

Description

BRAKE PAD AND ASSEMBLY METHOD

Technical field

[1] This disclosure relates to brake pads and to the methods for assembling these pads.

5 Prior art

[2] Typically, vehicle braking systems comprise a brake pad which, during braking phases, presses against an element that is rotating about a rotation axis, thus braking the vehicle. In particular, in rail vehicles such as trains, trams, or subways, braking is achieved using a shoe brake, also called a tread brake or TBU (Tread Brake Unit). In this type of brake, the brake pad, also called the wear plate or shoe, presses against a radially outer surface of a moving wheel of the railway vehicle during braking phases.

[3] The shoe of the shoe brake comprises a lining made of friction material. One face of this lining which comes into contact with the wheel during braking phases, called the friction face, is gradually worn down by abrasion, as is the wheel itself. This generates particles. Since these particles are pollutants, their release into the environment should be limited. For that purpose, the lining is conventionally equipped with a particle collection groove that is fully open on the friction face. This groove is fluidly connected to a negative-pressure source capable of suctioning in the collected particles. For example, a pneumatic hose fluidly connects the groove to the negative-pressure source, as described in FR 3 087 238 A.

[4] There is a need to develop pads that ensure that the connection between the pneumatic hose and the groove is reliable and without leaks, without increasing the pad's size.

Summary

[5] This disclosure improves the situation.

[6] To this end, a brake pad is proposed, the pad comprising a lining and a lining carrier, the lining being made of friction material and having at least one particle collection groove, the lining carrier being connected to a face of the lining, called the mounting face, in which a space is provided between the lining carrier and the mounting face of the lining, characterized in that a sealing chamber is arranged in the space, the sealing chamber comprising a suction duct intended to be fluidly connected to a negative-pressure source, wherein the at least one particle collection groove comprises a suction hole that leads into the sealing chamber and is fluidly connected to the suction duct.

[7] Thus, by means of the sealing chamber and in particular the suction duct comprised in this chamber, it is simpler to establish a reliable and sealed fluid connection between the collection groove and the negative-pressure source. Furthermore, since the sealing chamber is positioned in the space between the lining carrier and the mounting face of the lining, as already provided in prior art brake pads, the overall size of the pad is not increased by the presence of this sealing chamber, and it is not necessary to modify its geometry relative to known pads. The leak-proof and reliable

fluid connection between the collection groove and the negative-pressure source can therefore be achieved without increasing the overall size or altering the pad's geometry relative to known pads. Moreover, because the sealing chamber is designed to be installed in the space between the lining carrier and the mounting face of the lining, brake pad maintenance operations remain unchanged.

- 5 More specifically, the pad installed in a brake system can be replaced with a new pad in the same way as in the prior art, as will be described below.

[8] The pad is, for example, a wear plate (or shoe) of a shoe brake (or tread brake, or T.B.U.) of a rail vehicle. Alternatively, the pad may be a brake pad for a road vehicle, or for a stationary machine with a rotor such as a wind turbine, or for an industrial machine.

- 10 **[9]** The lining carrier may be shaped to be connected to a brake head, for example via a pin configured to pass through at least one orifice provided in the lining carrier. The lining carrier may comprise a plate, for example made of metal. In some cases, the plate comprises at least one bent area formed by two shoulders, which produces the space between the lining carrier and the mounting face of the lining. Advantageously, this bent area may comprise an orifice arranged in each shoulder.
- 15 Such orifices allow the passage of the pin of the brake head. Such a pin may be mounted to be movable in translation between a first and a second position. In the first position, the pin is passing through the orifices in the lining carrier, thus securing the pad to the brake head. In the second position, the pin is not inside the orifices in the lining carrier, thus detaching the pad from the brake head, which allows the pad to be replaced.

- 20 **[10]** The particles collected in the at least one collection groove may be generated during braking phases of the vehicle, during which the lining comes into contact with an element rotating about an axis of rotation. In particular, the lining may comprise a face, called the friction face, which is opposite the mounting face in a direction substantially perpendicular to the friction face. This friction face is designed to come into contact with the rotating element during the vehicle's braking phases. The
- 25 friction face and the rotating element thus wear down during braking phases, which generates the release of particles, generally pollutants, resulting from abrasion of the friction face and of the rotating element. These particles can be collected in the at least one collection groove.

