United States Patent [19]

Bes

[11] **4,353,447**

[45] **Oct. 12, 1982**

[54] **CYCLE FREEWHEEL ASSEMBLY AND CYCLE WHEEL THEREFOR**

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[21] Appl. No.: **85,805**

[22] Filed: **Oct. 17, 1979**

[30] **Foreign Application Priority Data**

Oct. 3, 1979 [FR] France 79 24649

[51] **Int. Cl.**[3] **F16D 41/30**

[52] **U.S. Cl.** **192/64**

[58] **Field of Search** ..... 192/64, 46; 301/105 B; 474/902, 78

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[57] **ABSTRACT**

A cycle wheel assembly comprises a hub member on which a gear assembly is rotatably carried, with pawls being operatively disposed between the gear assembly and the hub member for freewheel drive of the assembly. The opening in the assembly has splines which are slightly inclined or which extend longitudinally, with respect to the axis of the hub member, for drivingly fitting the freewheel assembly on a suitable cycle wheel hub.

6 Claims, 3 Drawing Figures

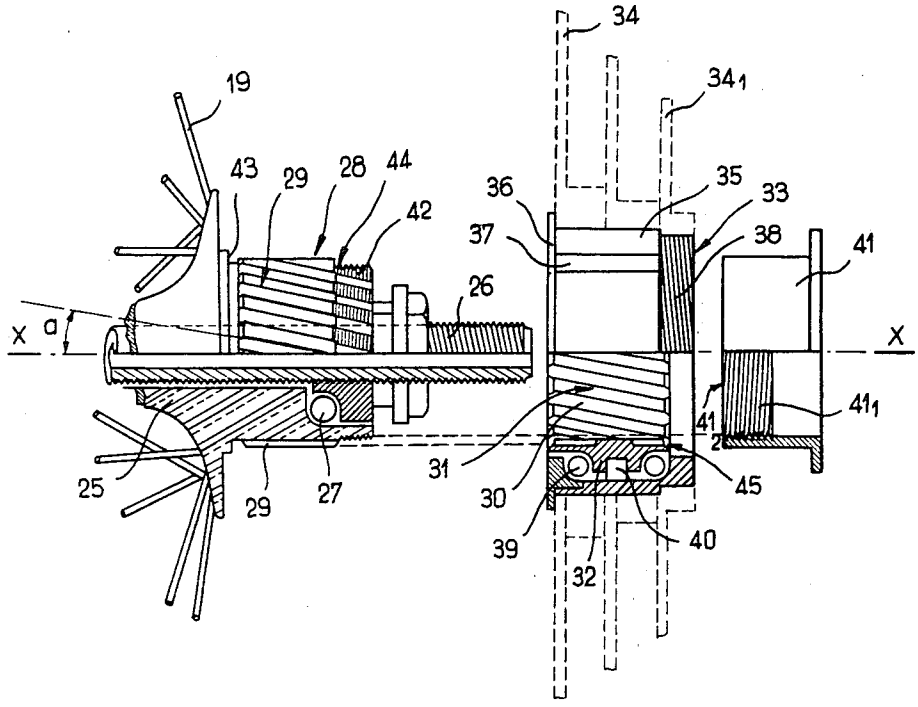


Fig.1
PRIOR ART

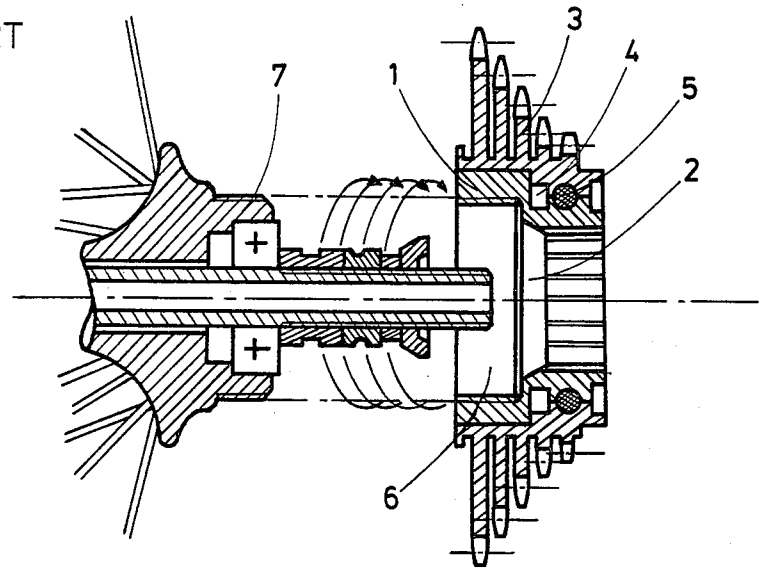


Fig.2

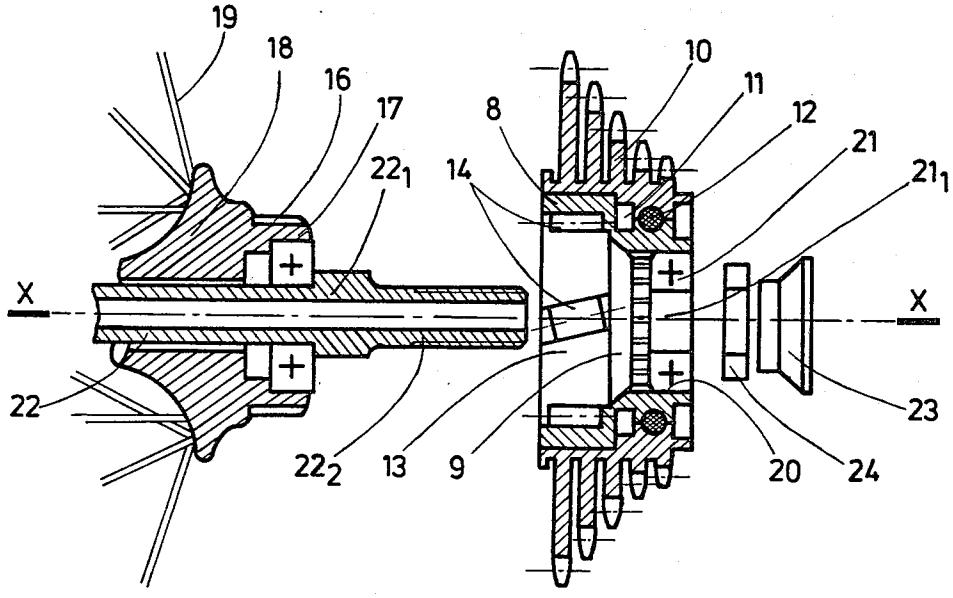
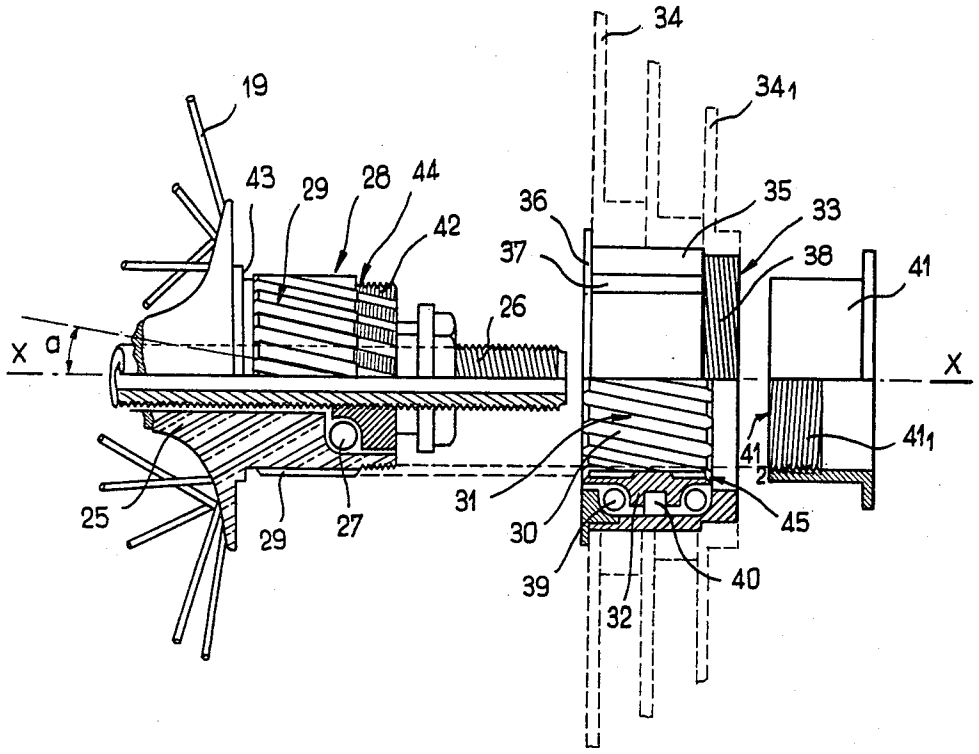


