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Datasheet for the decision of 17 April 2007

Case Number: T 0299/05 - 3.2.01

Application Number: 97103773.4

Publication Number: 0795462

IPC: B62M 11/16

Language of the proceedings: EN

Title of invention:
A hub bicycle transmission with a coaster brake

Patentee:
SHIMANO INC.

Opponent:
SRAM Deutschland GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - yes"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0299/05 - 3.2.01

D E C I S I O N
of the Technical Board of Appeal 3.2.01
of 17 April 2007

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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 21 January 2005 concerning maintenance of European patent No. 0795462 in amended form.**

Composition of the Board:

Chairman: S. Crane
Members: J. Osborne
S. Hoffmann

Summary of Facts and Submissions

I. The opponent's appeal is directed against the interlocutory decision posted 21 January 2005 according to which, account being taken of the amendments made by the patent proprietor during the opposition proceedings, the patent and the invention to which it relates were found to meet the requirements of the EPC.

II. The following state of the art documents played a role during the appeal proceedings:

E1: DE-C-23 37 725

E5: US-A-4 240 533

E7: DE-A-37 32 977.

III. During oral proceedings held 17 April 2007 the appellant requested that the decision under appeal be set aside and the patent revoked. The respondent requested that the appeal be dismissed and the patent maintained on the basis of claims 1 to 19 according to the main request and amended description, both submitted during the oral proceedings, and figures as granted.

IV. Claim 1 according to the respondent's request reads:

"A hub transmission with a coaster brake unit comprising:
a hub axle (2);
a drive member (3) rotatably mounted around the hub axle (2);

a hub body (4) rotatably mounted around the hub axle (2);
a planetary gear mechanism (5) coupled between the drive member (3) and the hub body (4) for communicating rotational force from the drive member (3) to the hub body (4) through multiple rotational force transmission paths,
the planetary gear mechanism (5) including:

- a planet gear (53) supported by a planet gear rack (52) for rotation around the hub axle (2);
- a ring gear (54) engaging the planet gear (53); and a clutch (6) movable in a direction of an axis (X) of the axle (2) between a first position (a, b), a standby position (c) and a second position (d),

the clutch (6) includes an engagement component (67);
the ring gear (54) includes a serration (54a) formed in a peripheral direction thereof;
the gear rack (52) includes a depression (70) formed in a peripheral direction thereof;
the engagement component (67) engages with the depression (70) in the gear rack (52) for transmitting rotational power to the gear rack (52) when the clutch (6) is located in the first position (a, b) and the standby position (c);
the engagement component (67) engages with the serration (54a) in the ring gear (54) for transmitting forward rotational power to the ring gear (54) when the clutch (6) is located in the second position (d);
the engagement component (67) contacts an inclined surface (54c) of the serration (54a) when reverse rotational power is applied to the drive member (3) and the clutch (6) is located in the second position (d), so as to move the clutch (6) to the standby position (c);

biasing means (69) are provided for biasing the clutch (6) from the second position (d) toward the standby position (c); and
forcible movement means (71) forcibly moving the clutch (6) from the standby position (c) toward the second position (d) when forward rotational power is applied to the drive member
(3);
characterized in that
the forcible movement means (71) comprises an inclined surface (71) formed in the gear rack (52) for contacting the engagement component (67) and pushing the clutch (6) toward the serration (54a) when forward rotational power is applied to the drive member (3)."

Claim 10 contains all features of claim 1 and its subject-matter differs only in that it specifies a plurality of serrations and depressions in the ring gear and gear rack (planet carrier) respectively, the engagement component engaging with "at least one" of each of the respective pluralities. Claims 2 to 9 and 11 to 19 define features additional to those of claims 1 and 10 respectively.

V. The appellant's arguments in as far as they are relevant to the respondent's present request may be summarised as follows:

The closest prior art for consideration of inventive step is known from E7 in the embodiment of figure 2 which relates to a bicycle multi-speed hub gear with a coaster brake. As is the case with the present patent the hub gear is arranged such that the effort applied to the pedals in the reverse direction in order to

operate the brake is always subjected to the same multiplication ratio irrespective of which gear ratio has been engaged prior to applying the braking effort. In E7 when the lowest gear ratios are selected, for which the clutch engages with the ring gear, the transmission of braking effort involves moving the clutch to a standby position in engagement with the gear rack. Upon removal of the braking effort the clutch is forcibly moved from the standby position back into engagement with the ring gear by means of a spring. If removal of the braking effort is quickly followed by application of a high forward pedalling effort frictional engagement between the clutch and the planet carrier may prevent the clutch from returning to its position of engagement with the ring gear. The feature of the inclined surface in present claim 1 provides a positive re-engagement of the clutch with the ring gear.