[11] The at least one collection groove thus allows reducing the amount of particles resulting from abrasion of the lining and rotating element that are released into the environment.

- 30 **[12]** In some cases, the at least one collection groove is fully open on the friction face of the lining. In other cases, the at least one collection groove comprises a first portion that is open on the friction face and a second portion that is covered by friction material of the friction face. Since the second portion of the at least one collection groove is covered by friction material, this second portion of the at least one collection groove is open on the friction face only after the friction material that covers it
- 35 has been completely worn away by abrasion of the pad in contact with the rotating element during braking phases. In particular, the second portion of the at least one collection groove is initially buried in the lining. As the friction face of the pad is worn down by contact with the rotating element, the second portion of the collection groove is exposed and becomes open on the friction face. This prevents the second portion of the collection groove from being open on the friction face before the

level of wear of the pad becomes sufficient for the rotating element to seal off the second portion of the at least one collection groove during braking phases. This thus reduces the risk that particles, originating from wear of the brake pad and rotating element and collected in the at least one collection groove, will escape through the second portion of the collection groove before being
5 suctioned in by the negative-pressure source. The efficiency of the collection and suctioning of these particles is thus improved, since fewer particles are lost than if the collection groove were initially completely open on the friction face.

[13] The lining also comprises a leading edge and a trailing edge, as well as an axially inner edge and an axially outer edge extending between the leading and trailing edges. In some cases, at least
10 one of the axially inner or outer edges is a chamfered edge.

[14] In this text, “axial” is understood to mean a direction substantially parallel to the axis of rotation of the rotating element, while “radial” is understood to mean any direction substantially perpendicular to the axis of rotation of the rotating element.

[15] In one example, the second portion of the at least one collection groove is located at least
15 partially beneath the chamfered edge. In another example, the entire second portion of the at least one collection groove is located beneath the chamfered edge.

[16] The rotating element is, for example, a wheel of a rail vehicle. The rotating element may alternatively be a brake disc. A radially outer surface of the rotating element may have a substantially frustoconical shape. In particular, the diameter of the rotating element may gradually increase
20 between an axially inner face and an axially outer face of the rotating element.

[17] The suction hole of the at least one groove may lead, directly or indirectly, into the suction duct. In one non-limiting example, the suction hole is arranged at one end of the at least one collection groove. This concentrates the suction of particles at that end of the at least one collection groove. Moreover, from a single suction hole, it is possible to suction the particles collected in the at least
25 one collection groove. This facilitates the manufacture of the pad and reduces its size.

[18] The negative-pressure source is, for example, a particle suction system. Communication means, such as a flexible hose, may connect the negative-pressure source to the suction hole.

[19] The sealing chamber may comprise a sealing body and a suction duct. In one non-limiting example, the sealing body is at least partially arranged in the space between the lining carrier and
30 the mounting face of the lining, while the suction duct protrudes from this space.

[20] The suction duct may be connected to the sealing body. Furthermore, the suction duct may be designed to be fluidly connected to the negative-pressure source. In particular, one end of the communication means may be connected to the suction duct, while the other end of the communication means may be connected to the negative-pressure source. Advantageously, an outer
35 surface of the suction duct may comprise at least one annular protrusion. This makes it possible to secure the connection of the communication means to the suction duct.

[21] Advantageously, when the sealing chamber is installed in the space between the lining carrier and the mounting face of the lining, the at least one orifice provided in the lining carrier to allow the passage of the pin is not obstructed by the sealing chamber. It is thus still possible to connect the pad to the brake head by inserting the pin into the at least one orifice in the lining carrier. The presence of the sealing chamber therefore does not change the maintenance operations for the pad, which can be replaced when the pin is removed from the at least one orifice in the lining carrier and the communication means disconnected from the suction duct. Moreover, as explained above, the chamber can be installed in prior art pads without altering their geometry or dimensions.

