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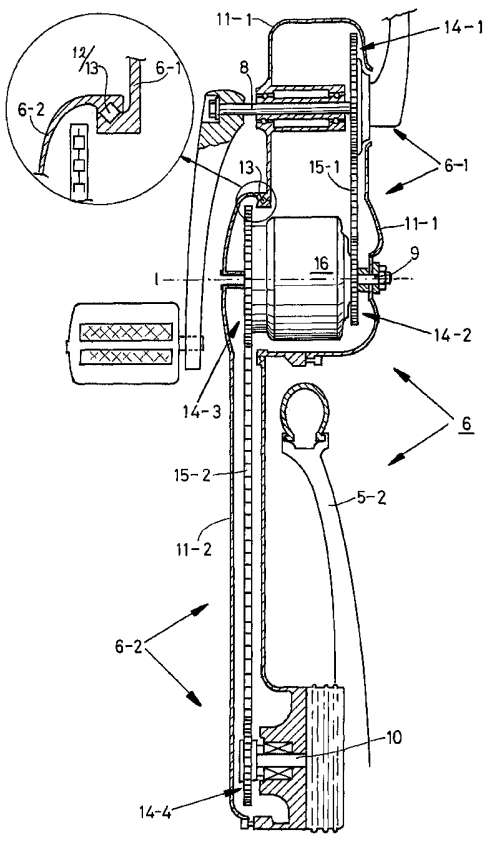
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(54) Title: BICYCLE AND DRIVE UNIT COMPRISING A SPRING-MOUNTED DRIVING ELEMENT




(57) Abstract: There is disclosed a bicycle comprising a frame (2) provided with spring means as well as a drive unit (6) consisting of a crankshaft (8), an auxiliary shaft (9) and a rear shaft (10), which is connected to the frame (2). The drive unit (6) is built up of two parts, wherein the first part (6-1), which comprises the crankshaft (8) and the auxiliary shaft (9), is rigidly connected to the frame (2), and wherein the second part (6-2), which comprises the rear shaft (10), is capable of spring-actuated pivoting movement. The advantage of the bicycle and the drive unit according to the invention is the fact that the first part (6-1) of the drive unit (6) is rigidly connected to the frame (2) and need not be spring-mounted. As a result, the weight of the second part (6-2), which is spring-mounted, is reduced, so that a lighter construction can be used also for the spring means in question. This leads to improved spring characteristics of the bicycle.

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# BICYCLE AND DRIVE UNIT COMPRISING A SPRING-MOUNTED DRIVING ELEMENT

The present invention relates to a bicycle provided with a frame having spring means, as well as a drive unit to be provided with a crankshaft, an auxiliary shaft and a rear shaft, which drive unit is connected to the frame.

The present invention also relates to a drive unit suitable for use in said bicycle, wherein the term bicycle is understood to include push-bikes, mopeds and the like.

Such a bicycle comprising a drive unit is known from NL 1009314. The known bicycle comprises a collapsible two-part frame, wherein the second frame part is provided with the drive unit. The drive unit consists of a crankshaft, an auxiliary shaft and a rear shaft, each having chain wheels, over which drive chains are passed. In one embodiment, the drive unit forms a rigid whole, which is in its entirety capable of spring means actuated pivoting movement about a horizontal axis. The relatively heavy gear mechanism is mounted on the auxiliary shaft near the crankshaft in that case, so that the moment of inertia can remain small during spring-actuated movement of the whole, which has a positive effect on the spring characteristics.

A drawback of the known bicycle is the fact that the spring means still need to be of relatively heavy construction.

The object of the present invention is to provide an improved bicycle having a drive unit wherein a lighter construction for the spring means may be used.

According to the invention, the bicycle and the drive unit are to that end characterized in that the drive unit is built up of two parts, wherein the first part, which is to be provided with the crankshaft and the auxiliary shaft, is rigidly connected to the frame, and wherein the second part, which is to be provided with the rear shaft, is capable of spring means actuated pivoting movement.

The advantage of the bicycle and the drive unit according to the invention is the fact that the first part of the drive unit is rigidly connected to the frame and need not be spring-mounted. As a result, the weight of the second part, which is spring-mounted, is reduced, so that a lighter construction can be used also for the spring means in question. This leads to even further improved spring characteristics of the bicycle.

