Title: NIPPLE FOR RADIATOR ELEMENTS, RELATIVE RADIATOR ELEMENTS AND SET OF RADIATOR ELEMENTS
"Nipple for radiator elements, relative radiator elements and set of radiator elements"

[0001] The present invention relates to a nipple for radiator elements.

[0002] As known, radiator elements are hollow elements internally crossed by a high temperature fluid, usually water.

[0003] Said radiator elements are connected to each other through hollow nipples for allowing the water flow, which are tightened on collars or connecting ends of two radiator elements adjacent to each other.

[0004] Hollow cylindrical nipples are known in the art, suitable for allowing the sealed tightening of the radiator elements through screwing.

[0005] However, the solutions of the prior art are provided with nipples that are heavy and expensive to manufacture and assemble as they require high tightening torques, up to about 20 Kgm, and thus large sizes. Moreover, such nipples do not always ensure the fluid seal over time.

[0006] The problem of the present invention is to provide a nipple which should solve the disadvantages mentioned with reference to the prior art.

[0007] Such disadvantages and limits are solved by a nipple in accordance with claim 1 and by a radiator element in
accordance with claim 12.

[0008] Further embodiments of the nipple according to the invention are described in the following claims.

[0009] Further features and the advantages of the present invention will appear more clearly from the following description of some preferred non-limiting embodiments thereof, wherein:

[0010] figure 1 shows a side partial section view of a nipple according to an embodiment of the present invention;

[0011] figure 2 shows a plan view of the nipple of figure 1, from the side of arrow II of figure 1;

[0012] figure 3 shows a section view of radiator elements connected to each other by the nipples of figure 1;

[0013] figure 4 shows the enlarged detail IV of figure 1;

[0014] figure 5 shows a section view of radiator elements according to a further embodiment of the present invention, said element being connected to each other by a nipple according to the present invention;

[0015] figure 6 shows an enlargement of detail VI of the radiator elements of figure 5;

[0016] figure 7 shows a plan view of a detail of figure 5;

[0017] figure 8 shows a section view of the detail of figure 7, along line VIII-VIII of figure 7;

[0018] figure 9 shows a section view of radiator elements
according to a further embodiment of the present invention;

[0019] figure 10 shows an enlarged view of particular X of figure 9, wherein a nipple and a relative gasket according to the present invention have been added;

[0020] figure 11 shows an enlarged view of particular XI of figure 9;

[0021] figure 12 shows an enlarged view of a particular of figure 10.

[0022] Common elements or portions of elements in the embodiments described hereinafter will be indicated with the same reference numerals.

[0023] With reference to the above figures, reference numeral "4 denotes a nipple for radiator elements 8 suitable for being internally crossed by a fluid such as water.

[0024] The radiator elements 8 are usually placed side by side in sets so as to make the radiator complex.

[0025] The radiator elements 8 are hollow so as to be crossed by water and comprise tubular connecting ends 12, having an inner threading 14 so as to engage in screwing with nipple 4. Said connecting ends 12 preferably are axial-symmetric relative to a symmetry axis X.

[0026] Preferably, the connecting ends 12 end with flat support surfaces 16, so as to be head-connected to each
other.

At said support surfaces 16, the connecting end 12 comprises a seat 20, preferably axial-symmetric relative to said symmetry axis X and having a toroidal pattern.

According to an embodiment, seat 20 is obtained by a recessed portion shaped as a circumferential chamfer 24. Such chamfer 24 is preferably inclined at 45 degrees relative to said symmetry axis X.

Chamfer 24 is inclined so that an extension thereof runs into the symmetry axis inwards of the connecting end 12. Chamfer 24 extends so as to end on the support surface 16, without concerning the entire wall thickness 26 of the connecting end 12.

According to a further embodiment of the present invention, at the recessed portion of the connecting ends 12, the radiator elements 8 comprise a first inclined wall 130, a second inclined wall 140 and a third inclined wall 150 adjacent to each other. Said inclined walls are truncated-conical relative to said symmetry axis X. The first inclined wall 130 is adjacent to the associable nipple 4 and is preferably inclined, relative to symmetry axis X, by a first angle α1 comprised between 30 and 60 degrees; preferably, said first angle α1 is equal to 45 degrees.

The second inclined wall 140 is adjacent to the
first inclined wall 130, on the side opposite the associable nipple 4. Said second inclined wall 140 is preferably inclined relative to the symmetry axis X, by a second angle $a_2$ comprised between 50 and 80 degrees; preferably, said second angle $a_2$ is equal to 70 degrees.

