodiments thereof. It is understood that each of the technical solutions implemented in the preferred embodiments described herein by way of example could advantageously be differently combined thereamong to generate other embodiments, all falling within the concept of the same invention and all however comprised within the protective scope of the claims hereinafter.



CLAIMS

1. Human powered vehicle (1; 31; 61; 71; 81) comprising:
- a frame (2; 32);
  - 5 - one or more driving wheels (3; 33);
  - a driver's seat (5; 35) for a user;
  - first propulsion means (11, 12, 13; 40, 41, 43) apt to be operated from said user by his/her lower limbs;
  - second propulsion means (20, 21; 50, 51) apt to be operated from said user by
  - 10 his/her upper limbs;
- wherein said second propulsion means (20, 21; 50, 51) comprises a mechanism operable by one or more alternating motion hand operable levers (20; 50), said vehicle further comprising a steering system operable by limited pivoting of said driver's seat by means of a mechanism with tie-rods and/or transmission means connected
- 15 between said driver's seat and said steering system.
2. Vehicle according to claim 1, wherein each of said hand operable levers (20, 50) comprises a respective bar hinged at one end to said frame at a hinge point (21) and apt to be moved by a rotation around said hinge point, of a predetermined angle,
- 20 alternately in two opposite ways.
3. Vehicle according to claim 2, wherein said second propulsion means comprises, for each of said hand operable levers (20; 50), a mechanism for converting the alternating motion of the lever into a rotating motion applicable to a respective rotating member
- 25 apt to transmit the motion to a drive wheel.
4. Vehicle according to claim 3, wherein said converting mechanism comprises a tie-rod connected between said hand operable lever and said rotating member.
- 30 5. Vehicle according to claim 3 or 4, wherein said rotating member comprises a freewheel.

6. Vehicle according to anyone of the claims 1 to 5, wherein said first propulsion means comprises a pedals and pedal cranks mechanism (11, 12, 13) for the rotation of a drive shaft (17).

5

7. Vehicle according to anyone of the claims 1 a 5, wherein said first propulsion means comprises a mechanism operable by alternating motion pedal operable levers (40) .

8. Vehicle according to claim 7, wherein each of said pedal operable levers comprises a respective bar hinged at one end to said frame at a hinge point (41) and apt to be moved by a rotation around said hinge point, of a predetermined angle, alternately in two opposite ways.

9. Vehicle according to claim 8, wherein said first propulsion means comprises, for each of said pedal operable levers (40), a mechanism for converting the alternating motion of the lever into a rotating motion applicable to a respective rotating member apt to transmit the motion to a drive wheel.

10. Vehicle according to claim 9, wherein said converting mechanism comprises a tie-rod connected between said pedal operable lever and said rotating member.