In addition, the first part of the drive unit may be positioned practically under the person who is riding the bicycle, viz. in the centre of gravity of the bicycle, on which in addition to the forces being exerted on the crankshaft also the forces of gravity of said person and of the bicycle act. The great forces and torques being exerted at that point are concentrated as much as possible in that case, so that said centre of forces can be made as robust as necessary, whilst a lighter construction can be used for the rest of the bicycle.

One embodiment of the bicycle according to the invention is characterized in that the two parts of the drive unit are each accommodated in a box-shaped casing.

The two box-like casings of the two parts of the drive unit prevent penetration of dust, dirt and moisture,

thus ensuring a continued smooth operation of the gears and the chain transmission that are accommodated therein.

If in a further embodiment said casings are oil-tight casings, it is possible to provide a leak-proof, maintenance-free lubricating system therein, for example a capillary lubricating system.

Another embodiment of the bicycle according to the invention is characterized in that the two parts of the drive unit are self-supporting and capable of pivoting movement with respect to each other by means of a ring bearing.

The ring bearing present between the two parts of the drive unit enables spring-actuated pivoting movement of the two self-supporting parts of the drive unit with respect to each other in a reliable manner, without an additional hinge mechanism being required. Furthermore, such a ring bearing is small in width and easy to clean and to dismount, with easy access to the drive mechanism present within the first part of the drive unit being possible via the ring bearing, which usually has a large diameter.

A symmetric embodiment of the bicycle according to the invention is characterized in that the centre of the ring bearing is located at the level of the auxiliary shaft.

The second part of the drive unit is thus capable of spring-actuated pivoting movement, as it were, about the auxiliary shaft and the ring bearing, which is concentric therewith.

One embodiment of the bicycle according to the invention, which exhibits a high degree of stability, is characterized in that the auxiliary shaft is supported in the casing of the one part of the drive unit on one side and in the casing of the other part of the drive unit on the other side.

Another embodiment of the bicycle according to the invention is characterized in that the bicycle is provided with a gear mechanism mounted on the auxiliary shaft or on the crankshaft.

Advantageously, various types of the mechanism can be mounted on, for example, the auxiliary shaft or on the crankshaft in the first part of the drive unit. In the latter case, the weight of the gear mechanism is concentrated at the crankshaft.

In another embodiment of the bicycle according to the invention, the spring means comprise a spring element provided between the frame and the second part of the drive unit, which spring element can be mounted at any desired position.

Yet another embodiment of the bicycle according to the invention is characterized in that the bicycle is provided with a seat portion, which is connected to the first part of the drive unit, which ensures a stable absorption of forces.

More preferably, the seat portion, the auxiliary shaft and the crankshaft are on one straight line.

The present bicycle and the drive unit according to the invention will now be explained in more detail with reference to the following drawing, in which like parts

are indicated by the same numerals in the various figures. In the drawing:

Fig. 1 shows a bicycle according to the invention in the form of a push-bike, which is provided with a drive unit according to the invention; and

Fig. 2 is a top plan view in longitudinal section of the drive unit according to the invention.

Fig. 1 shows a bicycle 1 comprising a frame 2, on which a handlebar 3, a saddle 4 and two wheels 5-1 and 5-2 are mounted. A drive unit 6 is integrated in the frame 2 and is positioned substantially under the seat portion comprising the saddle 4. A number of forces that occur in the bicycle 1 converge in the drive unit 6, viz. the bicycle's own weight, the weight of a rider present on the saddle 4 and the forces that the rider exerts on the pedals 7, which are rotatably mounted on a crankshaft 8 which extends into the drive unit 6.

The drive unit 6, which is shown in more detail in Fig. 2, is built up of two parts indicated 6-1 and 6-2. The first part 6-1 of the drive unit 6 comprises the crankshaft 8 and an auxiliary shaft 9, whilst the second part 6-2 supports a rear shaft 10, on which the rear wheel 5-2 is mounted. The first part 6-1 of the drive unit is rigidly connected to the frame 2 or to any part thereof. Said self-supporting part 6-1 is accommodated in a sturdy, box-like casing 11-1. The casing 11-1 possesses sufficient strength and stiffness to absorb the aforesaid considerable forces that converge there in a stable manner. The second part 6-2 of the drive unit, which comprises the rear shaft 10 with the rear wheel 5-2, is self-supporting and pivotable with respect to the first part 6-1 and the frame 2, respectively. Preferably, the second part 6-2 of the drive unit is accommodated in a sturdy, box-like casing 11-2 as well. By the partially

rigid, partially pivoted construction of the drive unit 6, only a small weight is taken up resiliently, so that internal or external spring means 12/13 (only implicitly indicated in the figures) that are present between the frame 2 and the second part 6-2 of the drive unit may be of light construction.

