

RIM STRUCTURE PARTICULARLY FOR CYCLE WHEEL WITH VARIABLE MAGNETIC FIELD ELECTRIC GENERATOR

Technical field

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The present invention is generally applicable in the field of wheeled vehicles and, in particular, relates to a rim structure, in particular for bicycles equipped with a current generator, as well as to a method and a machine for manufacturing this structure.

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Background art

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As is known, in bicycles where an available supply of electricity is required in order to power applications such as the front light and rear light, generators - commonly referred to as "dynamos" - are used, said generators being essentially alternators which receive the driving movement from a knurled roller which is arranged so as to make contact, via spring means, with one of the tyres of the bicycle.

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In addition to the problems associated with deterioration of the moving parts which reduce the efficiency of the dynamo and cause a bothersome noise, the dynamo has the major disadvantage that the voltage which is generated is dependent upon the speed of movement of the bicycle.

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In order to overcome the main problems associated with the dynamo, current generator devices which use variable magnetic fields have been developed.

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These devices comprise a plurality of curved segments to be fixed to the spokes of the bicycle wheel, which support, in succession, a plurality of permanent magnets.

The fork of the bicycle has fixed thereto, on a corresponding support, a plurality of pole shoes with associated windings around which an induced current flows, said

current being due to the passing movement of the magnets which, being spaced from each other, generate an alternating electrical field.

5 The pole shoes are then connected to electrical accumulators which allow energy to be supplied to the applications even when the bicycle is at a standstill.

10 This solution, however, also has problems associated in particular with the fact that there is a discontinuity in the succession of permanent magnets, since the curved segments are themselves arranged circumferentially spaced on the spokes.

15 The magnets are moreover not protected since they are arranged on curved segments which, being independent components on the outside of the bicycle wheel, may be moved, damaged and lost, being separated from the wheel itself.

Disclosure of the invention

20 A main object of the present invention is that of overcoming the abovementioned drawbacks by providing a rim structure which eliminates or substantially reduces the known problems associated with the supply of electricity to bicycles using current generators of the variable magnetic field type.

25 A particular object is that of providing a structure which, when combined with a suitable current generator, operates in a uniform and silent manner.

An additional object is that of providing a structure which allows a large number of permanent magnets to be used.

30 A further object of the invention is that of providing a structure which is able to protect the permanent magnets from dirt or accidental damage, preventing any dislodging or loss of efficiency of the said magnets during use.

Another particular object is that of providing a structure which is simple and economically advantageous in that it can be manufactured at a low cost using technology of the known type.

- 5 These objects, together with others which will appear more clearly below, are achieved, in accordance with Claim 1, by a rim structure, in particular for bicycles equipped with a current generator of the variable magnetic field type, comprising a circumferentially extending tubular body from which a pair of opposite flanges extends outwarelly to define a seat for housing a tyre, characterized in that the
- 10 tubular body comprises at least one annular side pocket able to house a plurality of circumferentially aligned permanent magnets, spacer means being inserted in said side pocket in order to keep the permanent magnets at predetermined distances from each other.
- 15 Owing to this particular configuration it will be possible to use a large number of permanent magnets and it arrange them in a safe and reliable manner, avoiding undesirable movement or vibration thereof.

Brief description of the drawings

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Further features and advantages of the invention will be more clearly understood in the light of the detailed description of some preferred, but not exclusive embodiments of a rim structure, a method for the manufacture thereof and a machine for implementing the method according to the invention, which are

25 illustrated by way of a non-limiting example with the aid of the accompanying drawing sheets in which:

FIG. 1 shows a side view of a bicycle equipped with a rim having the structure according to the invention;

FIG. 2 shows a side view of a wheel portion comprising a rim with the

30 structure according to the invention;

FIGS. 3 and 4 show two perspective views of respective enlarged details of a first example of embodiment of a structure according to the invention;

FIG. 5 and FIG. 6 show two perspective views of enlarged details of further examples of embodiment of a structure according to the invention;

FIG. 7 and FIG. 8 show two front views of a rim structure according to the invention, in two different configurations;

5 FIG. 9 shows a perspective view of a detail of the structures according to FIG. 5 and FIG. 6;

FIG. 10 shows a top plan view of a machine according to the invention;

FIG. 11 shows a side view of the machine according to FIG. 10;

10 FIG. 12 shows a block diagram of the manufacturing method according to the invention.

Detailed description of the preferred embodiment(s)

15 With particular reference to the above mentioned figures, a rim structure is shown according to the invention, denoted in its entirety by the reference number 1.