The use of an inclined surface for positively moving the clutch into the braking position is already known from E7 and it would be obvious for the skilled person to employ such a feature to supplement the action of the spring if this were found to be inadequate. Also E1 teaches the use of inclined surfaces for positively moving the clutch between an intermediate, disengaged position and an engaged position. Although the present patent discloses that the standby position is for braking when the low ratio is selected it could equally be the result of inadequate movement of the selector cable towards the low ratio position whereby the clutch fails to engage with the ring gear. Furthermore, although the intermediate position of E1 is an undesirable position the same is true of the presently

claimed standby position as regards providing forward rotational power.

Also E5 discloses the concept of using inclined surfaces to move the clutch body of a hub transmission for a bicycle into engagement for braking.

VI. The respondent replied essentially as follows:

The standby position according to the present patent is one in which the clutch remains, under the influence of the biasing means, when the low gear ratio is selected and no rotational power is applied. Only when forward rotational power is applied is the clutch moved into engagement with the ring gear by an inclined surface. In the transmission according to E7, on the other hand, the clutch is biased into engagement with the ring gear by means of a spring and remains in this position when no rotational power is applied. That spring is necessary also for selecting the lower gears and it therefore would not be obvious to replace it by an inclined surface. Moreover, in accordance with the present invention inclined surfaces are employed to move the clutch in both directions. Whilst E7 discloses the use of an inclined surface to move the clutch in one direction upon application of reverse rotational power E1 discloses that the clutch is always moved in the same direction irrespective of the direction of application of rotational power. E1 not only relates to a different problem than is solved by the presently claimed subject-matter but it concerns a transmission in which, unlike E7, braking effort does not follow the same path irrespective of the selected ratio.

Reasons for the Decision

1. The patent relates to a multi-speed hub transmission for a bicycle having a 'coaster' brake operated by reverse rotation of the pedals. The drive member through which the rotation from the pedals enters into the transmission is mounted at one end of the hub and the force applied to the drive member for operating the brake passes through the transmission to the brake which is mounted at the other end. Because of the passage of the braking effort through the transmission there is provision for making the braking effect independent of the selected gear ratio. Selection of the lowest gear is in part by axial movement of a clutch body and there is a provision to move the clutch body out of its low gear position in response to the reverse rotation.

2. During the oral proceedings the patent proprietor amended the claims on which its request for maintenance of the patent is based. As a result, all objections by the appellant resulting from amendments made during the opposition procedure were overcome. It remains only to consider the matter of inventive step. Before considering inventive step, however, it is necessary to determine some details regarding axial positioning of the clutch body according to the present patent.

2.1 Claim 1 specifies that the clutch body is movable into first, standby and second positions. It further specifies that the clutch ("engagement component") transmits rotational power to the planet carrier ("gear rack") when in the first and standby positions and

forward rotational power to the ring gear when in the second position. According to the description an intermediate position corresponds to the selection of the second of three gear ratios, in which position forward power is transmitted from the clutch body to the planet carrier (column 7, line 54 to column 8, line 4). The standby position is a further one in which braking is effected when the lowest gear ratio has been selected (column 8, lines 16 to 43). Whilst in the transmission of the described embodiment three gear ratios are provided the wording of the claim only concerns the provision of the highest and lowest of those three ratios.

2.2 According to the description column 4, lines 57, 58 a clutch operator connected to a shifter unit may "set" the clutch body to the first, intermediate and second positions but according to column 8, lines 44 to 52 it may also "set" the clutch body to the standby position. In the description of the operation of the transmission it is stated that the high and medium gear ratios are realised by "setting" the clutch body to the first and intermediate positions respectively (column 8, lines 32, 33 and 54 to 56) but that the low gear can be realised by "bringing" the clutch body from the standby position to the second position. These partly conflicting statements raise the question of whether the low gear ratio is selected by setting the clutch body to the standby position or to the second position. Whichever of these two positions is the "set" one would be the stable position in which the clutch body would remain when neither forward nor reverse rotation is applied. A further feature relevant to this matter is a spring 69 which biases the clutch body towards the standby

position (column 7, lines 20 to 25) and which is represented in claim 1 by the designation "biasing means".

3. The board considers that the skilled person's understanding of the disclosure as regards the selection and operation in low gear ratio is the following:

The clutch body may be set to the standby position by means of the clutch operator in opposition to action of the biasing spring and remains in this position in the absence of any rotation of the drive member. Upon forward rotation of the drive member the clutch body is moved by the inclined surface on the planet carrier against the action of the biasing spring and into the second position in engagement with the ring gear. If the forward rotation of the drive member ceases the biasing spring urges the clutch body towards the standby position and if the drive member is reversely rotated the inclined surface on the ring gear positively drives the clutch body into the standby position for operating the brake. Movement of the clutch body relative to the clutch operator away from the standby position into the second position would be accommodated by a spring which is visible in figure 1 but which neither has a reference numeral nor is mentioned in the description.

