

SEALING GASKET

Technical Field

The present application relates to a sealing gasket.

Background

5 A sealing gasket with a metal skeleton comprises a spiral wound gasket and a traditional toothed gasket. The metal skeleton of the spiral wound gasket comprises multiple metal bases each are a thin steel strip with a V-shaped cross-section and are alternately wound around the same axis with each of multiple non-metal filler strips, therefore, the multiple metal bases are not an integral structure and hence are vulnerable to pressure and have a relatively low compression resistance and resilience. The traditional toothed gasket is made of a metal material or a metal-nonmetal composite material and two groups of triangular sharp teeth are formed integrally with the metal skeleton of the traditional toothed gasket. When the traditional toothed gasket is installed between two flanges of a device, the two groups of triangular sharp teeth contact end faces of the two flange and thus damage the end faces of the two flanges easily. Moreover, the two groups of triangular sharp teeth have a relatively low resilience and thus the two flanges of the device are required to be manufactured accurately and the traditional toothed gasket has to function in working conditions without severe temperature and pressure fluctuations.

Currently, some technical solutions have been proposed to improve a toothed gasket's sealing performance. For example, the toothed gasket's teeth have been reshaped to improve the toothed gasket's resilience and avoid damaging the flanges, and the toothed gasket has been provided with bosses for improving the toothed gasket's strength/hardness.

However, these technical solutions haven't solved some important issues, namely: how to maintain the sealing gasket's compression resistance and resilience, how to timely compensate for a gap caused by vibrations and temperature and pressure fluctuations in working conditions, and how to prevent the sealing gasket from being crushed. In particular, pipes and flanges of a device used in such as petroleum, chemical, electric power, and metallurgy and other industries have to function in working conditions with mostly a high temperature, a high pressure and frequent temperature and pressure fluctuations, and 80 % of the pipes and the flanges are going to be reused after maintenance with a decreased surface accuracy, so the sealing gasket's sealing performance needs to be improved for meeting safety and environment requirements.

Summary

An object of the present application is to provide a sealing gasket which is safe in use, durable and has a stable sealing performance. Even if installed between the flanges of the device with the decreased surface accuracy, used in the working conditions with the frequent temperature and pressure fluctuations, and/or overloaded, the sealing gasket can maintain its compression resistance and resilience and can timely perform a sealing compensation.

According to one aspect of the present application, there is provided a sealing gasket suitable for use in a device in which a fluid medium is transmitted, the sealing gasket defining an axis and comprising:

5 a metal skeleton at least partially shaped like a herringbone in a cross section of the sealing gasket comprising the axis, and

a non-metal sealing layer coated on two axial end faces of the metal skeleton,

the metal skeleton comprises:

10 a base being straight in the cross section, having a first center line orthogonal to the axis, and defining an axial passage through which the fluid medium transmitted in the device can flow when the sealing gasket is installed in the device such that the sealing gasket is subjected to a medium pressure; and

15 two groups of annular tooth plates extending from two axial end faces of the base respectively and symmetrically arranged relative to the first center line in the cross section, the tooth plates in each group being arranged at intervals along the first center line, and each of the tooth plates comprising an inclined segment and a curved segment adjoining the inclined segment, the inclined segment being straight in the cross section and having a second center line being inclined oppositely to a direction of the medium pressure with an angle in a range from 15° to 50° to the axis, and the curved segment being curved toward the base in the cross section and having a third center line with at least one radius of curvature in a range from 1 mm to 4 mm; and

20 at least one pair of annular bosses extending from the two axial end faces of the base respectively and symmetrically arranged relative to the first center line in the cross section, each of the bosses and a corresponding tooth plate adjacent thereto are arranged at intervals along the first center line, the bosses in the at least one pair having an axial spacing between their vertices facing away from the base that is 60 % - 90 % of the axial thickness of the sealing gasket.

Optionally, each of the tooth plates has an axial height that is 35 % - 85 % of the maximum axial thickness of a portion of the non-metal sealing layer coated on one of the two axial end faces of the metal skeleton.

30 Optionally, each of the tooth plates has a thickness that is substantially constant.

Optionally, each of the bosses has a maximum width along the first center line in the cross section that is at least 2.5 times the thickness of each of the tooth plates.