[22] The sealing chamber may be an additional component inserted into the space between the lining carrier and the mounting face of the lining. This configuration has the advantage of not requiring any modification to the method for assembling the lining to the lining carrier. Alternatively, the sealing chamber may be integrated into the lining carrier and/or into the lining itself. This avoids having to provide means to hold the sealing chamber in position within the space between the lining carrier and the mounting face of the lining.

[23] The sealing chamber is advantageously connected in a sealed manner to the lining of the pad, and thus to each collection groove of the pad. The seal between the chamber and the lining (and between each collection groove) may be established, for example, using a layer of rubber or putty, by molding the lining onto the chamber, or by an O-ring fitted between the suction hole and the chamber.

[24] According to one aspect, the sealing chamber is welded to the lining carrier and/or to the lining.

[25] This configuration allows the chamber to be installed in the space between the lining carrier and the mounting face without modifying the structure of the lining carrier or of the lining. Thus, the sealing chamber can be installed on existing pads which comprise a space between the lining carrier and the mounting face of the lining. Furthermore, there is no need to use additional parts to hold the sealing chamber in position inside the space between the lining carrier and the mounting face of the lining.

[26] To perform the welding, the sealing body may comprise a shell, for example made of metal. The shell may define a recess in the sealing body. The shell may be welded to a face of the lining carrier that is positioned facing the mounting face of the lining. A weld bead therefore appears between the lining carrier and the sealing chamber.

[27] If the sealing chamber is welded to the lining, the lining may advantageously comprise a metal area for performing the welding.

[28] According to one aspect, the pad may further comprise a connecting means which connects the sealing chamber to the lining carrier and/or to the lining. Thus, the sealing block is reliably connected to the lining carrier and/or to the lining.

[29] The connecting means may be non-removable or removable. The connecting means may be a screw, for example. In order to connect the chamber to the lining carrier by the connecting means, the sealing body may comprise a cavity comprising an internal thread complementary to an external

thread of the connecting means. Furthermore, the lining carrier may comprise a bore aligned with the cavity of the sealing body and shaped to receive the connecting means. The sealing chamber can thus be connected to the lining carrier by the connecting means, holding it in position within the space provided between the lining carrier and the mounting face of the lining.

5 **[30]** It should be noted that the sealing chamber designed to be connected to the lining carrier by connecting means may otherwise comprise the same elements as the sealing chamber designed to be welded to the lining carrier and/or to the lining. It should be noted, however, that to avoid increasing the dimensions of the sealing chamber, the recess of the shell described above may be smaller than when the sealing chamber is welded.

10 **[31]** According to one aspect, the sealing chamber is press-fitted into the space provided between the lining carrier and the mounting face of the lining. This configuration also allows the chamber to be installed in the space between the lining carrier and the mounting face without modifying the structure of the lining carrier or of the lining. The sealing chamber can thus be installed in existing

15 pads that comprise a space between the lining carrier and the mounting face of the lining. Furthermore, there is no need to use additional parts to hold the sealing chamber in position in the space between the lining carrier and the mounting face of the lining.

20 **[32]** In particular, the sealing chamber may be shrink-fitted into the space between the lining carrier and the mounting face of the lining. For this purpose, the chamber is initially sized to have dimensions preventing its insertion into the space. The chamber, or at least its sealing body, is then cooled. This cooling process causes the sealing chamber to contract, allowing it to be easily inserted into the space between the lining carrier and the mounting face of the lining. The temperature of the sealing chamber then gradually increases until it reaches thermal equilibrium with its environment (in particular with the lining carrier and the mounting face). This increase in the temperature of the sealing chamber causes the chamber to gradually regain its original shape and dimensions. The

25 sealing chamber is then held tightly between the lining carrier and the lining, creating a seal.

30 **[33]** According to one aspect, the sealing chamber may comprise a nut welded to the lining carrier and/or to the lining. The nut comprises an inner annular face provided with an internal threading that is complementary to an external threading on an outer surface of the suction duct. The suction duct may thus be connected to the nut by the cooperation between the external thread on the outer surface of the suction duct and the internal thread in the nut.