FIG.3


34
19
34₁
43
29
28
44
42
36
35
33
37
38
41
26
X
a
X
41₁
41
2
31
45
25
29
27
30
39
40
32

CYCLE FREEWHEEL ASSEMBLY AND CYCLE WHEEL THEREFOR

BACKGROUND OF THE INVENTION

In most prior art cycle freewheels, the freewheel assembly comprises a hub member or boss which is secured onto a suitable part of the hub of the cycle wheel. The hub member of the freewheel assembly has an axial opening bearing the internal screwthread adapted to co-operate with the wheel hub, while the hub member rotatably carries a gear or pinion arrangement comprising one or more gears. At least one pawl is disposed between the hub member and the rotatable gear arrangement, to provide the freewheel drive action.

However, because the screwthread for fixing the freewheel assembly on the wheel hub is of fine pitch, and because the direction of the drive force applied to the freewheel assembly tends to tighten the freewheel hub member on the wheel hub, it is a difficult and delicate operation to remove this freewheel assembly from the wheel hub and generally requires the use of a vice, and a suitable remover for removing the freewheel assembly. Further, a specific freewheel removal tool is usually required to remove each type of freewheel assembly, because of the differences in the structure and the dimensions of the various freewheel assemblies available on the market.

Moreover, the operation of removing the freewheel assembly runs the risk of damaging the spindle of the wheel hub for example because the freewheel remover often tends to jump out of the lugs with which it is engaged on the freewheel assembly.

SUMMARY OF THE INVENTION

An object of the invention is to provide a cycle wheel freewheel assembly which remedies the above-indicated disadvantages and shortcomings of the foregoing prior-art assembly.

Yet another object of the invention is to provide a freewheel assembly which can be easily fitted to and removed from a cycle wheel, without requiring the use of special fitting and removal tools.

A still further object of the present invention is to provide a cycle freewheel assembly which does not tend to tighten upon the cycle wheel hub, under the normal forces applied thereto in operation.

A yet further object of the invention is to provide a cycle wheel freewheel assembly such that the distance between the spoke-mounting flange on the wheel hub, at the freewheel assembly side of the wheel hub, and the wheel mounting lug of the rear fork of the cycle frame, can be reduced, thereby to reduce the overhang and thereby to shoften the unsupported length of wheel spindle between the wheel hub and the wheel mounting lug.

Yet a further object of the invention is to provide a cycle wheel freewheel assembly in which drive to the freewheel assembly by the drive chain tends to cause the freewheel assembly to be more firmly fixed on the cycle wheel hub, without however the firmer fixing causing the cycle freewheel assembly to be even more difficult to remove.

Another object of the invention is a cycle wheel, for use in conjunction with the freewheel assembly of the invention.

These and other objects are achieved by a cycle wheel freewheel assembly comprising a hub member having an axial opening, with a spline arrangement on the radially inwardly facing surface of the hub member, adapted to co-operate with a corresponding spline arrangement on a cylindrical outside surface of the cycle wheel hub. The spline arrangement comprises splines which are slightly inclined or which extend longitudinally, with respect to the axis of the freewheel assembly hub member. The hub member may further carry a bearing assembly such as a ball bearing assembly by means of which the hub member is supported against a shoulder on the spindle of the cycle wheel hub, thereby to carry forces acting on the freewheel assembly hub member in the axial direction thereof. The hub member of the freewheel assembly may additionally be fixed on the cycle wheel hub by means of a screw-threaded ring or nut which however can be easily removed for the purposes of removing the freewheel assembly from the wheel hub. The pitch of the screwthread on the nut or ring for fixing the freewheel assembly on the wheel hub is preferably reversed with respect to the direction of inclination of the above-mentioned spline arrangement, whereby there is no tendency for the securing ring or nut to tighten up, in normal operation of the freewheel assembly and the cycle wheel provided therewith.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a view in axial section of part of a prior-art freewheel assembly,