Optionally, each of the bosses has two boss bottom points adjoining the base and each of the tooth plates has two tooth plate bottom points adjoining the base,

35 wherein there is a spacing between one of the two boss bottom points and a corresponding tooth plate bottom point adjacent thereto that is at least twice the thickness of each of the tooth plates; and/or

wherein there is a spacing between one of the two tooth plate bottom points of one of the tooth plates and a corresponding tooth plate bottom point of another tooth plate adjacent to the one of the tooth plates is 1 to 3 times the thickness of each of the tooth plates.

5 Optionally, a surface of each of the bosses facing the corresponding tooth plate adjacent thereto is an inclined surface or an arcuate surface.

Optionally, the top of each of the bosses facing away from the base is not sharp.

10 Optionally, the sealing gasket further comprises a positioning ring configured to assist in positioning the sealing gasket, the positioning ring being integrally formed with the metal skeleton or being detachable to the metal skeleton and having an axial thickness that is less than the axial height of each of the bosses.

Optionally, the metal skeleton has a width along the first center line in the cross section that is substantially equal to the width of the non-metal sealing layer along the first center line in the cross section.

15 Optionally, non-metal sealing material for forming the non-metal sealing layer comprises graphite, polytetrafluoroethylene, mica, vermiculite, ceramic fiber or a combination thereof.

Other features of the present application and its advantages will become clear from the following detailed description of exemplary embodiments of the application with reference to the accompanying drawings.

Brief Description of the Drawings

20 The attached drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the present application and, together with the description thereof, serve to explain the principles of the present application.

FIG. 1 is a perspective view of a sealing gasket according to an embodiment of the present application.

25 FIG. 2 is an axial cross section view of the sealing gasket taken along line B-B of FIG. 1.

FIG. 3 is an axial cross section view of a sealing gasket installed in a device according to an embodiment of the present application.

FIG. 4 is an axial cross section view of a sealing gasket installed in a device according to another embodiment of the present application.

30 FIG. 5 is an axial cross section view of a sealing gasket installed in a device according to yet another embodiment of the present application.

FIG. 6 is an enlarged axial cross section view of a portion of the sealing gasket of FIG. 2 in which hatching is removed for clarity and various parts of the sealing gasket are not necessarily drawn to scale.

35

Detailed Description of Embodiments

Various exemplary embodiments of the present application will now be described in detail with reference to the drawings. It should be noted that the relative arrangement of the components and steps, the numerical expressions, and numerical values set forth in these
5 embodiments do not limit the scope of the present application unless it is specifically stated otherwise.

Techniques, methods and apparatus as known by one of ordinary skill in the relevant art may not be discussed in detail but are intended to be part of the specification where appropriate.

10 In all examples of the embodiments discussed herein, any specific values should be interpreted as merely illustrative and not as exclusive. Thus, the embodiments may have different values.

It should be noted that similar reference numerals and letters refer to similar items in the accompanying drawings, and thus once an item is defined in one figure, it is possible that it
15 needs not be further discussed for following figures.

Fig. 1 is a perspective view of a sealing gasket 10 according to one embodiment of the present application. The sealing gasket 10 is substantially cylindrical and hollow and defines an axis A.

Fig. 2 shows an axial cross section of the sealing gasket 10 comprising the axis A and taken
20 along line B-B of Fig. 1. Generally, the sealing gasket 10 comprises: a metal skeleton 12, which is at least partially, for example, completely, shaped like a herringbone in the axial cross section, and therefore, the sealing gasket 10 provided in the present application may also be referred to as a herringbone-type sealing gasket; and a non-metal sealing layer 14, which is coated on two axial end faces 12a, 12b of the metal skeleton 12 that are arranged
25 axially opposite to each other.

FIG. 3 to FIG. 5 each show an axial cross section of a sealing gasket 10 installed in a device according to an embodiment of the present application. The sealing gasket 10 provided in the present application is suitable for a device, comprising, but not limited to, a pipeline device used in such as petroleum, chemical, electric power, and metallurgy and
30 other industries, in which a fluid medium is transmitted. When the sealing gasket 10 is installed in such a device, the device will be effectively sealed to prevent leakage of the fluid medium. For example, the pipeline device sometimes needs to transmit the fluid medium in harsh environments such as with high temperature and high pressure. In this case, the pipeline device comprises a first flange 16 arranged at one end of one pipeline (not shown) and a second flange 18 arranged at one end of another pipeline (not shown).
35 The sealing gasket 10 is arranged between an end face of the first flange 16 and an end face of the second flange 18, such that the axis A of the sealing gasket 10 coincides with an axis of the one pipeline and the axis of the other pipeline. Then, the first flange 16 and the second flange 18 can be fastened together by means of a plurality of bolts 20, whereby the
40 sealing gasket 10 forms a seal between the end face of the first flange 16 and the end face

of the second flange 18. In Fig. 3, the first flange 16 is a concave flange and the second flange 18 is a convex flange, and the sealing gasket 10 can be inserted into the concave flange. In Figs. 4 and 5, the first flange 16 and the second flange 18 are both flat flanges, so a positioning ring 22 is provided for assisting in positioning of the sealing gasket 10.

