

SPARGING LUBRICATION MECHANISM COMPRISING A DRIVE GEAR

The present invention relates to the field of sparging-lubricated mechanisms, comprising a drive gear or transmission gearing that possesses two toothed gear wheels intermeshing with one another for the driving of one toothed gear wheel ("driven" gear wheel) by the other ("drive" gear wheel).

In order to minimise the wear on gearing, it is necessary to lubricate the gearing. In particular it is possible to immerse the gearing at least partially in a lubricant bath. This is referred to as sparging lubrication.

Embodiments of the invention seek to improve lubrication by sparging in a mechanism comprising a drive or transmission gearing.

According to an aspect of the present invention, there is provided a sparging-lubricated mechanism, comprising a housing and a drive or transmission gearing disposed within the housing, the gearing possessing two toothed gear wheels provided with respective toothings intermeshing within a meshing zone, each toothing having a first lateral surface and a second lateral surface opposite thereto, the mechanism further also comprising a channel member distinct from the housing, stationary with respect to the housing, delimiting a channel and disposed to be facing the first lateral surfaces to the right of the meshing zone in order to channel the lubricant expelled from the meshing zone from the first lateral surfaces circumferentially in the meshing zone.

The sparging lubricated mechanism includes on an optional basis, one or more of the following characteristic features, taken into consideration in isolation or in accordance with all technically possible combinations :

- the channel member cooperates in a sealing manner with a sealing surface provided on at least one toothed gear wheel ;
- the channel member cooperates in a sealing manner with a sealing surface of each toothed gear wheel ;
- at least one toothed gear wheel possesses a sealing surface that is perpendicular to the axis of rotation of this toothed gear wheel ;
- at least one toothed gear wheel possesses a sealing surface of revolution about the axis of rotation of the toothed gear wheel and having an extension along the said axis of rotation ;
- at least one toothed gear wheel possesses a cylindrical sealing surface that is centered on the axis of rotation of the toothed gear wheel ;
- the channel member is configured so as to scrape a sealing surface of a toothed gear wheel ;

- the channel member cooperates in a sealing manner with a sealing surface of at least one toothed gear wheel by means of a labyrinth sealing system; and

- it comprises a deflector disposed in the space delimited between the toothings of two toothed gear wheels immediately downstream of the meshing zone when considering the direction of rotation of the toothed gear wheels about their axes of rotation, the deflector extending over the entire width of the teeth of the toothed gear wheels of the gearing and being configured so as to divert the lubricant flowing circumferentially around a toothed gear wheel away from the latter and/or to direct this lubricant circumferentially around the other toothed gear wheel.

The invention and its advantages will be better understood upon reading the description which follows, provided purely by way of example, and with reference being made to the accompanying drawings, in which:

- Figure 1 is a cross-sectional view of a mechanism comprising a transmission gearing that possesses two toothed gear wheels intermeshing with each other;
- Figure 2 is a view from the top of the transmission gearing;
- Figure 3 is a cross-sectional view along III-III in Figure 2, illustrating a channel member of the mechanism;
- Figures 4 and 5 are views that are analogous to that shown in Figure 1 illustrating some variants.

The sparging lubricated mechanism 2 illustrated in Figures 1 and 2 comprises a housing 4 intended for receiving a lubricant and a drive or transmission gearing 6 disposed within the interior of the housing 4.

The housing 4 delimits an internal volume 8. The internal volume 8 is intended to receive the mechanical transmission components including the gearing 6. In particular the internal volume 8 is provided in order to contain other mechanical transmission components in addition to the gearing 6.

The housing 4 is represented partially, with only one housing wall 10 being visible in Figure 1. The housing wall 10 is for example a lower wall of the housing 4.

The housing 4 is sealed tight and configured in order to contain a lubricant for the lubrication of the mechanical members of the mechanism accommodated in the housing 4, and in particular of the gearing 6.