11. Vehicle according to claim 9 or 10, wherein said rotating member comprises a freewheel.

25

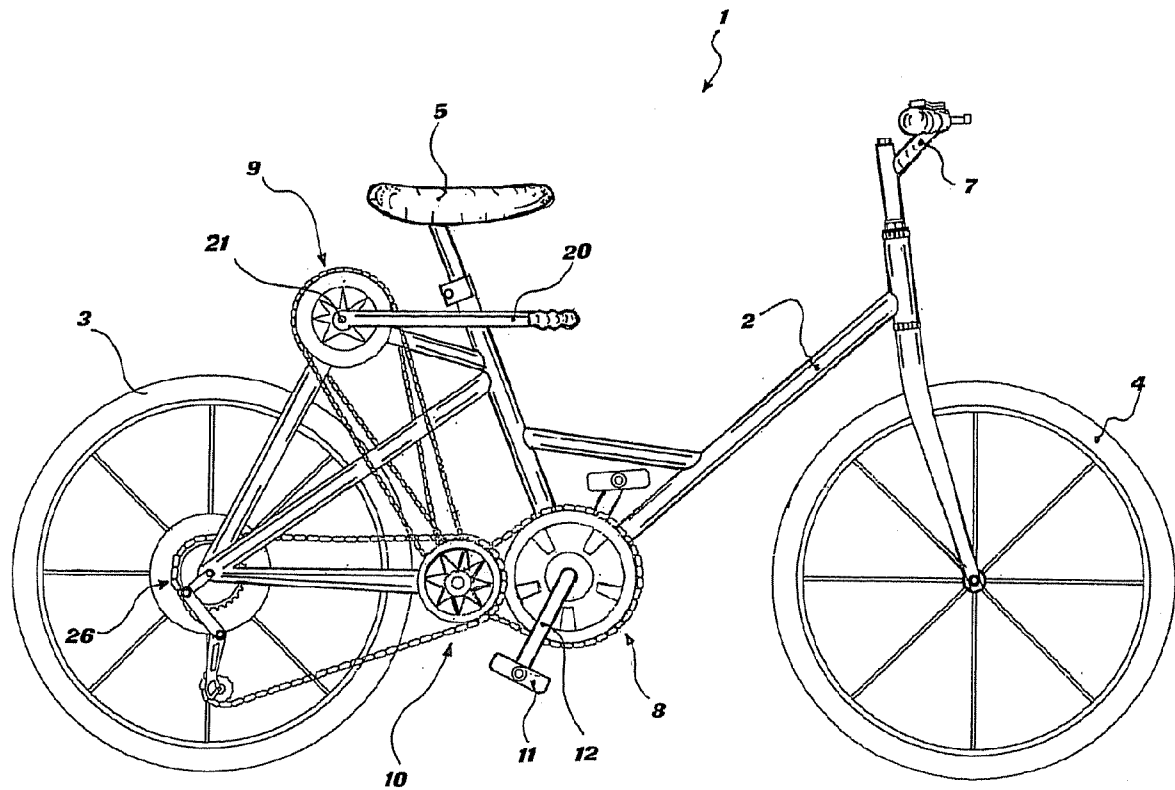


FIG. 1

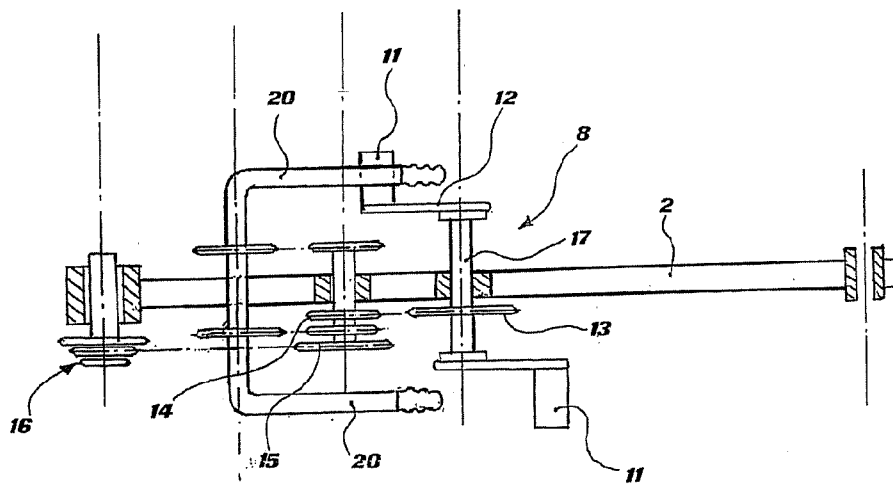


FIG. 2