- 5 In addition, the sealing gasket 10 defines a radial line C orthogonal to the axis A. As shown in FIG. 4, the positioning ring 22 may be formed integrally with the metal skeleton 12 and extend from a radial outer end of the metal skeleton 12 in a radial direction along the radial line C. Alternatively, as shown in FIG. 5, the positioning ring 22 may be detachable to the metal skeleton 12 and mounted to the radial outer end of the metal skeleton 12 in a suitable manner. For example, the positioning ring 22 may comprise at least two axially separable parts and the at least two axially separable parts may be clamped to the radial outer end of the metal skeleton 12 respectively.

Returning to FIG. 2, particularly, the metal skeleton 12 comprises a base 24 that is straight in the axial cross section and has a first center line D that is orthogonal to the axis A, i.e.,
15 the first center line D coincides with the radial line C. FIG. 2 shows a case in which the positioning ring 22 is present and extends from the radial outer end of the base 24, or in another case, the positioning ring 22 maybe mounted to the radial outer end of the base 24 in a suitable manner. The base 24 defines an axial passage, and when the sealing gasket 10 is installed in the device, the fluid medium transmitted in the device may flow through the
20 axial passage such that the sealing gasket 10 is subjected to a medium pressure. For example, when the fluid medium transmitted in the device has a pressure greater than an ambient pressure outside the device, the medium pressure (positive pressure) has a direction that is substantially radially outward (as shown by arrow H in FIG. 3), and when the fluid medium transmitted in the device has a pressure less than the ambient pressure
25 outside the device, the medium pressure (negative pressure) has a direction that is substantially radially inward. For the pipeline device, the diameter of the axial passage is equal to or greater than the inner diameter of the one pipeline and the inner diameter of the other pipeline.

Hereinafter, the configuration of various parts of the sealing gasket 10 is described when
30 the sealing gasket 10 is in an unused, i.e., unstressed state, unless otherwise specified.

Continuing to refer to FIG. 2, the metal skeleton 12 comprises two groups of annular tooth plates 26, which extend from two axial end faces 24a and 24b of the base 24 respectively. The two axial end faces 24a and 24b are arranged axially opposite to each other, and the two groups of tooth plates 26 are symmetrically arranged relative to the first center line D
35 in the axial cross section, and the tooth plates 26 in each group are arranged at intervals along the first center line D.

As shown in particular in FIG. 6, each of the tooth plates 26 comprises an inclined segment 26a and a curved segment 26b adjacent to the inclined segment 26a. The inclined segment 26a is straight in the axial cross section and has a second center line E, and the second
40 center line E is inclined oppositely to /to confront with the direction of the medium pressure with an angle β in a range from 15° to 50° to the axis A or to a virtual straight line

parallel to the axis A and intersecting the second center line E. In other words, when the direction of the medium pressure is substantially radially outward, the second center line E will be inclined radially inward to the axis A, and when the direction of the medium pressure is substantially radially inward, the second center line E will be inclined radially outward away from the axis A. The curved segment 26b is curved toward the base 24 in the axial cross section and has a third center line F which is continuous with the second center line E and has at least one radius of curvature in a range from R1 mm to R4 mm (i.e., 1 mm -4 mm) or has at least one radian in a range from 1.2 to 1.8 rad.

The inclined segment 26a of the tooth plate 26 has a thickness that is substantially constant in the axial cross section when measured in a direction perpendicular to the second center line E, and the curved segment 26b of the tooth plate 26 has a thickness that is substantially constant in the axial cross section when measured in a direction perpendicular to the third center line F, and the thickness of the inclined segment 26a and the thickness of the curved segment 26b may be substantially equal. That is, the thickness L_4 of the tooth plate 26 may be substantially constant.