The gearing 6 comprises toothed gear wheels 12, 14, each toothed gear wheel 12, 14 possessing a tothing 16, 18 that extends over the circumference of the toothed gear wheel 12, 14, the respective toothings 16, 18 of the toothed gear wheels 12, 14

intermeshing with each other in a meshing zone 19. Each toothing 16, 18 is formed by the alternating of teeth 20 and spaces 22 between the teeth 20 over the circumference of the toothed gear wheel 12, 14.

The toothing 16, 18 of each toothed gear wheel 12, 14 possesses a first lateral surface 24, 26 and a second lateral surface 28, 30 opposite each other. Each tooth 20 of a toothing 16, 18 extends between the first lateral surface 24, 26 and the second lateral surface 28, 30 of the toothing 16, 18. Each space 22 of a toothing 16, 18 opens out at one end on the first lateral surface 24, 26 of this toothing 16, 18 and at the other end on the second lateral surface 28, 30 of this toothing 16, 18.

The first lateral surfaces 24, 26 of the toothings 16, 18 are oriented on the same side in the meshing zone 19 and the second lateral surfaces 28, 30 of the toothings 16, 18 are oriented on the same side in the meshing zone 19.

In the meshing zone 19, the toothing 16, 18 are engaged with each other. In the meshing zone 19, the teeth 20 of each toothing 16, 18 are inserted into the spaces 22 of the other toothing 16, 18.

The gearing 6 is configured for the transmission of a torque between the toothed gear wheels 12, 14. In particular, the gearing 6 is configured for the transmission of a torque from one toothed gear wheel referred to as the "drive" gear wheel to another referred to as the "driven" gear wheel.

The toothed gear wheels 12, 14 are mounted so as to be rotatable about the respective axes of rotation A1, A2. The axes of rotation A1, A2 of the two toothed gear wheels 12, 14 are distinctly separate. The gearing herein has parallel axes. The axes of rotation A1, A2 of the toothed gear wheels 12, 14 are parallel to each other. The first lateral surface 24, 26 and the second lateral surface 28, 30 of each toothing 16, 18 here are perpendicular to the axis of rotation A1, A2 of the toothed gear wheel carrying this toothing.

The toothed gear wheels 12, 14 here are mounted so as to be rotatable on the housing wall 10. The housing wall 10 is for example a bottom wall that is substantially horizontal, with the axes of rotation A1, A2 being substantially vertical.

In the example illustrated, the teeth 20 of each toothing 16, 18 are straight. They extend between the first lateral surface 24, 26 and the second lateral surface 28, 30 substantially parallel to the axis of rotation A1, A2 of the toothed gear wheel 12, 14. Each space 22 of the toothing 16, 18 opens on the first lateral surface 24, 26 and the second lateral surface 28, 30 axially relative to the axis of rotation A1, A2 of the toothed gear wheel 12, 14. By way of a variant, the teeth 20 are, for example formed in helical or chevron (herringbone-type) patterns. Each space 22 opens on to the first lateral surface

24, 26 and the second lateral surface 28, 30 obliquely relative to the axis of rotation A1, A2 of the toothed gear wheel 12, 14.

In operation, there is some lubricant present in the housing 4. The lubricant is in particular present in the spaces 22 of the toothings 16, 18. The insertion of a tooth 20 of one tothing 16, 18 in a space 22 of the other tothing 16, 18 in the meshing zone 19 drives the lubricant in this space 22 towards the ends of the space 22 which open on to the first and second lateral surfaces 24, 26; 28, 30 of the tothing 16, 18.

Thus, when the toothed gear wheels 12, 14 rotate, in the meshing zone 19, the jets of lubricant are expelled from the spaces 22 of the tothing 16, 18 from the first and second surfaces 24, 26; 28, 30 of the tothing 16, 18. In this present case, the toothed gear wheels 12, 14 are with parallel axes and straight teeth 20, such that the jets of lubricant are substantially axial.

This phenomenon is quite likely to disrupt the flow of lubricant around the meshing zone 19 and result in an accumulation of lubricant upstream of the meshing zone 19, when considering the direction of rotation of the toothed gear wheels (Arrows R in Figure 2). In addition, the jets of lubricant are quite likely to disrupt the operation of other mechanical transmission members of the mechanism accommodated in the housing 4.