The self-supporting casings 11-1 and 11-2 of the respective part 6-1 and 6-2 are pivotable with respect to each other. In the illustrated embodiment, this is achieved through the use of a ring (radial) bearing 13, which is shown more clearly in a detail of Fig. 2. Chain wheels 14-1 and 14-2 are mounted on the crankshaft 8 and the auxiliary shaft 9, over which chain wheels a chain 15-1 is passed. The crankshaft 8 may comprise a gear mechanism 16 (not shown); in Fig. 2 such a mechanism 16 is mounted on the auxiliary shaft 9, however. The whole of the first part 6-1 of the drive unit is rigidly mounted with respect to the frame 1. One end of the auxiliary shaft 9 is mounted in the rigid casing 11-1, whilst the other end of the auxiliary shaft 9, which may or may not be provided with the gear mechanism 16, is mounted in the casing 11-2 of the second part 6-2, being rotatable about an axis 1 of the ring bearing 13, which casing is rotatable about said axis. Mounted on the auxiliary shaft 9 is furthermore a chain wheel 14-3, whilst a chain wheel 14-4 is mounted on the rear shaft, about which chain wheels a chain 15-2 is passed for driving the rear shaft 10 with the rear wheel 5-2.

Each of the box-like casings 11-1 and 11-2 may be sealed against the dirt, dust and water, but they may also be constructed as oil-tight casings, in which case a low-maintenance lubricating system can lubricate the chain wheels 14 and the chains 15. In this connection a capillary lubricating system may be considered, which, without using external means, is capable of causing oil

that has collected on the bottom of the casings 11 to drip onto the chains 14 and/or the chain wheels 15 via capillary filaments. Chain tensioners (not shown) may be provided in the casings 11-1 and 11-2 to compensate for any elongation of the chain that may occur during use as a result of wear.

As is shown in the detail view of Fig. 2, the ring bearing 13 may form an integral part of the drive unit 6, so that an additional hinge is not required when using the spring means 12/13. To achieve a proper equilibrium of forces, the saddle 4, the auxiliary shaft 9 and the crankshaft 8 are substantially in line with each other, as is shown in Fig. 1. Preferably, lightweight high-quality materials are used for the various parts of the bicycle 1. Aluminium and magnesium are suitable, easily recyclable materials, which can be produced by means of a Thixo moulding process. The production of the components of the two casings 11 can take place in an automated manner, using an injection moulding process. It stands to reason that all kinds of drive mechanisms 6 may be used, e.g. mechanisms comprising a drive shaft, a toothed belt or a pull rod with a crankshaft, cable drive mechanisms or hydraulic and/or electrical drive mechanisms for a push-bike, a moped or other means of transport. It has been found that a continuously lubricated chain transmission makes it possible to cover more than 50,000 km without maintenance on or replacement of any part being required.

CLAIMS

1. A bicycle provided with a frame having spring means, as well as a drive unit to be provided with a crankshaft, an auxiliary shaft and a rear shaft, which drive unit is connected to the frame, characterized in that the drive unit is built up of two parts, wherein the first part, which is to be provided with the crankshaft and the auxiliary shaft, is rigidly connected to the frame, and wherein the second part, which is to be provided with the rear shaft, is capable of spring means actuated pivoting movement.

2. A bicycle according to claim 1, characterized in that the two parts of the drive unit are each accommodated in a box-shaped casing.

3. A bicycle according to claim 2, characterized in that said casings are oil-tight casings.

4. A bicycle according to any one of the claims 1-3, characterized in that the two parts of the drive unit are self-supporting and capable of pivoting movement with respect to each other by means of a ring bearing.

5. A bicycle according to claim 4, characterized in that the centre of the ring bearing is located at the level of the auxiliary shaft.

6. A bicycle according to any one of the claims 1-5, characterized in that the auxiliary shaft is supported in the casing of the one part of the drive unit on one side and in the casing of the other part of the drive unit on the other side.

7. A bicycle according to any one of the claims 1-6, characterized in that the bicycle is provided with a gear mechanism mounted on the auxiliary shaft or on the crankshaft.

8. A bicycle according to any one of the claims 1-7, characterized in that the spring means comprise a spring element provided between the frame and the second part of the drive unit.