When the sealing gasket 10 is installed in the device, such as the pipeline device, the sealing gasket 10 is first subjected to a sealing pressure from the end face of the first flange 16 and the end face of the second flange 18, such that the sealing gasket 10 is axially compressed by a certain amount of compression. The amount of compression comes from an elastic deformation of the non-metal sealing layer 14 and more importantly comes from an elastic deformation and a shape change of the metal skeleton 12, i.e. a shape change of the tooth plate 26, embedded in the non-metal sealing layer 14. The shape change of the tooth plate 26 relates to a deflection of the tooth plate 26 toward the base 24 under the sealing pressure. The curved segment 26b of the tooth plate 26 has an arcuate surface facing away from the base 24 or facing the end face of the first flange 16 or the end face of the second flange 18. The arcuate surface is advantages for the tooth plate 26 to be elastic deformed and shape changed, and even when the non-metal sealing layer 14 is elastically deformed to be extremely thin, the deflected tooth plate 26 is still kept in a non-sharp indirect contact with the end face of the first flange 16 or the end face of the second flange 18 via the non-metal sealing layer 14. As the fluid medium flows through the axial passage of the sealing gasket 10, the sealing gasket 10 is additionally subjected to the medium pressure. The medium pressure forces the tooth plate 26, especially the inclined segment 26a of the tooth plate 26, to at least tend to deflect away from the base 24 to restore the tooth plate 26's original shape. Thus, the amount of compression of the sealing gasket 10 changes accordingly, such that the sealing gasket 10 can timely compensate for a gap between the end face of the first flange 16 and the end face of the second flange 18 caused by fluctuations in temperature and pressure of the fluid medium or the device, thereby enhancing a sealing performance of the sealing gasket 10.

It is advantageous for the second center line E to be inclined oppositely to the direction of the medium pressure with an angle β in a range from 15° to 50° to the axis A. If the angle β is less than 15° , as the sealing pressure increases, the amount of compression of the sealing gasket 10 will be increased insufficiently, i.e., the tooth plate 26 lacks compressibility. If

the angle β is greater than 50° , the tooth plate 26 is too easy to be deflected toward the base 24 under the sealing pressure and is not easy to be deflected away from the base 24 to restore the tooth plate 26's original shape when the sealing pressure is removed or reduced, i.e., the tooth plate 26 lacks resilience.

- 5 It should be noted that herein the curved segment 26b has greater flexibility, i.e., compressibility than the inclined segment 26a, such that the tooth plate 26 experiences two stages of compression under the sealing pressure, thereby expanding the application of the sealing gasket. Moreover, during the use of the sealing gasket, even if the curved segment 26b fails due to cracks, the inclined segment 26a still can be compressed and rebounded
10 under the sealing pressure and thus continue to provide an effective support.

The metal skeleton 12 comprises at least one pair of annular bosses 28 (also referred to as limiting bosses 28) extending from the two axial end faces 24a, 24b of the base 24 respectively and symmetrically arranged relative to the first center line D in the axial cross section. Thus, one of the bosses 28 can be arranged on one axial end face 24a of the base
15 24, and the one of the bosses 28 can be radially adjacent to two tooth plates 26 arranged on the one axial end face 24a and located between the two tooth plates 26. Alternatively, the one of the bosses 28 can be arranged at the radial outer end of the base 24 (in the case in which the positioning ring 22 is present, the one of the bosses 28 is adjacent to the positioning ring 22 and is positioned radially inward relative to the positioning ring 22),
20 and the one of the bosses 28 is adjacent to one tooth plate 26 arranged on the one axial end face 24a of the base 24 and is positioned radially outward relative to the one tooth plate 26. Each of the bosses 28 and a corresponding tooth plate 26 adjacent thereto are arranged at intervals along the first center line D to prevent the tooth plate 26 from being crushed (that is, the sealing gasket 10 is damaged) when the sealing pressure from the end face of the
25 first flange 16 and the end face of the second flange 18 is overloaded. Specifically, in order to allow the tooth plate 26 to have better compressibility and resilience, the thickness of the tooth plate 26 is basically small, such that the tooth plate 26 forms a relatively thin strip, while the boss 28 can provide sufficient strength/hardness to resist the sealing pressure. It can be understood that the at least one pair of bosses 28 can comprise a plurality of pairs of
30 bosses 28.

The bosses 28 in the at least one pair has an axial thickness L_7 between their vertices facing away from the base 24 that is 60 % - 90 % of the axial thickness L_8 of the sealing gasket 10. To clarify, the shape of the boss 28 is not limited but the top of boss 28 facing away from the base 24 is not sharp, i.e., the top of the boss 28 has no sharp points. When
35 the top of the boss 28 is formed into a curved surface or an arcuate surface, the vertex is a point in the top that is axially farthest away from the base 24. When the top of the boss 28 comprises a plane axially farthest away from the base 24, the vertex comprises a number of vertices forming the plane. The axial spacing L_7 between the vertices of the bosses 28 in the at least one pair can be understood as the sum of the axial heights of the two bosses 28
40 and the axial thickness of the base 24.