In order to overcome these drawbacks, the mechanism 2 further also comprises a channel member 32 disposed to be facing the first lateral surfaces 24, 26 of the tothing 16, 18 and straddling the meshing zone 19 in order to collect and channel the lubricant expelled from the meshing zone 19 from the said first lateral surfaces 24, 26.

The channel member 32 is configured so as to force the lubricant collected to circulate circumferentially in relation to at least one of the toothed gear wheels 12, 14, in the meshing zone 19. The channel member 32 is here configured so as to force the lubricant to flow circumferentially in relation to the toothed gear wheel 14.

The channel member 32 is positioned to remain facing the meshing zone 19 on a continuous basis. The channel member 32 is immovable in relation to the axes of rotation A1, A2 of the toothed gear wheels 12, 14. The channel member 32 is immovable in relation to the housing 4.

In the example illustrated, the channel member 32 extends circumferentially in relation to a toothed gear wheel, here the gear wheel 14. The channel member 32 extends tangentially to the other toothed gear wheel, by the toothed gear wheel 12.

The channel member 32 includes, on one surface oriented to be facing the meshing zone 19, a channel 33 in order to channel the lubricant expelled from the meshing zone 19 from the said first lateral surfaces 24, 26.

The channel 33 is configured so as to collect the jets of lubricant expelled from the first lateral surfaces 24, 26 and to channel these jets of lubricant circumferentially around at least one of the toothed gear wheels 12, 14, here the toothed gear wheel 14.

5 The channel 33 extends along a longitudinal line L. The longitudinal line L here extends circumferentially in relation to the toothed gear wheel 14.

The channel member 32 extends circumferentially in a limited angular range about the axis of rotation of one of the toothed gear wheels 12, 14, i.e. on a fraction of the circumference of said one of the toothed gear wheels 12, 14. Advantageously, the limited angular range is lower than 90°. The channel member 32 extends here circumferentially in
10 a limited angular range about the axis of rotation of the toothed gear wheel 14, i.e. on a fraction of the circumference of the toothed gear wheel 14.

The channel 33 has a first closed longitudinal end 33A and a second open longitudinal end 33B. The second longitudinal end 33B opens here circumferentially relative to the gear wheel 14.

15 The channel 33 has a longitudinal opening 33C that extends along the channel 33 and is oriented to be facing the lateral surfaces 24, 26. The longitudinal opening 33C is located on the surface of the channel member 32 oriented to be facing the meshing zone 19.

The first longitudinal end 33A is situated in a manner such that the jets of lubricant
20 penetrate into the channel 33 at its first longitudinal end 33A, through the longitudinal opening 33C.

The first longitudinal end 33A is situated to the right of the meshing zone 19, where the jets of lubricant start to form.

The channel 33 comprises at its first longitudinal end 33A a deflecting surface 33D
25 configured so as to deflect the jets of lubricant along the longitudinal line L of the channel 33. The deflecting surface 33D is for example inclined and/or curved. Here it is curved.

The channel member 32 is configured so as to cooperate tightly with the surfaces 34, 36 of the toothed gear wheels 12, 14 in order to limit the passage of lubricant between the channel member 32 and the toothed gear wheels 12, 14.

30 In one embodiment, the sealing surface 34, 36 of each toothed gear wheel 12, 16 is a surface of revolution about the axis of rotation A1, A2 of this toothed gear wheel 12, 16 that has an axial extension along the axis of rotation of the toothed gear wheel 12, 16. The sealing surface 34, 36 of each toothed gear wheel 12, 14 protrudes out axially in relation to the first lateral surface 24, 26 of the toothing 16, 18 of this toothed gear wheel
35 12, 14 .

The sealing surface 34, 36 of each toothed gear wheel 12, 16 is here a cylindrical surface that is centered on the axis of rotation A1, A2 of the toothed gear wheel 12, 16.

The sealing surfaces 34, 36 are positioned to be facing each other on the right of the meshing zone 19, and the channel member 32 is inserted into the interval delimited
5 between the sealing surfaces 34, 36 of the two toothed gear wheels 12, 14.