35 **[34]** To weld the nut to the lining carrier, a wall substantially perpendicular to the suction duct may be obtained by bending the plate of the lining carrier or by welding such a wall to the lining carrier.

35 **[35]** In some cases, to improve the seal between the sealing body and the suction duct, a sealing member, for example an O-ring, may be arranged at the end of the suction duct that is received in the sealing body.

35 **[36]** According to one aspect, the sealing chamber may include a filler block comprising a cavity fluidly connecting the suction hole of the at least one collection groove to the suction duct.

[37] The filler block may be installed in the recess of the shell described above. The filler block may occupy the entire recess delimited by the shell. The cavity of the filler block extends, for example, between the suction hole and the suction duct, making it possible to establish a fluid connection between the suction hole and the suction duct.

5 **[38]** The filler block may also be obtained after overmolding the lining onto the lining carrier.

[39] According to one aspect, the filler block may be made of silicone and/or in the friction material of the lining.

[40] When the filler block is made in the friction material of the lining, it is possible to obtain the filler block at the same time that the lining is overmolded onto the lining carrier.

10 **[41]** According to one aspect, the sealing chamber may be made as a single unit with the lining carrier. In this manner, there is no need for additional parts or steps to connect the sealing chamber to the lining carrier during pad assembly.

[42] According to one example, the plate used to form the lining carrier may be designed so that it can be bent to form the sealing body of the sealing chamber.

15 **[43]** According to another example, at least one wall may be welded to the lining carrier, this wall extending substantially perpendicularly to the suction duct. For example, two walls substantially perpendicular to the suction duct may be welded to the lining carrier to form a single unit. A cavity formed between these walls and the lining carrier can be filled with the friction material of the lining when the lining is overmolded onto the lining carrier.

20 **[44]** According to another aspect, a method for assembling a brake pad as described above is proposed, the method comprising:

- supplying the lining, the lining carrier, and the sealing chamber;
 - connecting the lining carrier to the mounting face of the lining;
 - arranging the sealing chamber in the space provided between the lining carrier and the mounting
- 25 face of the lining, such that the suction hole of the at least one particle collection groove leads into the sealing chamber and is fluidly connected to the suction duct.

[45] The method for assembling the brake pad is therefore simple. In particular, by means of this method, it is possible to install the sealing chamber without having to modify the brake head, the latter operation being very complex in the case of brake systems for rail vehicles. A seal established

30 between the suction hole, the suction duct, and the negative-pressure source is thus easily achieved.

[46] According to one aspect, the sealing chamber may be arranged in the space by at least one of the following techniques:

- welding the sealing chamber to the lining carrier and/or to the lining; and/or
 - attaching the sealing chamber to the lining carrier and/or to the lining via a connecting means;
- 35 and/or
- shrink-fitting the sealing chamber between the lining carrier and the lining; and/or
 - overmolding the lining onto an assembly comprising the lining carrier and the suction duct.

[47] It should be noted that it is possible to combine several of these techniques in the same brake pad in order to arrange the sealing chamber in the space between the lining carrier and the mounting face of the lining. For example, a same chamber may be both welded to the lining carrier and attached to the lining carrier by connecting means. This helps to better ensure that the sealing chamber remains in position within the space between the lining carrier and the mounting face of the lining.

[48] Advantageously, when the chamber comprises a shell enclosing a recess occupied by the sealing block, and the chamber is welded or attached via connecting means to the lining carrier and/or to the lining, the filler block is installed in the recess before the sealing block is connected to the lining and/or to the lining carrier. In the case of the embodiments in which the chamber is welded or connected via connecting means to the lining carrier and/or to the lining, it is possible to first connect the lining carrier to the mounting face of the lining, and then install the sealing chamber in the space between the lining carrier and the mounting face. In these examples, it is also possible to first connect the chamber to the lining carrier and/or to the lining (by welding or by connecting means), and then connect the lining carrier to the mounting face of the lining. In this case, the step of connecting the lining carrier to the mounting face and the step that includes arranging the chamber in the space between the lining carrier and the mounting face are carried out concurrently.