FIG. **2** is a corresponding view of part of a freewheel assembly according to the invention, together with the cycle wheel on which it is fitted, and

FIG. **3** is an exploded view, half in crosssection, of another embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will first be made to FIG. **1** which shows a known freewheel assembly, to supplement the discussion hereinbefore of previous forms of prior-art freewheel assemblies, and the disadvantages thereof. Thus, FIG. **1** shows a freewheel assembly comprising a hub member **1** which is provided with an axial opening **2** and which, on an outward peripheral surface, rotatably carries a gear assembly **3** by means of ball bearing balls **5**. A pawl arrangement **4** comprising at least one pawl is provided for producing a unidirectional drive through the freewheel assembly in known manner. The assembly **3** may have one or more gears.

The axial opening **2** in the hub member **1** is provided with an internal screwthread **6** for screwing the freewheel assembly on to a screw-threaded portion of a hub **7** of a cycle wheel.

The screwthread **6** comprises screwthreads which are small in height and fine in pitch, being only slightly inclined and indeed often being virtually perpendicular with respect to the axis of the opening **2** through the hub member **1**, so that screwing the hub member of the freewheel assembly on to the hub of the cycle simultaneously results in locking, centering and lateral positioning (ie positioning in the axial direction of the hub **1**) of the freewheel assembly on the hub **7** of the cycle wheel. Such a freewheel assembly is often very difficult to remove from the wheel hub because the fine-pitch screwthread **6**, after a period of use of the wheel and the freewheel assembly, can easily become so tight on the hub **7** that it is virtually impossible to unscrew the free-

wheel assembly, even when using the special tools usually provided.

The present invention seeks to avoid this kind of difficulty, by providing a freewheel assembly which while simple and reliable, is quick and easy to fit and to remove, without the need for any special tool, thereby for example to permit the wheel to be cleaned after the freewheel assembly has been removed, or to permit replacement of a broken spoke on the hub flange at the freewheel side, or to permit the gear ratios to be very quickly changed, by replacing one freewheel assembly which carries a certain range of gears, with another freewheel assembly which has gears of different diameters and thus different gear ratios.

Referring therefore now to FIG. 2, the freewheel assembly of the invention comprises a hub member **8** which is provided with an axial opening **9** therethrough. On its outward peripheral surface, the hub member **8** rotatably carries a gear assembly **10** by way of bearing balls **12**. At least one pawl **11** is operatively disposed between the gear assembly **10** and the hub member **8**, which assembly has one or more gears or pinions **10**.

The opening **9** in the hub member **8** includes a generally cylindrical generally smooth-walled portion **13** in which there is a spline means comprising preferably a plurality of ribs and/or grooves as indicated at **14**. The splines **14** are slightly inclined or extend longitudinally with respect to the axis XX of the freewheel assembly, ie parallel to axis XX, and are adapted to cooperate with a spline arrangement comprising ribs and/or grooves **16** which correspond in shapes and sizes to the splines **14**; the spline arrangement **16** is provided on a portion **17**, which has a generally cylindrical surface, of the hub **18** of the wheel, to a flange of which spokes **19** of the wheel are connected.

When the splines **14** and **16** are inclined as aforesaid, the angle of inclination of the splines **14** and **16**, taking into account the direction of operation of the pawls **11**, is such as to ensure a self-locking action for the freewheel assembly relative to the hub member **18**, when the gear assembly **10** is driven by a drive chain, ie the freewheel assembly tends to tighten on to the hub **18**, without however becoming fixed on the hub **18**.