According to another embodiment (figures 9,10,11), the second inclined wall 140 is adjacent to the first inclined wall 130 and it is inclined with respect to the symmetry axis X, by a second angle $b_2$ comprised between 90 and 110 degrees. In other words, the second inclined wall has an inclination opposed to the inclination of the first wall so as to improve the radial blockage of a gasket.

Preferably, said second angle $b_2$ is equal to 100 degrees.

The third inclined wall 150 is adjacent to the second inclined wall 140, on the side opposite the first inclined wall 130. Said third inclined wall 150 is preferably inclined relative to the symmetry axis X, by a third angle $a_3$ comprised between 20 and 45 degrees; preferably, said third angle $a_3$ is equal to 30 degrees.

According to another embodiment (figures 9,10,11), the third inclined wall 150 is adjacent to the second inclined wall 130 and it is inclined with respect to the symmetry axis X, by a third angle $b_3$ comprised between 10...
and 30 degrees. Preferably, said third angle \( b3 \) is equal to 22 degrees.

[0036] Two radiator elements 8 adjacent to each other exhibit same connecting ends 12, so as to determine, when the respective connecting ends 12 are placed side by side at the head thereof, a seating space 27 for an associable seal 28. According to an embodiment, seal 28 is an o-ring of polymeric material, for example an 'EPDM' rubber, a 'Viton' or silicone rubber.

[0037] According to a possible embodiment, said seal 28 is a ring seal having an elliptic cross-section, having a major axis \( W \) and a minor axis \( Z \).

[0038] Preferably, said seal 28 has an elliptic cross-section wherein the ratio between said major axis \( W \) and said minor axis \( Z \) is comprised between 1.10 and 1.40.

[0039] Preferably, the ratio between said major axis \( W \) and said minor axis \( Z \) is equal to 1.21.

[0040] Advantageously, in an assembly configuration the major axis \( W \) of said cross-section is disposed parallel to said symmetry axis \( Y \).

[0041] Advantageously, the seal, thanks to the particular elliptic configuration described, gives the possibility to perform a perfect tight seal with the respective radiator elements.

[0042] According to a further embodiment, said seal 28 is
of the O-ring type and comprises at least one tooth 160 radially arranged along an inner edge 165 of seal 28, directly facing the relevant nipple 4; preferably, the seal comprises at least two teeth 160 diametrically opposite one another. Said teeth 160 are preferably arranged symmetrically relative to a symmetry axis of the seal which in assembled configuration coincides with said symmetry axis X. Preferably, said teeth are arranged angularly at a pitch along said inner edge; according to a preferred embodiment, said seal comprises at least four teeth and even more preferably it comprises twelve teeth 160.

[0043] Nipple 4 as a whole has a cylindrical shape having a symmetry axis Y and suitable for being introduced at least partly into the connecting ends 12 and coaxially therewith, that is, making the symmetry axis Y of nipple 4 coinciding with the symmetry axis X of the connecting end 12.

[0044] Nipple 4 extends between opposite axial ends 29 suitable for directly facing the connecting ends 12 of the radiator elements 8.

[0045] Advantageously, nipple 4 exhibits a pair of outer threads 30, 32 arranged on the outer side surface thereof, said threads 30, 32 being suitable for screwing with the inner thread 14 of the connecting ends 12 of radiator
elements 8. The outer threads 30, 32 have helix angles equal to one another but with opposite inclination, that is, one helix is right-hand while the other is left-hand.

Nipple 4 advantageously comprises a circular and continuous sealing wall 36 along all the circumference thereof, suitable for receiving and influencing said seal 28 associable to nipple 4.

Advantageously, the sealing wall 36 is parallel and coaxial relative to said symmetry axis Y, so as to evenly influence the associable seal 28 along axis Y. Advantageously, the diameter of the bottom of the thread of the outer threads 30,32 is substantially equal to the diameter of said sealing wall 36. Preferably, the diameter of the top of said outer threads 30,32 is substantially equal to the diameter of the sealing wall 36 of an associable nipple 4.

Preferably, the sealing wall 36 has a height, measured parallel to axis Y, not smaller than the height of the seating space 27 determined by two adjacent seats 20.

In this way, it is possible to ensure that after the assembly of the nipple into two radiator elements 8 adjacent to each other, seal 28 is always contained within seats 20 and the seating space 27, inside which it is influenced in compression between the sealing wall 36.
and chamfers 24.