[49] In embodiments in which the lining is overmolded onto the assembly comprising the lining carrier and the suction duct, the step of arranging the chamber in the space is also carried out concurrently with the step that includes connecting the lining carrier and the lining.

Brief description of drawings

[50] Other features, details, and advantages will become apparent from the detailed description below, and from an analysis of the accompanying drawings, in which:

Fig. 1

[51] [Fig. 1] shows a schematic perspective view of a braking system according to one exemplary embodiment.

Fig. 2

[52] [Fig. 2] shows a schematic side view of a brake assembly of the braking system of FIG. 1.

Fig. 3

[53] [Fig. 3] shows a schematic perspective view of a brake pad of the braking system of FIG. 1 according to one exemplary embodiment.

Fig. 4

[54] [Fig. 4] shows a schematic perspective view of the pad of FIG. 3 from a first angle, with the pad equipped with a sealing chamber.

Fig. 5

[55] [Fig. 5] shows a schematic perspective view of the pad of FIG. 3 from a second angle, with the pad equipped with the sealing chamber.

Fig. 6

5 [56] [Fig. 6] shows a schematic perspective view of an axial cross-section of the pad of FIG. 3 and a sealing chamber according to a first embodiment.

Fig. 7

[57] [Fig. 7] shows a schematic perspective view of an axial cross-section of the pad of FIG. 3 and a sealing chamber according to a second embodiment.

Fig. 8

10 [58] [Fig. 8] shows a schematic perspective view of an axial cross-section of the pad of FIG. 3 and a sealing chamber according to a third embodiment.

Fig. 9

[59] [Fig. 9] shows a schematic perspective view of an axial cross-section of the pad of FIG. 3 and a sealing chamber according to a fourth embodiment.

15 **Fig. 10**

[60] [Fig. 10] shows a schematic perspective view of an axial cross-section of the pad of FIG. 3 and a sealing chamber according to a fifth embodiment.

Fig. 11

20 [61] [Fig. 11] shows a schematic perspective view of an axial cross-section of the pad of FIG. 3 and a sealing chamber according to a sixth embodiment.

Fig. 12

[62] [Fig. 12] shows a schematic perspective view of a seventh embodiment.

Fig. 13

[63] [Fig. 13] shows a schematic view of an eighth embodiment.

25 **Fig. 14**

[64] [Fig. 14] shows a schematic view of a ninth embodiment.

Description of embodiments

30 [65] FIG. 1 shows an example of a braking system 10 for a vehicle, in particular a rail vehicle (train, tram, subway, etc.). The braking system 10 comprises a rotating element 12 and a brake assembly 14.

[66] The rotating element 12 corresponds to a part of the vehicle that causes translational movements of the vehicle by means of a rotational movement of this element 12 about an axis of

rotation. In the case here, the rotating element 12 is a wheel of the vehicle, configured to rotate about an axis of rotation A, although this is not a limitation.

5 [67] Advantageously, a radially outer surface 16 of the wheel 12 has a substantially frustoconical shape. In particular, the diameter of the wheel 12 gradually increases between an axially inner face 13A and an axially outer face 13B of the wheel 12. In this text, the axial direction corresponds to any direction substantially parallel to the axis of rotation A, and the radial direction corresponds to any direction substantially perpendicular to the axis of rotation A. Such a frustoconical shape of the radially outer surface 16 makes it possible to ensure that the wheel 12 is self-centering during the vehicle's translational movement, and reduces the risk of derailment on curves in its path.

10 [68] As can be seen in FIG. 1, the wheel 12 may also comprise a flange 17 projecting radially from the axially inner face 13A of the wheel 12. Such a flange 17 also reduces the risk of the vehicle derailling.

15 [69] The brake assembly 14 comprises a brake pad 18, also called a wear plate or shoe. The pad 18 comprises a lining 20 made of friction material. The lining 20 comprises a first face, called the friction face 22A, arranged radially facing the radially outer surface 16 of the wheel. The friction face 22A is substantially curved.

[70] As will be described in more detail below, the friction face 22A is intended to come into contact with the radially outer surface 16 of the wheel 12 during the vehicle's braking phases.