In one embodiment, the channel member 32 cooperates with the sealing surface 34, 36 of each toothed gear wheel 12, 14 by means of labyrinth sealing systems 38, 40.

In the example illustrated, the channel member 32 cooperates with each sealing surface 34, 36 by means of a labyrinth sealing system 38, 40 comprising three sealing fins
10 42.

In operation, in the meshing zone, the lubricant present in the spaces 20 of the toothings 16, 18 is expelled on the first lateral surfaces 24, 26 of the tothing 16, 18. This lubricant is collected by the channel member 32 and driven circumferentially around the toothed gear wheels 12, 14 due to the rotation of the latter about their respective axes of
15 rotation A1, A2. The channel member 32 channels the lubricant circumferentially on the side of the first lateral surfaces 24, 26 of the toothings 16, 18.

More specifically, as is visible in Figure 3, the jets of lubricant penetrate into the channel 33, through the longitudinal opening 33C, at the first longitudinal end 33A of the channel 33, are deflected, flow along the channel 33, and emerge out at the second
20 longitudinal end 33B, circumferentially.

Moreover, downstream of the meshing zone, the tothing 20 of each toothed gear wheel 12, 14 tends to drive the lubricant circumferentially around this toothed gear wheel 12, 14. When one toothed gear wheel 12 (on the left in Figure 2) has a smaller diameter than the other 14 (on the right in Figure 2), the lubricant circulates at the same
25 circumferential speed around the two toothed gear wheels 12, 14, but travels a shorter distance around the toothed gear wheel 12 having the smaller diameter and a greater distance around the toothed gear wheel 14 having the larger diameter. This results in an imbalance in the distribution of the lubricant.

In order to obviate this drawback, as illustrated in Figure 2 and Figure 3, the
30 channel member 32 is configured so as to channel the lubricant circumferentially around the toothed gear wheel 14 having the larger diameter. The channel 33 extends circumferentially in relation to the toothed gear wheel 14 having the larger diameter.

In addition, the mechanism comprises on an optional basis a deflector 44 disposed in the space delimited between the toothings 16, 18 of the two toothed gear wheels 12, 14
35 immediately downstream of the meshing zone 19, the deflector 44 being configured so as to divert the lubricant flowing circumferentially around the toothed gear wheel 12 having

the smaller diameter away from the latter and/or to direct this lubricant circumferentially around the toothed gear wheel 14 having the larger diameter.

The deflector 44 extends here from the circumference of the toothed gear wheel 12 having the smaller diameter and substantially circumferentially relative to the toothed gear wheel 14 having the larger diameter. This deflector 44 makes it possible to divert the lubricant flowing circumferentially around the toothed gear wheel 12 having the smaller diameter away from the latter and to direct this lubricant circumferentially around the toothed gear wheel 14 having the larger diameter.

Preferably, the deflector 44 extends substantially over the entire width of the toothing 16 of the toothed gear wheel 12 having the smaller diameter. The width of the toothing 16 is the distance between the first lateral surface 24 and the second lateral surface 28 of the toothing 16.

In the example illustrated, as is visible in Figure 3, the deflector 44 is here formed integrally in one piece with the channel member 32.

The variant embodiment represented in Figure 4 differs from that represented in Figures 1 to 3 in that the channel member 32 is configured so as to cooperate in a sealing manner with a sealing surface 34 of a toothed gear wheel 12 which is perpendicular to the axis of rotation A1 of this toothed gear wheel 12. In particular, the channel member 32 includes a lateral edge 46 provided with a scraper configured so as to scrape the sealing surface 34 in question.

In Figure 4, the toothed gear wheel 12 having the smaller diameter is provided with a sealing surface 34 that is perpendicular to the axis of rotation A1 of this toothed gear wheel, and the toothed gear wheel 14 having the larger diameter is provided with a surface seal 36 of revolution about the axis of rotation A2 of the toothed gear wheel 14 having the larger diameter. By way of a variant, the configuration is reversed.