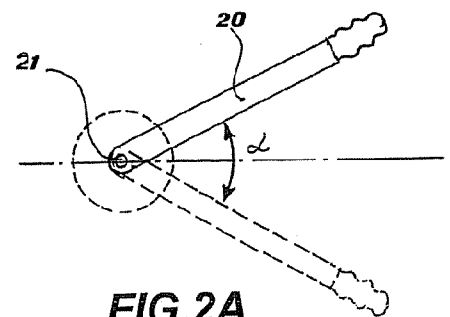


FIG. 2A

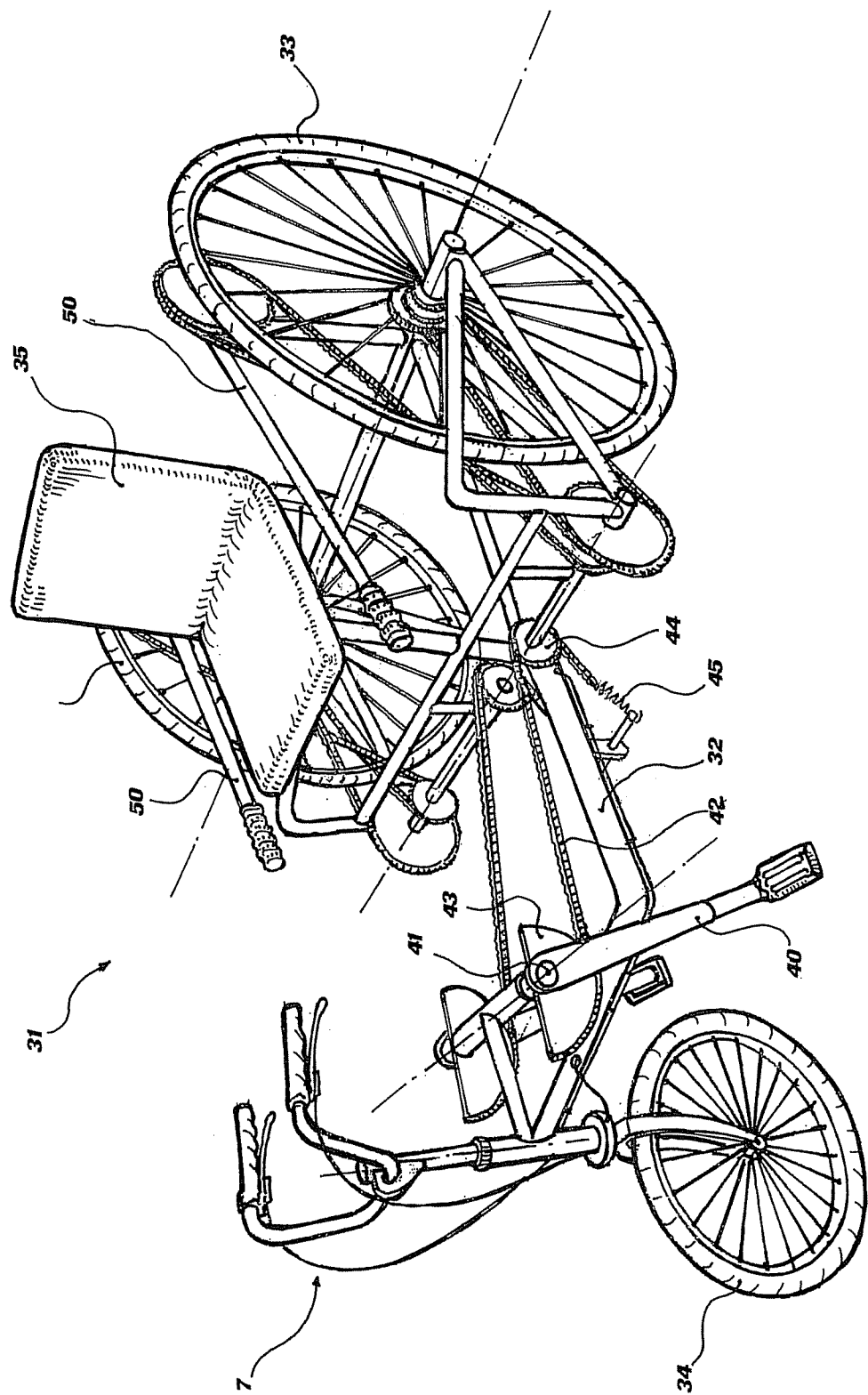


FIG.3

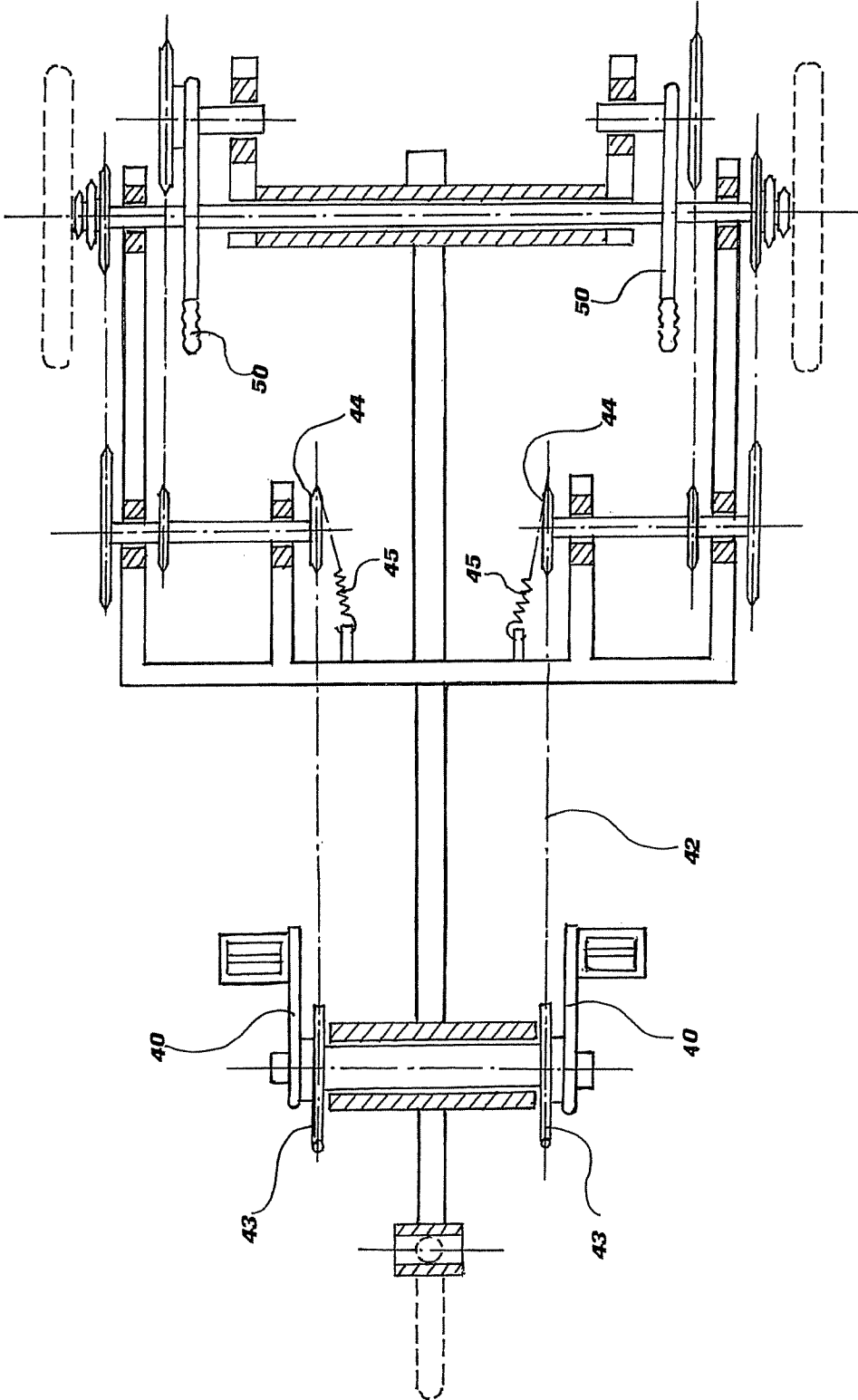


FIG.4

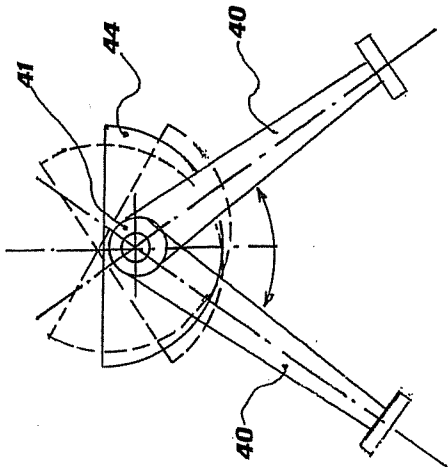


FIG. 4A

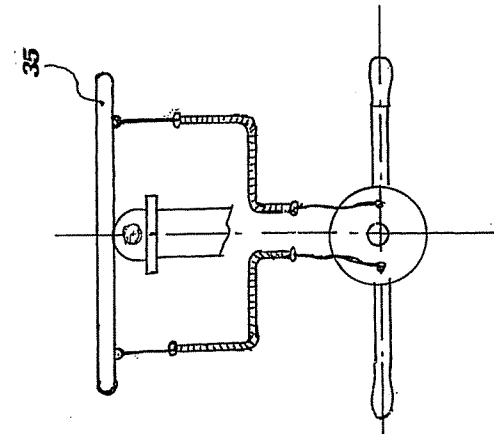