20 [71] The lining 20 comprises a second face 22B, called the mounting face, that is opposite the friction face 22A. In particular, the friction face 22A and the mounting face 22B are opposite one another in the axial direction.

[72] The lining 20 further comprises an axially inner edge 22C, an axially outer edge 22D, a leading edge 22E, and a trailing edge 22F. The edges 22C, 22D, 22E, and 22F extend substantially radially between the friction face 22A and the mounting face 22B.

25 [73] The axially inner edge 22C and the axially outer edge are opposite in the axial direction. These axially inner and outer edges 22C, 22D interconnect the leading edge 22E and the trailing edge 22F.

[74] As can be seen from FIGS. 1 and 3, the axially inner edge 22C may be chamfered.

30 [75] The leading edge 22E and the trailing edge 22F are defined in relation to the direction of rotation of the wheel 12. In the example in FIG. 1, it is assumed that the wheel 12 is rotating in a direction R about the axis A. The leading edge 22E corresponds to the edge of the lining 20 that is seen first by a specific imaginary point P on the wheel 12 as it rotates about its axis of rotation A in direction R, while the trailing edge 22F corresponds to the edge of the lining 20 that is seen last by the specific point P as the wheel 12 rotates about its axis of rotation A in direction R. Of course, the direction of rotation R could be opposite to what is indicated in FIG. 1, which would reverse the position of the leading edge 22E and trailing edge 22F.

35 [76] As will be described in more detail below, the lining 20 comprises at least one particle collection groove.

[77] The brake assembly 14 may comprise include a lining carrier 24, visible in particular in FIG. 2. The lining carrier 24 may comprise a plate 25, for example made of metal. The lining carrier 24 is connected, directly or indirectly, to the mounting face 22B of the lining 20.

5 [78] The plate 25 may comprise at least one bent area 26, visible in FIGS. 3 and 4. In the case here, the bent area 26 comprises a first shoulder 26A and a second shoulder 26B that are opposite each other. The first shoulder 26A comprises an orifice 27A, and the second shoulder comprises an orifice 27B. Preferably, the orifices 27A and 27B are in line with each other.

10 [79] As can be seen from FIG. 3, when the lining carrier 24 is connected to the mounting face 22B, the bent area 26 protrudes from the rest of the plate 25 which is in contact with the mounting face 22B. A space 29 thus exists between the lining carrier 24 and the mounting face 22B of the lining 20. This space is defined between the bent area 26 of the plate 25 and the mounting face 22B of the lining 20.

15 [80] The brake assembly 14 may also be equipped with a brake head 28. The brake head 28 is connected to the lining carrier 24. In particular, as can be seen in FIG. 2, the brake head 28 may comprise a pin 31. The pin 31 is shaped to pass through the orifices 27A, 27B provided in the lining carrier 24. The pin 31 may, in particular, be mounted to be movable in translation between a first position where it is passing through the orifices 27A, 27B in the lining carrier 24, and a second position where the pin 31 is not inside the orifices 27A, 27B. Thus, in the first position of the pin 31, the pad 18 is fixed to the brake head 28, while in the second position of the pin 31, the pad 18 can
20 be detached from the brake head 28, for example in order to be replaced by another pad 18.

[81] The brake assembly 14 is configured to move the brake head 28, and therefore the pad 18. During the vehicle's braking phases, the brake assembly 14 is configured to move the pad 18 in a direction that brings it closer to the wheel 12, until the friction face 22A and the radially outer surface 16 of the wheel 12 come into contact, as can be seen in FIG. 3. Once the braking phase is over, the
25 brake assembly 14 is configured to move the pad 18 in a direction that distances it from the wheel 12, so that contact ceases between the friction face 22A and the radially outer surface 16 of the wheel 12. Indeed, outside of braking phases, the brake pad 18 and the wheel 12 are apart from each other, as illustrated in FIG. 1.