The rim structure 1 is mounted on a bicycle C equipped with a current generator of the variable magnetic field type, known per se.

20 The rim 1 comprises a peripherally or circumferentially extending tubular body - denoted in its entirety by the reference number 2 - from which a pair of opposite flanges 3 defining a seat 4 for housing a tyre P extends outwards.

25 According to the invention, the tubular body 2 comprises at least one annular peripheral side pocket 5 which is able to house a plurality of permanent magnets aligned along a circumference. Moreover, spacer means, denoted overall by the reference number 7, are envisaged, said spacer means being inserted inside the side pocket 5 so as to keep the permanent magnets 6 suitably directed and situated at predetermined distances from each other.

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When the rim 1 is rotated, the permanent magnets 6 generate a variable electric field on the windings of corresponding pole shoes - not shown in the drawings and

of a type known per se - facing the permanent magnets 6 and arranged on a corresponding support S fixed to the frame of the bicycle C so as to follow the curved profile of the side pocket 5.

- 5 The windings of the pole shoes, although not shown in the drawings, are connected to a voltage rectifier and stabilizer unit which is in turn connected to an electric energy accumulator, which are both of a type known per se.

10 Preferably the distances between the permanent magnets 6 are substantially the same along the entire extension of the tubular body 2. Moreover, the side pocket 5 may have a quadrilateral, for example approximately trapezoidal, cross-section, with an external annular wall 8 which is substantially flat and perpendicular to the axis of rotation of the rim 1.

- 15 The tubular body 2 may have a pair of longitudinal ends 9, 10 facing each other and connected by means of a pin 11.

20 The tubular body 2 may comprise a main cavity 12 which extends circumferentially and inside which the pin 11 may be inserted at the facing ends 9. As an alternative or in addition to the main cavity 12, the tubular body 2 may comprise a secondary cavity 12' inside which it is possible to insert a second suitably shaped pin 11'. The secondary cavity 12' may be positioned opposite the side pocket 5. The pin 11 inserted into the main cavity 12 and the pin 11' inserted into the secondary cavity 12' have an external surface with a shape matching the internal surface of the corresponding main cavity 12 and secondary cavity 12' and have dimensions such that they may be inserted inside the latter by means of interference.

30 The tubular body 2 may be made of metallic material, such as for example aluminium alloy, or synthetic material, such as for example PVC or another polymer, or also a composite material, such as a reinforced polymer or carbon fibres.

The permanent magnets 6 may be preferably made of an alloy composed of neodymium-iron-chromium in different percentages depending on the desired electrical power. The permanent magnets 6 may also be treated with zinc or nickel.

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In a first preferred example of embodiment, the spacer means 7 may comprise an annular strip 13 of deformable laminar material inserted inside the side pocket 5. The permanent magnets 6 may be fixed to the strip 13 inside suitable shaped seats 14 able to receive them.

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Suitably the shaped seats 14 may be formed by transverse folds 15 able to provide an undulating profile.

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In greater detail, the base material of the strip 13 may be chosen from among non-magnetic or ferromagnetic materials, or synthetic materials.

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In a further preferred example of embodiment, the spacer means 7 may consist of a plurality of non-magnetic inserts 16 which are for example made of synthetic material and arranged inside the side pocket 5 alternating with the permanent magnets 6.

The rim structure 1 described above may be advantageously manufactured by means of a method comprising the following steps.

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During a first step a), a linear tubular body 2 having a length substantially equal to the circumferential extension of the rim structure is prepared.

During the following steps b) and c), a plurality of permanent magnets 6 as well as suitable means 7 for spacing said magnets are prepared.