Each of the bosses 28 has a maximum width L_2 in a direction along the first center line D

that is greater than or equal to 2.5 times the thickness L_4 of each of the tooth plates 26.

Optionally, each of the tooth plates 26 has an axial height L_5 that is 35 % - 85 % of the maximum axial thickness L_6 of a portion of the non-metal sealing layer 14 coated on one of the two axial end faces 12a, 12b of the metal skeleton 12. To clarify, when the tooth plate 26 extends from the one axial end face 24a of the base 24 and is embedded in the portion of the non-metal sealing layer 14, the axial height L_5 of the tooth plate 26 is an axial distance between a vertex of the tooth plate 26 and the one axial end face 24a of the base 24, and the vertex of the tooth plate 26 is located on the arcuate surface of the curved segment 26b facing away from the base 24 and axially farthest away from the base 24. The maximum axial thickness L_6 of the portion of the non-metal sealing layer 14 is an axial distance between an axial outer surface of the non-metal sealing layer 14 and a portion of the one axial end face 24a of the base 24 without the tooth plates 26 and the bosses 28.

Each of the bosses 28 has two boss bottom points directly connected / adjoining to the base 24, and the tooth plate 26 has two tooth plate bottom points directly connected / adjoining to the base 24.

Optionally, there is a spacing L_3 between one of the two boss bottom points and a corresponding tooth plate bottom point adjacent thereto that is at least twice the thickness L_4 of the tooth plate 26. If the spacing L_3 is less than twice the thickness L_4 of the tooth plate 26, the elastic deformation and the shape change of the tooth plate 26 will be limited by the spacing L_3 , thus affecting the tooth plate's resilience and compressibility.

Optionally, there is a spacing L_1 between one of the two tooth plate bottom points of one of the tooth plates 26 and a corresponding tooth plate bottom point of a corresponding tooth plate 26 adjacent the one of the tooth plates 26 that is 1 to 3 times the thickness L_4 of the tooth plate 26. If the spacing L_1 is less than the thickness L_4 of the tooth plates 26, the one of the tooth plates 26 and the corresponding tooth plate 26 are easy to rest against each other and it is difficult to manufacture such a sealing gasket 10. If the spacing L_1 is greater than 3 times the thickness L_4 of the tooth plates 26, the number of tooth plates 26 may be too less for the tooth plates 26 to function normally.

Optionally, in order to facilitate the tooth plate's resilience and compressibility and avoid the tooth plate's yielding caused by stress concentration, the inclined segment 26a of the tooth plate 26 has a first transition segment connected / adjoining to the base 24, the first transition segment having a radially outward side that is rounded and a radially inward side that is rounded as well. Similarly, the boss 28 has a second transition segment connected / adjoining to the base 24, the second transition segment having a radially outward side that is rounded and a radially inward side that is rounded as well. It should be noted in a case in which the first transition segment and the second transition segment are present, the first transition segment contains the two tooth plate bottom points and the second transition segment contains the two boss bottom points.

Optionally, the curved segment 26b of the tooth plate 26 is rounded at its free end to have an arc-shaped end face.

Optionally, the positioning ring 22 has an axial thickness that is less than the axial height of each of the bosses 28, and the axial thickness of the positioning ring 22 is 50% or less of the axial thickness L_8 of the sealing gasket 10.

- 5 Optionally, the metal skeleton 12 has a radial width that is substantially equal to the radial width of the non-metal sealing layer 14. That is, the metal skeleton 12 has a width along the first center line D in the cross section that is substantially equal to the width of the non-metal sealing layer 14 along the first center line D in the cross section. In the case in which the positioning ring 22 is present, the non-metal sealing layer 14 may be at least partially or may not be coated on two axial end faces of the positioning ring 22.
- 10 Optionally, the boss 28 has an inclined surface or an arcuate/curved surface facing a side of the corresponding tooth plate 26 adjacent to the boss 28, and the side of the corresponding tooth plate 26 is especially inclined to the boss 28 and does not have to face any sharp points. The inclined surface or the arcuate/curved surface provides more space for the tooth plate 26 to be compressed and rebounded and allows non-metal sealing material for
- 15 forming the non-metal sealing layer to be coated on the boss 28 stably. For example, the boss 28 can be shaped like a half ellipse for forming the arcuate surface/curved surface. In a case in which the maximum width L_2 is formed at the two boss bottom points of the boss 28, the boss 28 has a greater strength/hardness with the arcuate/curved surface than with the inclined surface.
- 20 Optionally, the non-metal sealing material comprises graphite, polytetrafluoroethylene, mica, vermiculite, ceramic fiber or a combination thereof.