Provided at the other end, ie the outer end, of the axial opening **9** in the hub member **8**, there is also a cylindrical bearing surface **20** in which a ball bearing assembly **21** is housed, the axial opening 21_1 in the ball bearing assembly **21** corresponding to the diameter of an external shoulder or enlarged-diameter portion 22_1 formed on the spindle **22** of the hub **18**.

Centering and support of the freewheel assembly on the hub **18** of the wheel are therefore effected by cooperation between the ball bearing assembly **21** and the shoulder 22_1, so that the support and centering action is effected directly in relation to the spindle **22** and not the hub **18**.

When the freewheel assembly has thus been fitted without screwing on to the hub **18** and its spindle **22**, the freewheel assembly is fixed laterally, ie axially of the spindle **22**, by means of a nut **23** which is screwed on to the screwthreaded end portion 22_2 of the spindle **22**. The nut **23** thus bears against the inner track ring of the ball bearing assembly **21**, by way of a washer member **24**.

Reference will now be made to FIG. 3, which shows a freewheel assembly which is locked on the wheel hub by means of an independent ring which is engaged on to the hub. The ring does not have any connection to the spindle of the wheel so that there is no danger, when locking the freewheel assembly on the wheel hub, that an axial force will be applied to the spindle of the wheel, which axial would have to be completely carried by the ball bearing balls which are disposed between the spindle and the hub of the cycle wheel.

This embodiment also makes it possible for the wheel hub bearing assembly to be moved towards the position at which the wheel spindle is fixed to the carrier lug on the fork of the cycle, in order to avoid an excessive spindle overhang.

In this embodiment, the hub **25** of the cycle wheel, to which the spokes **19** are connected, is mounted rotatably on a screw-threaded spindle **26**, by means of ball bearing balls **27**.

The hub **25** has a portion providing a cylindrical surface **28** on which there is provided a spline arrangement comprising ribs and/or grooves **29** which are inclined with respect to the axis of the hub. The spline arrangement **29** is intended to receive a spline arrangement comprising ribs or grooves **30**, of corresponding shapes, sizes and angle of inclination, which in this embodiment are provided in a cylindrical opening **31** which passes completely through the hub member **32** of the freewheel assembly **33**.

In this embodiment, the freewheel assembly **33** comprises a gear assembly **34** formed by a plurality of removable gears which are arranged in succession on a cylindrical body **35**, the largest gear bearing against an end flange member **36** on the body **35**.

The gear assembly **34** is non-rotatably locked on the cylindrical body **35** by means of internal ribs provided on the gear assembly **34**, which ribs are received in longitudinal grooves **37** formed in the peripheral surface of the body **35**.

The gears which form the gear assembly **34** and which are arranged on the body **35**, are locked for example by the last and smallest gear 34_1 being screwed on to a screwthreaded portion **38** formed at the end of the body **35** which is remote from the flange member **36**.

The body **35** is mounted rotatably on the hub member **32** by means of bearing balls **39**, with interposed pawls **40**, the angle of inclination of the spline arrangements **29** and **31** being in a direction, taking into account the direction of operation of the pawls **40**, that the freewheel assembly **34** tends to be urged further on to the surface **28**, when the gear assembly **34** is driven by the cycle drive chain in order to turn the hub **25** of the cycle wheel on its spindle **26**.

The angle of inclination of the spline arrangements is such that the freewheel assembly does not have a tendency to become locked on the wheel hub, so that the freewheel assembly can be removed from the wheel hub by simply pulling it outwardly, after having removed the clamping ring **41**.

The function of locking the freewheel assembly on the wheel hub **25**, so as to prevent relative rotation between the freewheel assembly and the wheel hub **25**, by means of the spline arrangements **29** and **31**, is disassociated from the function of fixing the freewheel assembly on the hub **25** axially of the hub spindle **26**, the axial fixing action being provided by the locking ring **41**. For this purpose, the ring **41** is provided with an internal screwthread 41_1 which is engaged on to a screwthreaded portion **42** on the wheel hub at the free end of the cylindrical portion **28**, the portion **42** being of smaller diameter than the portion **28**.