[0050] Preferably, the sealing wall 36 is arranged symmetrically relative to said axial ends 28 of nipple 4.

[0051] Advantageously, the diameter of the sealing wall 36 is substantially equal to the inside diameter of the connecting ends 12 of the associable radiator element 8.

[0052] The inside diameter of seal 28 is substantially equal to the diameter of the sealing wall 36, so that after being fitted, the same seal 28 remains positioned on the sealing wall 36.

[0053] The sealing wall 36 interrupts the continuity of the outer threads 30, 32.

[0054] Preferably, the outer threads 30, 32 of nipple 4 exhibit a thread bottom diameter substantially equal to the diameter of said sealing wall 36. In this way, on the side opposite the axial ends 28, the outer threads 30, 32 make a pair of containment guides for the associable seal 28 associated to said sealing wall 36.

[0055] Advantageously, on the side of each one of axial ends 29, nipple 4 exhibits a pair of indentations 40 arranged diametrically opposite relative to axis Y of nipple 4, so as to protrude inwards of nipple 4, that is, towards the cavity of nipple 4.

[0056] Indentations 40 are preferably obtained by punching nipple 4, at portions concerned by the outer threads 30,
32, that is, they are arranged between channel 36 and each one of the axial ends 29 of nipple 4.

[0057] Indentations 40 are suitable for being engaged by a special tightening wrench for screwing and tightening nipple 4 between the radiator elements 8.

[0058] The assembly of a nipple according to the invention shall now be described.

[0059] In particular, nipple 4 is placed at the inlet of two adjacent radiator elements 8 so as to move opposite axial ends 28 of nipple 4 in contact with the relevant inner threads 14 of the connecting ends 12 of the adjacent radiator elements 8.

[0060] Seal 28 is first fitted on nipple 4 so as to arrange it on the sealing wall 36.

[0061] The tightening wrench is then inserted through the free axial duct of one of the two radiator elements 8, so as to lock the same onto indentations 40 of nipple 4.

[0062] By rotating nipple 4, thanks to the fact that the threaded portions 30, 32 have reversed helix angles, nipple 4 concurrently screws on the opposite axial ends 29 so as to move close and tighten to one another the two radiator elements 8.

[0063] During the tightening of nipple 4, the radiator elements 8 move in contact with each other, in particular moving the respective support surfaces 16 in abutment.
Chamfers 24 of the connecting ends 12 contact seal 28, which is symmetrically positioned on the sealing wall 36 of nipple 4.

Seal 28 therefore undergoes a crushing by chamfers 24 but also by the sealing wall 36, so as to take on a substantially ellipsoidal section (figure 4), ensuring perfect hydraulic seal.

The continuity of the sealing wall 36 and of chamfers 24 ensures evenness of the seal compression and therefore of the hydraulic seal of the same.

The inclination of chamfer 24 at 45 degrees ensures an even distribution of both radial and axial compression forces on the seal.

The use of the inclined walls at the connecting end of the radiator element contributes to facilitating the assembly and to ensuring the necessary hydraulic seal of the nipple over time.

In particular, the first inclined wall contributes to favouring the insertion of the nipple into the ends of the radiator element.

The second inclined wall substantially contributes to providing the necessary hydraulic seal between the nipple and the radiator element.

The third inclined wall serves as optional discharge for burrs or chips that could result from the screwing of
the nipple on the connecting ends of the radiator elements. Such burrs or chips could cause the cracking of the seal.

[0072] The use of toroidal seals provided with teeth, on the inner edge thereof, contributes to axially locking the seal into position on the relative sealing wall of the nipple, especially during the insertion of the nipple into the connecting end of the radiator element. Moreover, the presence of teeth causes a state of radial compression of the seal which improves the adhesion thereof on the relative seat and ensures the seal over time. Moreover, the symmetric or pitch arrangement of such teeth always ensures the correct centring of the seal relative to the nipple and to the radiator elements.

[0073] As can be appreciated from the above description, the nipple according to the invention allows overcoming the disadvantages of the prior art.

[0074] In particular, the described nipple is lighter than the nipples of the prior art and therefore less expensive to make.

[0075] In fact, the nipple according to the present invention has a thickness of 2.5 mm whereas the nipples of the prior art have a thickness of 3.3 mm.

[0076] The reduction of the thickness also implies an increase of the inner passage section of the nipple that
allows a larger water flow section inside the radiator. Moreover, thanks to the larger inner passage section of the nipple, it is possible to install an electrical resistance into the nipple having a diameter up to 19 mm, in the case of radiator operating with oil, whereas in the radiators of the prior art it is not possible to install resistances with diameters larger than 15 mm. In this way, the heating performance due to such electrical resistances is improved.