FIG. 4B

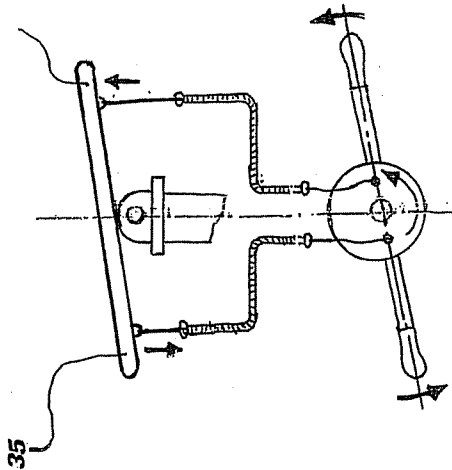


FIG. 4C

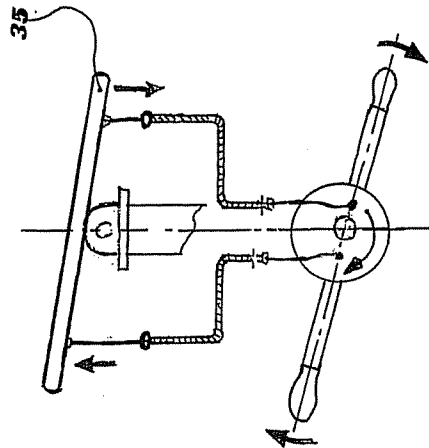


FIG. 4D

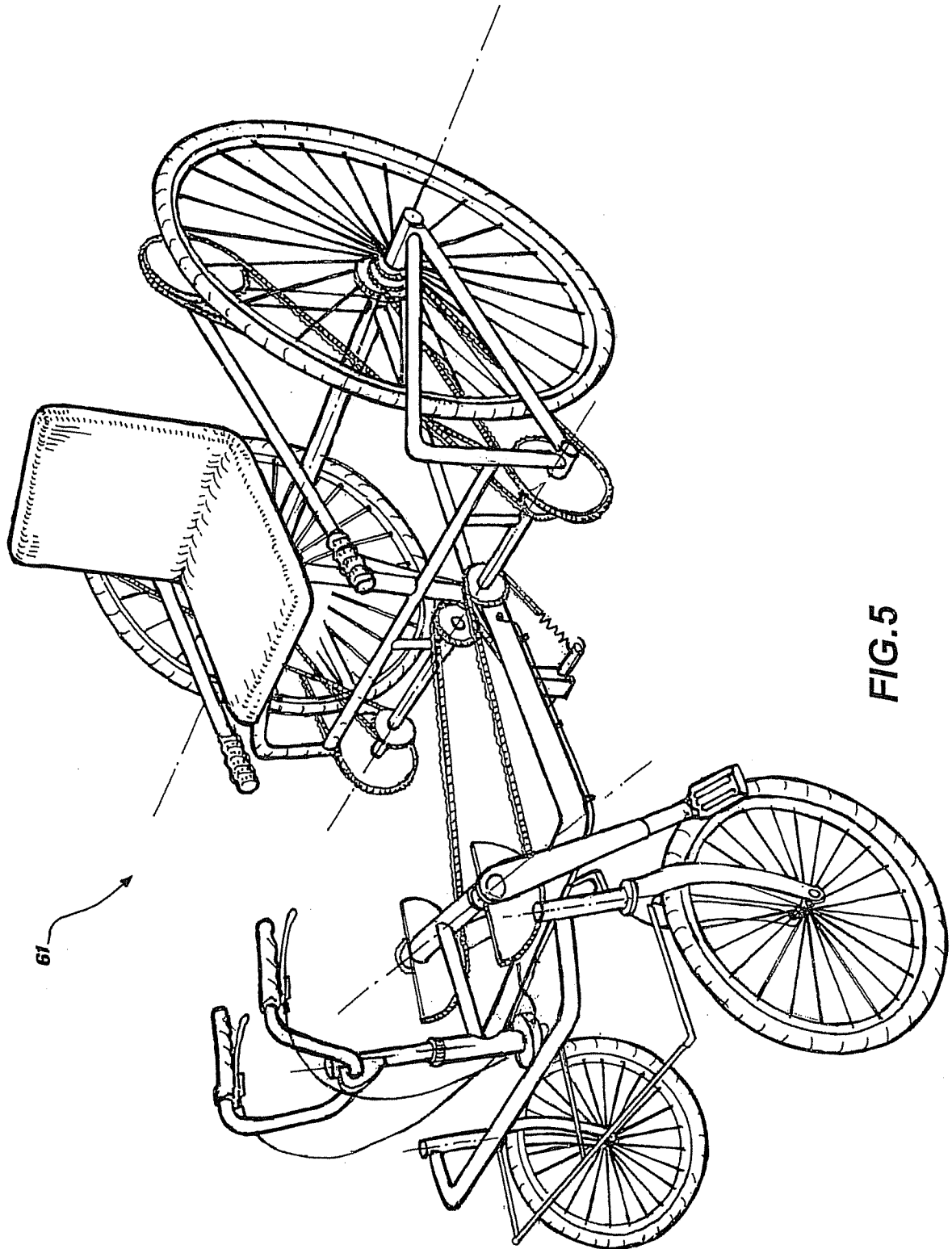


FIG.5

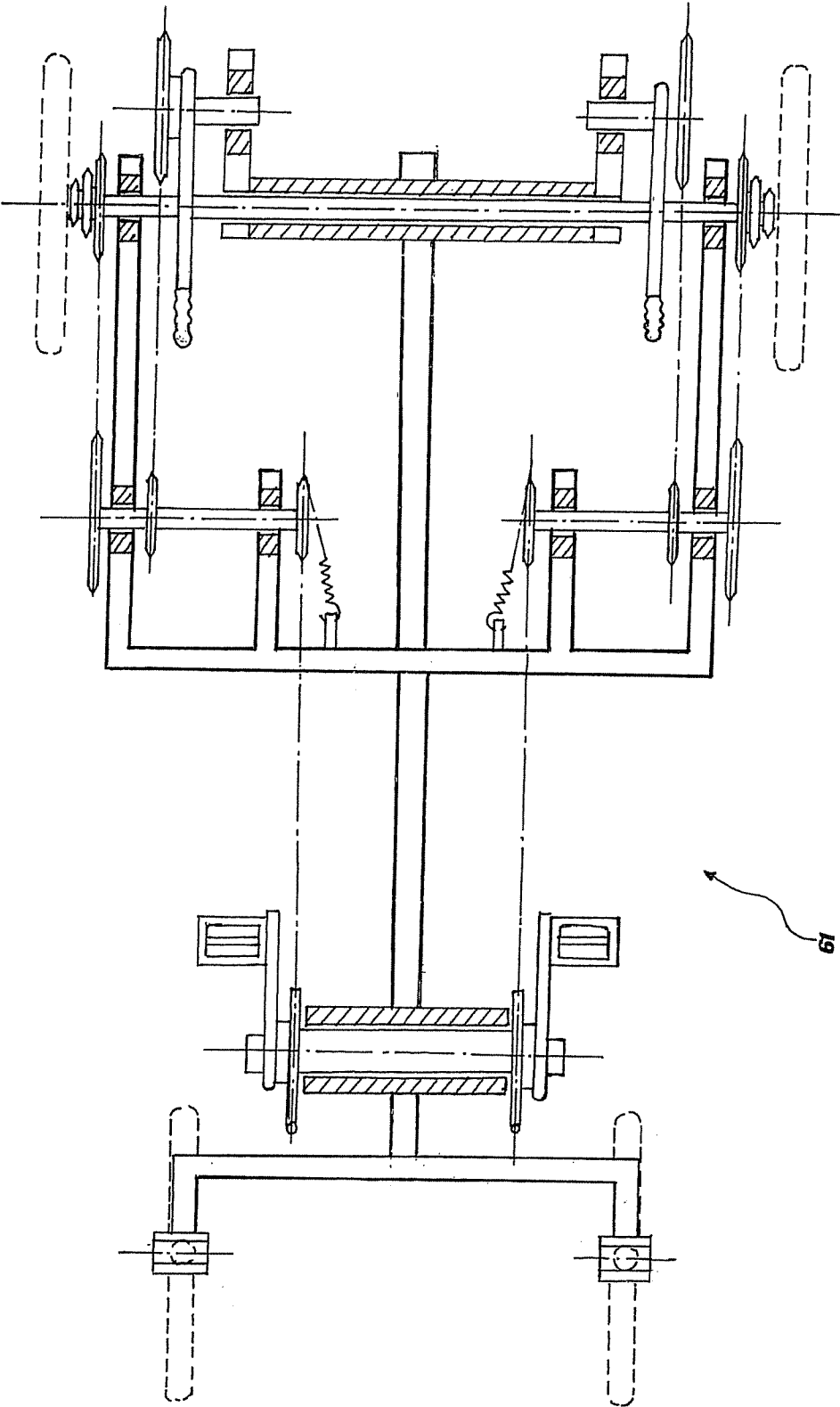


FIG.6