4. The board agrees with both parties that the closest state of the art is that disclosed in the embodiment of figure 2 of E7. That disclosure is of a five-speed hub transmission with a 'coaster' brake in which upon selection of the lowest two gears the clutch body is

urged into engagement with the ring gear by a spring 20. In response to reverse rotation of the drive member when one of those two lowest gear ratios has been selected inclined surfaces move the clutch body out of engagement with the ring gear and into engagement with the planet carrier in what is hereafter termed the "braking position". The spring 20 is compressed during this movement and subsequently restores the engagement of the clutch body with the ring gear when the reverse rotation ceases (column 7, lines 17 to 20). A further spring 21 acts in opposition to the spring 20.

4.1 It is derivable from E7 column 5, final line to column 6, line 12 that when the selected gear ratio is changed from the second highest to intermediate ("normal" in E7) the movement of the clutch body by spring 20 is transmitted to the ring gear by the spring 21. This has the effect of removing the ring gear from driving engagement with the transmission hub. According to column 6, lines 25 to 36, however, when the selected gear ratio is further changed from intermediate to low a surface in fixed connection with the ring gear and against which spring 21 abuts can move no further and the clutch body is moved by the spring 20 in opposition to the spring 21. It follows that the spring 21 exerts a lower force than does spring 20 and the net force is to bias the clutch body from the braking position toward the equivalent of the presently claimed second position. In the context of the patent specification it is apparent that the biasing means of claim 1 must be such that in the absence of other forces acting on the clutch this will be moved by the biasing means into the standby position. Indeed it can fairly be said that it is these biasing means which are determinative for the

standby position being just that, namely the position in which the clutch stably resides when neither forward nor reverse rotation is applied to the drive member. From what is said above about the relative strengths of springs 20 and 21 it is therefore apparent that E7 does not comprise biasing means within the meaning of claim 1.

4.2 According to present claim 1 the forcible movement means forcibly moves the clutch from the standby position to the second position "when forward rotational power is applied to the drive member". This is a wholly accurate representation of the action of the inclined surface on the planet carrier in as far as the movement occurs when, and only when, forward rotational power is applied. By comparison, in the transmission according to E7 the action of the spring in moving the clutch body out of the braking position occurs when the application of reverse rotational power ceases. If the cessation of reverse rotational power is not immediately followed by application of forward rotational power the spring does not move the clutch into the second position 'when' the forward rotational power is applied but before it. There is thus no causal link between the application of forward rotational power and the operation of the forcible movement means, as is clearly required by present claim 1. It follows that E7 also does not disclose the presently claimed features of the forcible movement means, as are defined in combination by the last feature of the preamble and the characterising clause.

4.3 The board therefore finds that the subject-matter of present claim 1 differs from the disclosure of E7 by the following features:

– biasing means provided for biasing the clutch from the second position toward the standby position; and

– forcible movement means forcibly moving the clutch from the standby position toward the second position when forward rotational power is applied to the drive member, comprising an inclined surface formed in the gear rack for contacting the engagement component and pushing the clutch toward the serration when forward rotational power is applied to the drive member.

These features when considered together represent the fundamental difference between the instable braking position of the clutch body in the transmission of E7 and the stable standby position according to the present patent.

4.4 The skilled person presented only with the teaching of E7 which employs the same spring both to urge the clutch body into engagement with the ring gear for selecting lower gear ratios and to reengage the ring gear after braking would have no incentive to modify the transmission in the way presently claimed because the braking position is an instable position and therefore fundamentally different from the presently claimed standby position.

4.5 E1 also relates to a multi-speed hub transmission with a 'coaster' brake and which also employs inclined

surfaces for axially moving the clutch between positions of engagement with the ring gear and the planet carrier. However, this transmission is of a somewhat different design to that of E7 in as far as the braking effect is not independent of the selected transmission ratio and the concept of a standby position within the meaning of the present claim is not disclosed. It follows that the skilled person aware of E1 would have no incentive to modify the transmission of E7 in such a way as to arrive at the subject-matter of present claim 1.

4.6 The transmission according to E5 is similar to that of E7 in as far as it provides a braking effect which is independent of the selected gear ratio and involving the axial movement of a clutch body. However, the mechanism corresponds to that of E7 in as far as the clutch body is movable in response to reverse rotation of the drive member by virtue of inclined faces in opposition to the action of a spring which, upon cessation of the application of reverse rotational power urges the clutch back into engagement with the gear carrier. It follows that as far as inventive step of present claim 1 is concerned E5 provides no teaching which extends beyond that of E7. Indeed, the appellant did not rely upon this document during the oral proceedings.

4.7 The board concludes from the foregoing that the subject-matter of claim 1 involves an inventive step (Article 56 EPC). Since claims 2 to 19 contain all features of claim 1 the same conclusion applies also to those claims.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent on the basis of:

   – claims 1 to 19 of the main request and modified description (columns 1 to 9, additional pages 2a, 2b) both submitted during the oral proceedings; and

   – figures 1 to 5 as granted.

The Registrar: The Chairman:

A. Vottner S. Crane