30 [82] When the friction face 22A of the pad 18 and the radially outer surface 16 of the wheel 12 come into contact during braking phases, the wheel 12 is in the process of rotating about axis A. A friction force is thus produced between the friction face 22A and the radially outer surface 16, causing wear on both the lining 20 of the pad 18 and on the radially outer surface 16 of the wheel 12. Particles, which are usually polluting particles, are thus formed by the abrasion of the friction material of the lining 20 and the wheel 12. During this wear, the friction face 22A of the lining 20 is reshaped to fit
35 against the radially outer surface 16 of the wheel 12.

[83] As indicated above, the lining 20 comprises at least one particle collection groove.

[84] Each collection groove is at least partially open on the friction face 22A, as will be detailed below. Each collection groove extends depthwise between the friction face 22A and the mounting face 22B.

Each collection groove is preferably blind at an end that is opposite its opening on the friction face 22A. Furthermore, each collection groove is shaped to collect the polluting particles resulting from wear of the lining 20 and wheel 12, thereby preventing these particles from being released into the environment.

5 **[85]** FIG. 5 shows a non-limiting example of the arrangement of the collection grooves in the lining 20. In particular, this lining 20 comprises a first main collection groove 30, a second main collection groove 32, a secondary collection groove 38, a first transverse collection groove 40, and a second collection groove 42. As will be described below, all these grooves 30, 32, 38, 40, 42 are advantageously fluidly connected to each other, so that they form a single continuous collection
10 groove.

[86] The first main collection groove 30 is arranged near the leading edge 22E. For example, the first main collection groove 30 is substantially parallel to the leading edge 22E. The second main collection groove 32 is arranged near the trailing edge 22F. For example, the second main collection groove 32 is substantially parallel to the trailing edge 22F. "Near the leading/trailing edge" is
15 understood here to mean "at a distance from the leading/trailing edge that is less than or equal to 30% of the distance between the leading and trailing edges, preferably less than or equal to 15% of the distance between the leading and trailing edges."

[87] The presence of the main collection grooves 30, 32 near the leading edge 22E and trailing edge 22F makes it possible to ensure the collection of polluting particles, regardless of the direction of
20 rotation of the wheel 12.

[88] Advantageously, each main collection groove 30, 32 may comprise a first portion that is open on the friction face 22A and a second portion that is covered by friction material of the friction face 22A. The second portion of each groove 30, 32 is therefore buried in the lining when the pad 18 is new or only slightly worn. Once the pad 18 reaches a certain level of wear, the second portion of
25 each groove 30, 32 is uncovered, i.e. it is also open on the friction face 22A. The second portion of each main collection groove 30, 32 may be located beneath the chamfered edge 22C, but this is not a limitation. Alternatively, part of the second portion could be buried under the friction material of the friction face 22A, with the remainder of the second portion being buried under the chamfered edge 22C.

30 **[89]** The secondary collection groove 38 is located between the first main collection groove 30 and the second main collection groove 32. In one non-limiting example, the secondary collection groove 38 is situated in a central position in the lining. "Central position" is understood here to mean a position located substantially equidistant between the leading edge 22E and the trailing edge 22F of the lining 20. Of course, the secondary collection groove 38 could be closer to one among the leading
35 edge 22E or trailing edge 22F than to the other.

[90] The secondary collection groove 38 may extend substantially parallel to the main collection grooves 30, 32, but this is not a limitation. For example, the secondary collection groove could be

substantially parallel to only one of the two grooves 30, 32, or could extend in a direction that is not parallel to the main collection grooves 30, 32.

5 [91] As can be seen from FIGS. 6 to 10, the secondary collection groove 38 may comprise a first portion 38-1 that is open on the friction face 22A, and a second portion 38-2 that is covered by friction material. The second portion 38-2 of the secondary collection groove 38 may be located entirely beneath the chamfered edge 22C. Alternatively, part of the second portion 38-2 of the secondary collection groove 38 may be buried under the friction material of the friction face 22A, with the remainder of the second portion 38-2 of the secondary collection groove 38 being buried under the chamfered edge 22C. Once the pad 18 reaches a certain level of wear, the second portion 38-2 of the secondary collection groove 38 is uncovered, i.e., it is also open on the friction face 22A.