61



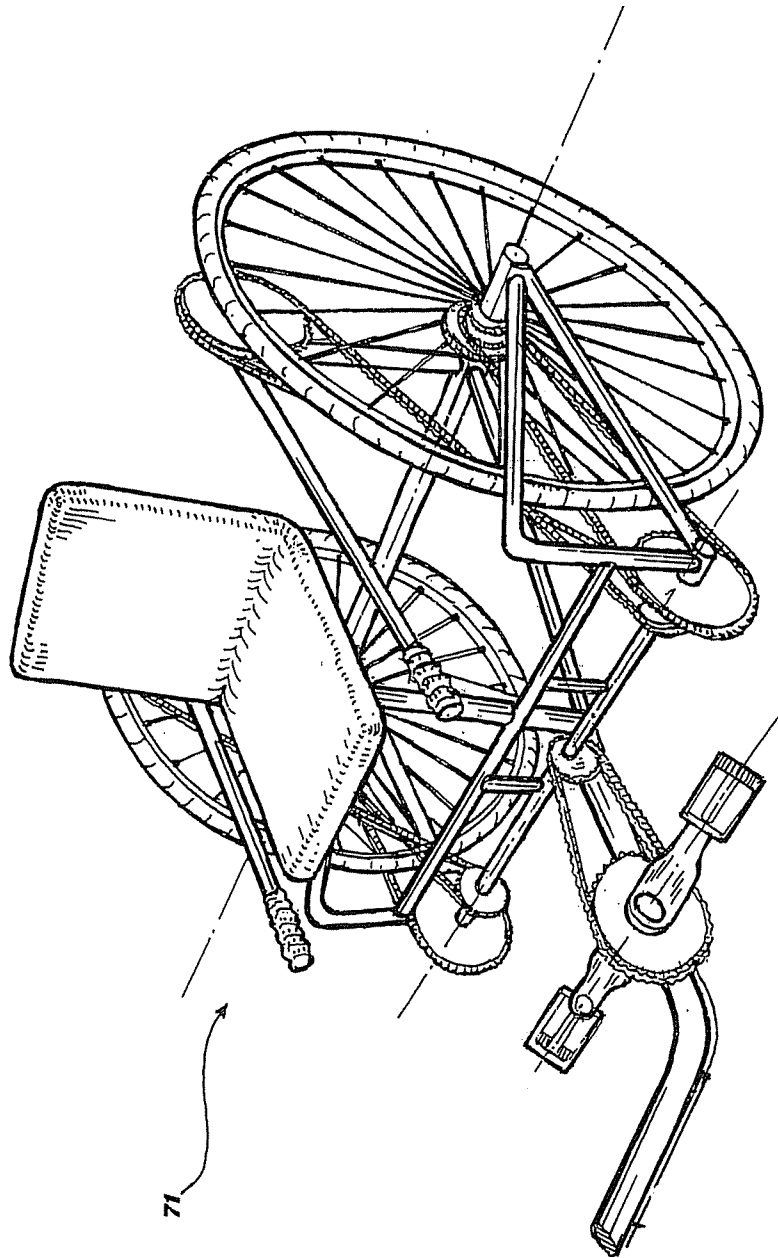


FIG.7

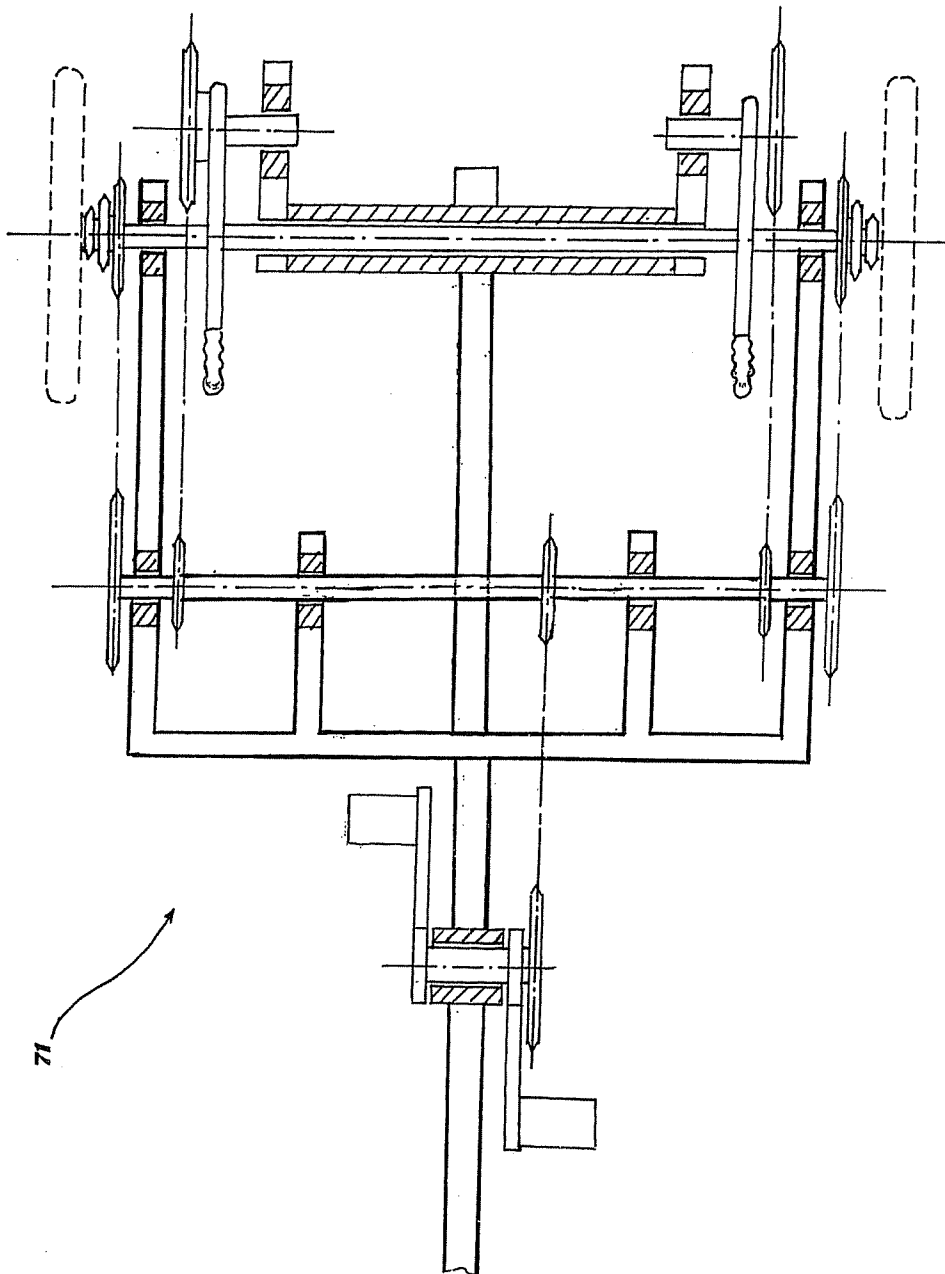


FIG. 8

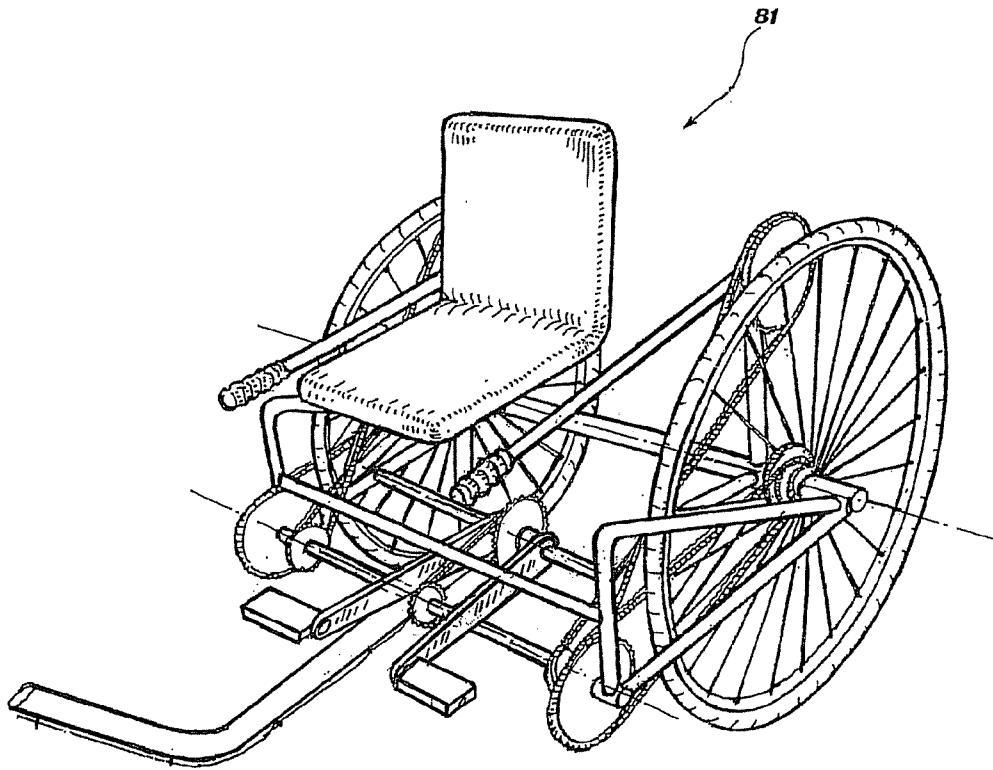


FIG. 9

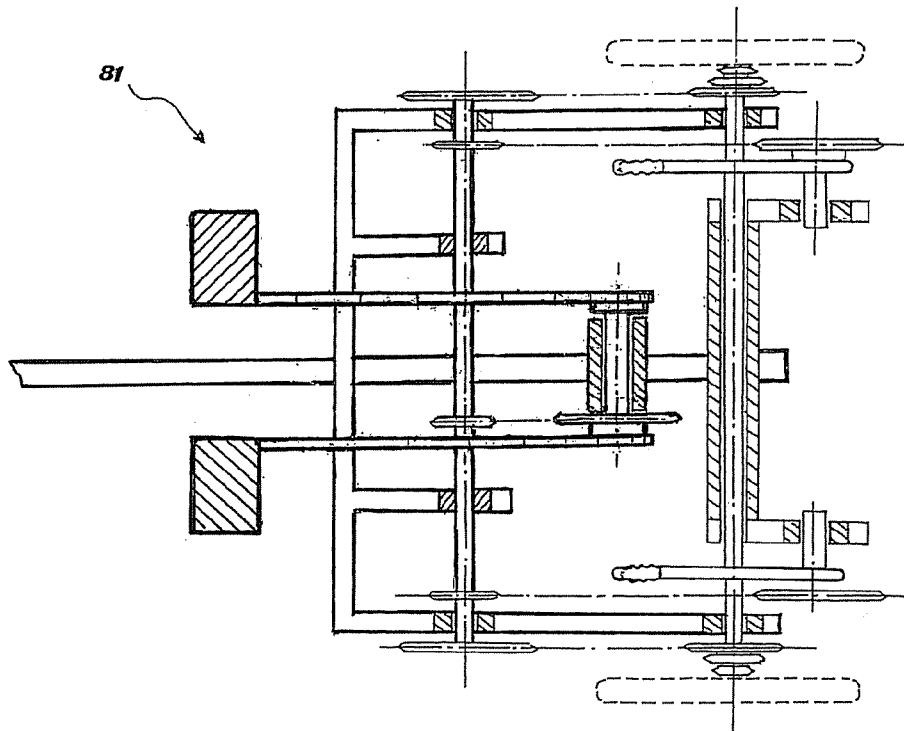


FIG. 10

## INTERNATIONAL SEARCH REPORT

International application No

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## A. CLASSIFICATION OF SUBJECT MATTER

INV. B62M1/12 B62K5/08  
ADD.

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)

B62M B62K

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 practicable, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C.



See patent family annex.

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22/01/2014

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Information on patent family members

International application No

PCT/IB2013/058400

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