9. A bicycle according to any one of the claims 1-8, characterized in that the bicycle is provided with a seat portion, which is connected to the first part of the drive unit.

10. A drive unit suitable for use in a bicycle according to any one of the claims 1-9, which bicycle is provided with a frame having spring means, as well as a drive unit to be provided with a crankshaft, an auxiliary shaft and a rear shaft, which drive unit is connected to the frame, characterized in that the drive unit is built up of two parts, wherein the first part, which is to be provided with the crankshaft and the auxiliary shaft, is rigidly connected to the frame, and wherein the second part, which is to be provided with the rear shaft, is capable of spring means actuated pivoting movement.

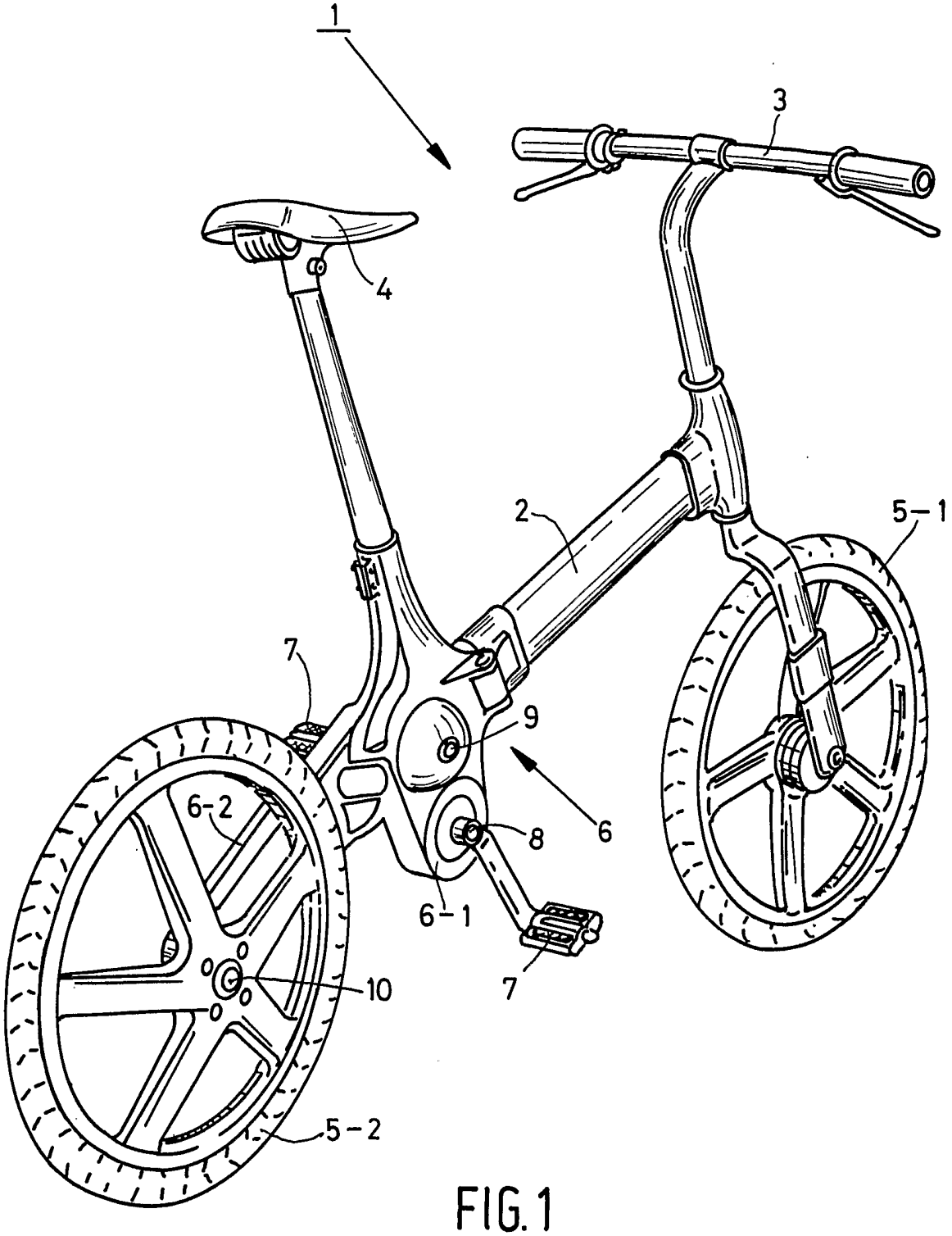



FIG. 1

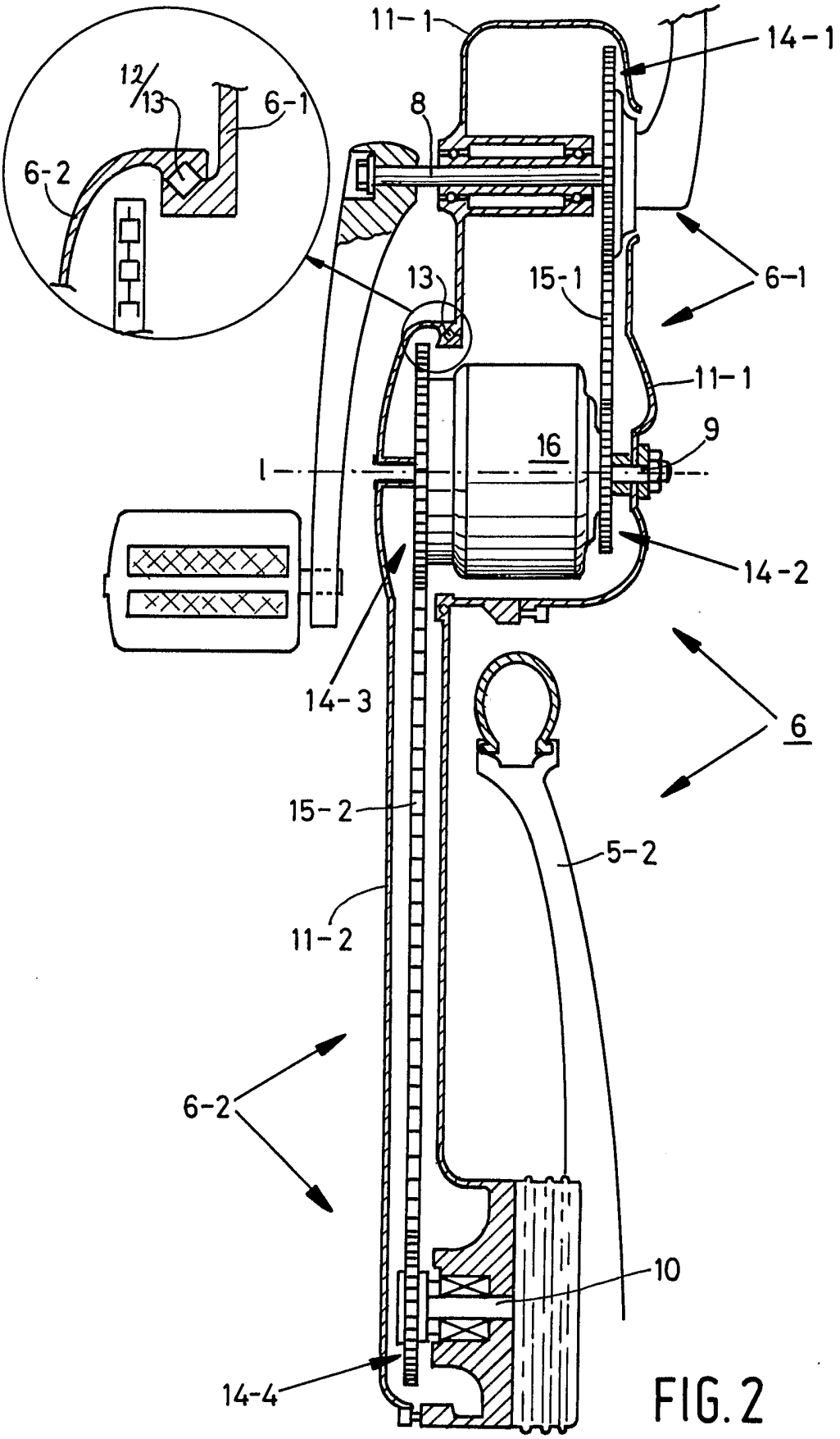

11-1
14-1
12/13
6-1
8
6-2
13
15-1
6-1
11-1
9
16
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14-2
14-3
6
15-2
5-2
11-2
6-2
10
14-4

FIG. 2

# INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B62K25/32 B62M1/02 B62J13/04

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 7 B62M B62K B62J

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)

EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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