The nipple according to the invention requires an especially moderate tightening torque, equal to about 5 Kgm, while ensuring a perfect and constant fluid seal over time.

The tightening operation can be easily carried out using a smaller tightening wrench than the wrenches available on the market and requiring a moderate tightening effort.

The inner bore of the nipple, and therefore the passage section of the nipple are larger than in the nipples available on the market, outer diameter being equal. In fact, the inner diameter of the nipple is larger and the radial overall dimensions of the tightening indentations are smaller.

Moreover, thanks to the reduced thickness it is possible to make the indentations also on nipples having
height smaller than 27 mm, for example with nipples having height equal to 26 mm. On the contrary, in the prior art it is not possible to make indentations on nipples having heights smaller than 27 mm without irreparably deforming the nipple itself.

[0082] The seal undergoes an even and axial-symmetric crushing by the chamfers and by the sealing wall so as to take on a substantially ellipsoidal section and ensure perfect hydraulic seal, even over time.

[0083] In order to meet specific and incidental needs, a man skilled in the art may make several changes and variations to the nipples described above, all falling within the scope of the invention as defined in the following claims.
Claims

1. A nipple (4) for radiator elements (8), having a symmetry axis (Y), comprising a pair of outer threads (30, 32) arranged on opposite axial ends (29) of the nipple (4) for allowing the screwing of the nipple (4) on connecting ends (12) of the radiator elements (8), a sealing wall (36) suitable for cooperating with an associable seal (28), arranged between the sealing wall (36) and the connecting ends (12) of the radiator elements (8) characterised in that said sealing wall (36) is parallel and coaxial relative to said symmetry axis (Y), so as to evenly influence the associable seal (28) along axis (Y), and the diameter of the bottom of the outer threads (30, 32) is substantially equal to the diameter of said sealing wall (36).

2. A nipple (4) according to claim 1, wherein the outer threads (30, 32) comprise helix angles equal to one another but with opposite inclination.

3. A nipple (4) according to claim 1 or 2, wherein on the side opposite the axial ends (28), the outer threads (30, 32) make a pair of containment guides for an associable seal (28) associated to said sealing wall (36).

4. A nipple (4) according to any one of the previous claims, wherein the nipple (4), on the side of each one
of axial ends (29) comprises a pair of indentations (40) protruding inwards of the nipple (4), said indentations (40) being suitable for being engaged by a special tightening wrench for screwing and tightening the nipple (4) between the radiator elements (8).

5. A nipple (4) according to claim 4, wherein said indentations (40) are arranged diametrically opposite relative to the axis (Y), so as to protrude inwards of the nipple (4).

6. A nipple (4) according to claim 4 or 5, wherein said indentations (40) are obtained by punching the nipple (4).

7. A nipple (4) according to claim 4, 5 or 6, wherein said indentations (40) are arranged at said outer threads (30, 32) of the nipple (4).

8. A nipple (4) according to any one of the previous claims, wherein said seal (28) is of the O-ring type.

9. A nipple (4) according to any one of claims 1 to 8, wherein said seal (28) is a ring seal having an elliptic cross-section, having a major axis (W) and a minor axis (Z).

10. A nipple (4) according to claim 9, wherein said seal (28) has an elliptic cross-section wherein the ratio between said major axis (W) and said minor axis (Z) is comprised between 1.10 and 1.40.

11. A nipple (4) according to claim 10, wherein the ratio
between said major axis (W) and said minor axis (Z) is equal to 1.21.

12. A nipple (4) according to any one of claims 9 to 11, wherein, in an assembly configuration, the major axis (W) of said cross-section is disposed parallel to said symmetry axis (Y).

13. A nipple (4) according to any one of the previous claims, wherein said seal (28) is of the O-ring type and comprises at least one tooth (160) radially arranged along an inner edge (165) of the seal (28), directly facing the nipple itself.

14. A nipple (4) according to claim 13, wherein said seal (28) comprises at least two teeth (160) diametrically opposite one another.

15. A nipple (4) according to claim 13 or 14, wherein said teeth (160) are arranged angularly at a pitch along said inner edge (165).