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During a fourth step d) the plurality of permanent magnets 6 and the spacer

means 7 are inserted inside the side pocket 5 of the tubular body 2 so as to keep the permanent magnets 6 at predetermined distances from each other.

5 During a fifth step e) the tubular body 2 is bent so as to provide the latter with a circular shape with the longitudinal ends 9, 10 substantially aligned.

During a final step f) the longitudinal ends 9, 10 are joined together so as to provide a continuous rim structure 1.

10 The step e) may be performed before or after the step d) for insertion of the permanent magnets 6 and the spacer means 7.

15 In a first example of embodiment the spacer means 7 may consist of a strip 13 of laminar material. The latter may be made by means of plastic deformation, for example by means of moulding, so as to provide a plurality of shaped seats 14 with folded edges 15 at predetermined distances from each other for receiving the permanent magnets 6.

20 Once the shaped seats 14 have been formed, the permanent magnets 6 may be fixed there by means of an interference fit. Then the strip 13, together with the permanent magnets 6, may be inserted inside the side pocket 5 substantially along the entire longitudinal extension of the tubular body 2 and may be cut at the longitudinal ends 9 of the latter.

25 In a second example of embodiment, the spacer means 7 may consist of non-magnetic inserts 16. In this case, the permanent magnets 6 may be inserted inside the side pocket 5 alternating with the non-magnetic inserts 16.

30 Advantageously, the insertion step d) may be performed after the step e) for bending the tubular body 2. In particular the longitudinal ends 9, 10 may be moved away from each other transversely, by elastically deforming the tubular body 2 as shown in FIG. 7, so as to allow access to the side pocket 5 and the

alternating insertion of the permanent magnets 6 and the non-magnetic inserts 16 until the said pocket is completely filled.

5 The method described, with respect to solely the first example of embodiment of the rim structure 1, is implemented by means of a machine which is denoted overall by 17.

10 The machine 17 may comprise means 18 for continuous feeding a strip 13 of laminar material, means 19 for fixing a plurality of permanent magnets 6 onto the strip 13, and means 20 for inserting the strip, together with the permanent magnets 6, inside the linear tubular body 2 of predetermined length.

15 The machine 17 may also comprise, even though not shown in the drawings, means for cutting the strip 13 at the longitudinal ends 9 of the tubular body 2, means for bending the tubular body 2, and means for joining together the longitudinal ends 9 of the tubular body so as to provide a unitary rim structure 1.

20 In particular, the fixing means 19 may comprise means for deforming the strip 13, so as to provide a plurality of shaped seats 14 at predetermined distances from each other, and a device 21 for loading permanent magnets 6 into each shaped seat 14.

25 Suitably, the machine 17 may comprise a pair of stores 22 for the tubular bodies 2, before the latter are bent, and a control console 23 for an operator.

From that described above, it is obvious that the rim structure according to the invention achieves the predefined objects and in particular allows the provision of a large number of permanent magnets and a drastic reduction in the risk of damage to or deterioration in the properties of the said magnets.

30 The rim structure, the manufacturing method and the machine according to the invention may be subject to numerous modifications and variations all falling within

the inventive idea expressed in the accompanying claims. All the details may be replaced by other technically equivalent elements and the materials may differ according to the requirements, without departing from the scope of the invention.

- 5 Although the rim structure, the manufacturing method and the machine have been described with particular reference to the accompanying figures, the reference numbers used in the description and the claims are used in order to facilitate understanding of the invention and do not limit in any way the scope of protection claimed.

CLAIMS

1. A rim structure, in particular for bicycles equipped with a current generator of the variable magnetic field type, comprising a circumferentially extending tubular body (2) from which a pair of opposite flanges (3) extends outwardly to define a seat (4) for housing a tyre, characterized in that said tubular body (2) comprises at least one annular peripheral side pocket (5) able to house a plurality of circumferentially aligned permanent magnets (6), envisaged spacer means (7) being inserted in said annular side pocket (5) in order to keep said permanent magnets (6) at predetermined distances from each other.

2. Structure according to Claim 1, characterized in that said predetermined relative distances are substantially the same along the entire extension of said tubular body (2).