- Although some specific embodiments of the present application have been demonstrated in detail with examples, it should be understood by those skilled in the art that the above examples are only intended to be illustrative but not to limit the scope of the present
- 25 application and the above embodiments could be modified without departing from the scope and spirit of the present application.

CLAIMS

Claim 1. A sealing gasket suitable for use in a device in which a fluid medium is transmitted, the sealing gasket defining an axis and comprising:

5 a metal skeleton at least partially shaped like a herringbone in a cross section of the sealing gasket comprising the axis, and

a non-metal sealing layer coated on two axial end faces of the metal skeleton,

characterized in that the metal skeleton comprises:

10 a base being straight in the cross section, having a first center line orthogonal to the axis, and defining an axial passage through which the fluid medium transmitted in the device can flow when the sealing gasket is installed in the device such that the sealing gasket is subjected to a medium pressure; and

15 two groups of annular tooth plates extending from two axial end faces of the base respectively and symmetrically arranged relative to the first center line in the cross section, the tooth plates in each group being arranged at intervals along the first center line, and each of the tooth plates comprising an inclined segment and a curved segment adjoining the inclined segment, the inclined segment being straight in the cross section and having a second center line being inclined oppositely to a direction of the medium pressure with an angle in a range from 15° to 50° to the axis, and the curved segment being curved toward the base in the cross section and having a third center line with at least one radius of curvature in a range from 1 mm to 4 mm; and

20 at least one pair of annular bosses extending from the two axial end faces of the base respectively and symmetrically arranged relative to the first center line in the cross section, each of the bosses and a corresponding tooth plate adjacent thereto are arranged at intervals along the first center line, the bosses in the at least one pair having an axial spacing between their vertices facing away from the base that is 60 % - 90 % of the axial thickness of the sealing gasket.

30 Claim 2. The sealing gasket according to claim 1, characterized in that each of the tooth plates has an axial height that is 35 % - 85 % of the maximum axial thickness of a portion of the non-metal sealing layer coated on one of the two axial end faces of the metal skeleton.

Claim 3. The sealing gasket according to claim 1 or 2, characterized in that each of the tooth plates has a thickness that is substantially constant.

35

Claim 4. The sealing gasket according to claim 3, characterized in that each of the bosses

has a maximum width along the first center line in the cross section that is at least 2.5 times the thickness of each of the tooth plates.

5 Claim 5. The sealing gasket according to claim 3, characterized in that each of the bosses has two boss bottom points adjoining the base and each of the tooth plates has two tooth plate bottom points adjoining the base,

wherein there is a spacing between one of the two boss bottom points and a corresponding tooth plate bottom point adjacent thereto that is at least twice the thickness of each of the tooth plates; and/or

10 wherein there is a spacing between one of the two tooth plate bottom points of one of the tooth plates and a corresponding tooth plate bottom point of another tooth plate adjacent to the one of the tooth plates is 1 to 3 times the thickness of each of the tooth plates.

15 Claim 6. The sealing gasket according to claim 1 or 2, characterized in that a surface of each of the bosses facing the corresponding tooth plate adjacent thereto is an inclined surface or an arcuate surface.

Claim 7. The sealing gasket according to claim 1 or 2, characterized in that the top of each of the bosses facing away from the base is not sharp.

20

Claim 8. The sealing gasket according to claim 1 or 2, characterized in that the sealing gasket further comprises a positioning ring configured to assist in positioning the sealing gasket, the positioning ring being integrally formed with the metal skeleton or being detachable to the metal skeleton and having an axial thickness that is less than the axial height of each of the bosses.

25

Claim 9. The sealing gasket according to claim 1 or 2, characterized in that the metal skeleton has a width along the first center line in the cross section that is substantially equal to the width of the non-metal sealing layer along the first center line in the cross section.

30

Claim 10. The sealing gasket according to claim 1 or 2, characterized in that non-metal sealing material for forming the non-metal sealing layer comprises graphite, polytetrafluoroethylene, mica, vermiculite, ceramic fiber or a combination thereof.