The variant embodiment shown in Figure 5 differs from the one shown in Figure 4 in that the channel member 32 is configured so as to cooperate in a sealing manner with the sealing surfaces 34 and 36 of each toothed gear wheel 12, 14 which are perpendicular to the axis of rotation A1, A2 of these toothed gear wheels 12, 14. In particular, each lateral edge of the channel member 32 is configured so as to cooperate in a sealing manner with the sealing surface 34, 36 of a respective toothed gear wheel 12, 14. Each lateral edge is provided for this purpose with a scraper that is configured for scraping 46 the corresponding sealing surface 34, 36.

In Figures 1, 4 and 5, the first lateral surfaces 24, 26 of the toothings 16, 18 are oriented to be facing a region of the internal volume 8 of the housing 4 which is free or

within which are situated other mechanical members. The channel member 32 is disposed in a manner so as to prevent the jets from being projected into this space.

The second lateral surfaces 28, 30 of the toothings 16, 18 are oriented to be facing the housing wall 10, in a manner such that the jets of lubricant expelled from the spaces 22 of the toothings on the second lateral surfaces 28, 30 are blocked by this housing wall 10. By way of a variant, the mechanism 2 additionally also comprises another channel member that is similar to the channel member 32 and disposed on the side of the second lateral surfaces 28, 30 of the toothings 16, 18 in order to channel the lubricant expelled from the spaces 22 in the meshing zone 19.

The channel member 32 is distinctly separate from the housing 4 and is mounted within the interior of the housing 4, by any suitable means, for example by means of bonding, welding, screwing and/or riveting.

In the example illustrated, the gearing 6 is of the type having parallel axes. By way of a variant, the gearing 6 is of the type having non-parallel axes, in particular having intersecting axes.

The invention is applicable to any mechanical system comprising a gearing system. In particular, the mechanism 2 can be for example a reducer or a manual or automatic gear-box.

CLAIMS

1. - A sparging-lubricated mechanism, comprising a housing and a drive or transmission gearing disposed within the housing, the gearing possessing two toothed gear wheels provided with respective toothings intermeshing within a meshing zone, each toothing having a first lateral surface and a second lateral surface opposite thereto, the mechanism further also comprising a channel member distinct from the housing, stationary with respect to the housing, delimiting a channel and disposed to be facing the first lateral surfaces to the right of the meshing zone in order to channel the lubricant expelled from the meshing zone from the first lateral surfaces circumferentially in the meshing zone.

2. - A mechanism according to claim 1, in which the channel member cooperates in a sealing manner with a sealing surface provided on at least one toothed gear wheel.

3. - A mechanism according to claim 2, in which the channel member cooperates in a sealing manner with a sealing surface of each toothed gear wheel.

4. - A mechanism according to claim 2 or claim 3, in which at least one toothed gear wheel possesses a sealing surface that is perpendicular to an axis of rotation of the toothed gear wheel.

5. - A mechanism according to claim 4, in which at least one toothed gear wheel possesses a sealing surface of revolution about the axis of rotation of the toothed gear wheel and having an extension along the said axis of rotation.

6. - A mechanism according to claim 4 or 5, in which at least one toothed gear wheel possesses a cylindrical sealing surface that is centered on the axis of rotation of the toothed gear wheel.

7. - A mechanism according to any one of claims 2 to 6, in which the channel member is configured so as to scrape a sealing surface of a toothed gear wheel.

8. - A mechanism according to any one of claims 2 to 7, in which the channel member cooperates in a sealing manner with a sealing surface of at least one toothed gear wheel by means of a labyrinth sealing system.

9. - A mechanism according to any one of the preceding claims, comprising a deflector disposed in a space delimited between the toothings of two toothed gear wheels immediately downstream of the meshing zone when considering a direction of

rotation of the toothed gear wheels about their axes of rotation, the deflector extending over an entire width of the teeth of the toothed gear wheels of the gearing and being configured so as to divert the lubricant flowing circumferentially around a toothed gear wheel away from the latter and/or to direct the lubricant circumferentially around the other toothed gear wheel.

10.- A mechanism according to any one of claims 4 o 6, in which the channel member extends circumferentially in a limited angular range about the axis of rotation of one of the toothed gear wheels.