3. Structure according to Claim 1, characterized in that said side pocket has a quadrilateral cross-section, with an external side wall (8) arranged in a plane substantially perpendicular to the axis of rotation of the rim.

4. Structure according to one or more of the preceding claims, characterized in that said tubular body (2) has longitudinal ends (9, 10) facing each other and connected by means of a pin (11).

5. Structure according to Claim 4, characterized in that said tubular body comprises an annularly extending main cavity (12) inside which said pin (11) is inserted with interference at said facing ends (9, 10).

6. Structure according to Claim 4, characterized in that said tubular body (2) comprises a secondary cavity (12') inside which a corresponding pin (11') is inserted with interference at said longitudinal facing ends (9, 10).

7. Structure according to Claim 1, characterized in that said spacer means (7) comprise an annular strip (13) which is inserted inside said side pocket (5) and to which said permanent magnets (6) are fixed.

5 8. Structure according to Claim 7, characterized in that said strip (13) is made of deformable laminar material and has a plurality of shaped seats (14) able to receive corresponding permanent magnets (6).

10 9. Structure according to Claim 8, characterized in that the base material of said strip (13) is chosen from among ferromagnetic or non-magnetic metallic materials.

15 10. Structure according to Claim 8, characterized in that the base material of said strip (13) is chosen from among synthetic materials or composite materials which are suitably reinforced.

20 11. Structure according to Claim 8, characterized in that said shaped seats (14) consist of transverse alternating folds (15) able to provide an undulating profile.

12. Structure according to Claim 1, characterized in that said spacer means (7) comprise a plurality of non-magnetic inserts (16) which are arranged inside said side pocket (5), alternating with said permanent magnets (6).

25 13. A method for manufacturing a rim structure according to any one of the preceding claims, comprising the following steps:

a) preparing a substantially straight tubular body (2) having a length substantially equal to the circumferential extension of the rim structure;

b) preparing a plurality of permanent magnets (6);

30 c) preparing means (7) for spacing said permanent magnets;

d) inserting said plurality of permanent magnets (6) and said spacers (7) inside a side pocket (7) of said tubular body (2) so as to keep said permanent magnets (6) at predetermined distances from each other;

e) bending said substantially straight tubular body (2) so as to provide it with a circular form having substantially aligned longitudinal ends (9, 10);

f) joining together said longitudinal ends (9, 10) so as to provide a continuous rim structure (1).

14. Method according to Claim 13, characterized in that said bending step e) is performed after said step d) for inserting said permanent magnets (6) and said spacer means (7).

15. Method according to Claim 13, characterized in that said bending step e) is performed before said step d) for inserting said permanent magnets (6) and said spacer means (7).

16. Method according to Claim 13, characterized in that said spacer means consist of a strip (13) of laminar material which is subjected to plastic deformation so as to provide a plurality of shaped seats (14) at predetermined distances from each other for said permanent magnets.

17. Method according to Claim 16, characterized in that the permanent magnets (6) are fixed inside said corresponding shaped seats (14) by means of an interference fit.

18. Method according to Claim 16, characterized in that said strip (13) with said permanent magnets (6) is inserted inside said side pocket (5) substantially along the entire longitudinal extension of said tubular body (2) and is cut at the longitudinal ends (9, 10) of the latter.

19. A machine for implementing the method according to one or more of Claims 13 to 18, characterized in that it comprises means (18) for continuously

feeding a strip (13) of laminar material, means (19) for fixing a plurality of permanent magnets (6) onto said strip (13), means (20, 21) for inserting said strip together with said permanent magnets inside a linear tubular body of predetermined length, means for cutting said strip (13) at a longitudinal end of said
5 tubular body (2), means for bending said tubular body, and means for joining together the longitudinal ends (9, 10) of said tubular body so as to provide a unitary rim structure (1).

20. Machine according to Claim 19, characterized in that said fixing
10 means (19) comprise means (19) for deforming said strip (13) so as to provide a plurality of shaped seats (14) at predetermined distances from each other, and a device (20) for loading a permanent magnet (6) inside each of said shaped seats (14).