In this embodiment, the outside diameter of the ring **41** is slightly greater than the minimum diameter (as determined by the tops of the ribs **30**) of the hub member **32**, while the length of the hub member **32**, over which the ribs **30** extend, is slightly greater than the distance between the flange portion **43** of the wheel hub, against which the hub member **32** of the freewheel assembly bears, and the junction at **44** between the cylindrical portion **28** and the screwthreaded portion **42**.

Thus, when the freewheel assembly is fitted on the hub **25** by means of their respective spline arrangements, the hub member **32** of the freewheel assembly comes to bear against the flange portion **43** and screwing the ring **41** on to the screwthreaded portion **42** causes the end face 41_2 of the ring **41** to bear against the end face **45** of the hub member **32**, the end face **45** being at the level of the screwthreaded portion **42**.

By slightly tightening the ring **41**, the freewheel assembly is axially secured on the wheel hub **25**. The ring **41** can be easily removed by hand, as there is no danger of the freewheel assembly suffering from self-locking on the wheel hub **25** under the pulling force applied by the drive chain, as the drive connection between the freewheel assembly and the wheel hub **25** is provided by the ribs and grooves **29** and **31**.

In order to improve this effect, the screwthreads **42** and **41**, on the hub **25** and the ring **41** respectively, are inclined with respect to the axis X—X, in the opposite direction to the angle of inclination a of the ribs and grooves **29** and **31**.

The above-described forms of mounting a freewheel assembly on a cycle wheel thus provide for improved locking, centering and lateral or axial positioning of the freewheel assembly on the cycle wheel hub.

Various modifications may be made in the above-described constructions without thereby departing from the scope and spirit of the invention, and such modifications are thus deemed to be within the scope of the invention.

I claim:

1. A cycle wheel engaged to an integral freewheel assembly, said assembly comprising a hub member with an axial opening therein, a gear means rotatably supported and secured to said hub member, a pawl arrangement operatively disposed between said gear means and said hub member, a spline means in said axial opening, said spline means extending the width of said hub member, said cycle wheel adapted to receive said freewheel assembly, said cycle wheel comprising a rim, a hub, means connecting said rim and said hub, and a spindle on which said hub is rotatably supported, said wheel hub having an external generally cylindrical portion provided with a spline means having a length sufficient to extend across a substantial portion of said axial opening and engage said axial opening spline means whereby said cylindrical portion and cylindrical portion spline means provides uniform support and a rotatable drive for said freewheel assembly, and means for axially securing said freewheel assembly to said hub member whereby disengagement of said securing means permits manual disengagement of said integral freewheel assembly as a unit from said hub member.

2. A cycle wheel engaged to a freewheel assembly and clamping ring, said assembly comprising a hub member with an axial opening therein, a gear means rotatably supported on said hub member, a pawl arrangement operatively disposed between said gear means and said hub member, and a spline means in said axial opening,, said cycle wheel adapted to receive said freewheel assembly, said cycle wheel comprising a rim, a hub, means connecting said rim and said hub, and a spindle on which said hub is rotatably supported, said wheel hub having an external generally cylindrical portion provided with a spline means adapted to cooperate with said spline means in said axial opening of said freewheel assembly and further provided with screwthreads on the free end of said wheel hub, said clamping ring having screwthreads adapted to cooperate with the screwthreads of the wheel hub, the outside diameter of said ring being slightly greater than the minimum diameter of said opening in said hub member of the freewheel assembly.

3. A wheel as set forth in claim **2** wherein the diameter of said cylindrical portion carrying the spline means of said wheel hub is slightly greater than the diameter of the screwthreaded free end of the wheel hub.

4. A cycle wheel as set forth in claim **2** wherein said axial opening spline means and said cylindrical portion spline means extend at a slight angle to the axis of said wheel.

5. A wheel as set forth in claim **4** wherein the screwthread of the free end of the wheel hub has a pitch inclined with respect to the axis of the hub member in the opposite direction to the angle of inclination of said spline means.

6. A wheel as set forth in claim **2** wherein said wheel hub has a bearing flange portion for abutment of a first axial end face of said hub member of the freewheel assembly, and wherein said hub member has a second axial end face at a slightly greater distance from said first end face than the distance between said flange portion of the wheel hub and the junction of said cylindrical and screwthreaded portions of the wheel hub.

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