16. A nipple (4) according to any one of claims 13 to 15, wherein said seal (28) comprises at least four teeth (160).

17. A nipple (4) according to claim 16, wherein said seal (28) comprises twelve teeth (160).

18. A radiator element (8) comprising at least one connecting end (12) axial-symmetric with axis (X), provided with an inner thread (14) suitable for engaging
in screwing with an outer thread \((30,32)\) of a nipple, wherein said connecting end \((12)\) exhibits a seat \((20)\) with toroidal pattern obtained by a recessed portion and wherein the diameter of the top of said outer threads \((30,32)\) is substantially equal to the diameter of the sealing wall \((36)\) of an associable nipple \((4)\).

19. A radiator element \((8)\) according to claim 18, wherein said recessed portion comprises a chamfer \((24)\) inclined by 45 degrees relative to said symmetry axis \((X)\) so as to converge inwards of the connecting end \((12)\).

20. A radiator element \((8)\) according to claim 18 or 19, wherein said chamfer \((24)\) extends so as to end on a support surface \((16)\) of the connecting end \((12)\), without concerning the entire wall thickness \((26)\) of the connecting end \((12)\).

21. A radiator element \((8)\) according to any one of claims 18 to 20, wherein said recessed portion comprises a first inclined wall \((130)\), a second inclined wall \((140)\) and a third inclined wall \((150)\) adjacent to each other.

22. A radiator element \((8)\) according to claim 21, wherein said inclined walls \((130, 140, 150)\) are truncated-conical relative to said symmetry axis \((X)\).

23. A radiator element \((8)\) according to claim 21 or 22, wherein the first inclined wall \((130)\) is adjacent to the associable nipple \((4)\) and is inclined, relative to the
symmetry axis X, by a first angle \( \alpha_l \) comprised between 30 and 60 degrees.

24. A radiator element (8) according to claim 23, wherein said first angle \( \alpha_l \) is equal to 45 degrees.

25. A radiator element (8) according to any one of claims 21 to 24, wherein the second inclined wall (140) is adjacent to the first inclined wall (130) and is inclined relative to the symmetry axis (X), by a second angle \( \alpha_2 \) comprised between 50 and 80 degrees.

26. A radiator element (8) according to claim 25, wherein said second angle \( \alpha_2 \) is equal to 70 degrees.

27. A radiator element (8) according to any one of claims 21 to 24, wherein the second inclined wall (140) is adjacent to the first inclined wall (130) and it is inclined with respect to the symmetry axis (X), by a second angle \( \beta_2 \) comprised between 90 and 110 degrees.

28. A radiator element (8) according to claim 27, wherein said second angle \( \beta_2 \) is equal to 100 degrees.

29. A radiator element (8) according to any one of claims 21 to 26, wherein the third inclined wall (150) is adjacent to the second inclined wall (140) and is inclined relative to the symmetry axis (X), by a third angle \( \alpha_3 \) comprised between 20 and 45 degrees.

30. A radiator element (8) according to claim 29, wherein said third angle \( \alpha_3 \) is equal to 30 degrees.
31. A radiator element (8) according to claim 27 or 28, wherein the third inclined wall (150) is adjacent to the second inclined wall (140) and is inclined relative to the symmetry axis (X), by a third angle (b3) comprised between 10 and 30 degrees.

32. A radiator element (8) according to claim 31, wherein the third angle (b3) is equal to 22 degrees.

33. A set of radiator elements comprising at least two radiator elements according to any one of claims 18 to 32, wherein two radiator elements (8) adjacent to each other exhibit same connecting ends (12) and chamfers (24) or inclined walls (130, 140, 150), so as to determine, when the respective connecting ends (12) are placed side by side at the head thereof, a seating space (27) for an associable seal (28).

34. A set of radiator elements according to claim 33, comprising at least one nipple according to any one of claims 1 to 17.

35. A set of radiator elements according to claim 33 or 34, wherein the outer diameter of said sealing wall (36) is substantially equal to the internal diameter of said connecting ends (12).

36. A set of radiator elements according to claim 33, 34 or 35, wherein the outer diameter of the sealing wall (36) is substantially equal to the internal diameter of .
tops of an internal thread (14) of the connecting ends (12), suitable for engaging with the respective external threads (30,32) of the nipple (4).

37. A set of radiator elements according to any of claims 33 to 36, wherein said sealing wall (36) has a height, measured parallel to axis (Y), not smaller than the height of the seating space (27) of said seal (28).
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

**INV.** F28F9/26 F16J15/06

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)  
F28F  F16J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched.

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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**X** Further documents are listed in the continuation of Box C  
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**Date of the actual completion of the international search**  
17 July 2007

**Date of mailing of the international search report**  
27/07/2007

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