[92] In some cases, the secondary collection groove 38 is fully open on the friction face 22A even when the pad 18 is new. In such cases, the secondary collection groove 38 advantageously is shorter; for example, it has no portion extending into the chamfered edge 22C.

15 [93] It should be noted that although in FIG. 5 only one secondary collection groove 38 is shown, the lining 20 could comprise a plurality of secondary collection grooves 38 as described above.

[94] The presence of the main collection grooves 30, 32 and the secondary collection groove 38 offers the advantage of ensuring that, regardless of the radius of curvature of the friction face 22A of the brake pad, the contact of the friction face 22A with the wheel 12 during braking occurs while facing one of the grooves 30, 32, or 38. A greater amount of polluting particles emitted by the abrasion of the pad 18 and wheel 12 can thus be collected in the grooves 30, 32, or 38. Moreover, as stated above, the presence of the main collection grooves 30, 32 near the leading edge 22E and trailing edge 22F makes it possible to ensure the collection of polluting particles regardless of the direction of rotation of the wheel 12.

25 [95] The first transverse collection groove 40 fluidly connects the first main collection groove 30 and the secondary collection groove 38. In the non-limiting example of FIG. 5, the first transverse collection groove 40 extends between one end of the first main collection groove 30, located next to the axially outer edge 22D of the lining 20, and one end of the secondary collection groove 38, located next to the chamfered edge 22C. The first transverse collection groove 40 thus extends obliquely between the first main collection groove 30 and the secondary collection groove 38.

30 [96] The second transverse collection groove 42 fluidly connects the second main collection groove 32 and the secondary collection groove 38. In the non-limiting example of FIG. 5, the second transverse collection groove 42 extends between one end of the second main collection groove 32, located next to the axially outer edge 22D of the lining 20, and the end of the secondary collection groove 38 located next to the chamfered edge 22C. The second transverse collection groove 42 thus extends obliquely between the second main collection groove 32 and the secondary collection groove 38.

[97] In this text, when it is stated that the transverse collection grooves 40, 42 extend "obliquely," it is understood that they form a non-zero, non-right angle with each of the grooves that they connect.

In the current case, the first transverse collection groove forms a non-zero, non-right angle with the first main collection groove and the secondary collection groove, while the second transverse collection groove forms a non-zero, non-right angle with the second main collection groove and the secondary collection groove.

5 **[98]** The first transverse collection groove 40 and the second transverse collection groove 42 are advantageously open on the friction face 22A. In the non-limiting example of FIG. 7, the first and second transverse collection grooves 40, 42 are open along their entire length on the friction face 22A. However, it is possible to have buried portions in each of the first and second transverse collection grooves 40, 42.

10 **[99]** Due to the presence of the transverse collection grooves 40, 42, the entire length of the lining 20 between the main collection grooves 30, 32 is traversed by at least one particle collection groove. This increases the surface area of the lining that is occupied by collection grooves, thereby increasing the amount of polluting particles collected in the grooves and thus not released into the environment.

15 **[100]** The fact that the first and second transverse collection grooves 40, 42 extend obliquely is also advantageous. In particular, as indicated above, during braking phases, the radially outer surface 16 of the wheel 12 wears concurrently with the wear of the lining 20. The portion of the radially outer surface 16 of the wheel 12 that is directly facing one of the collection grooves at any given moment during braking is not wearing at that moment. Indeed, each collection groove forms a recess in the friction face 22A. Each collection groove therefore prevents friction forces from occurring between
20 the friction face 22A and the radially outer surface 16 of the wheel 12. If the transverse collection grooves 40, 42 connected the main collection grooves 30, 32 and the secondary collection groove 38 in a direction tangential to the portion of the radially outer surface 16 that is in contact with the lining 20 during braking phases, an annular portion of the radially outer surface 16 of the wheel 12 would never be in contact with the friction material of the friction face 22A. Eventually, the radially
25 outer surface 16 of the wheel 12 would have an excess thickness in this annular portion relative to the rest of the radially outer surface 16 of the wheel 12. Such excess thickness can damage the rail on which the wheel 12 travels, and/or can cause the vehicle to derail. In the current case, due to the oblique transverse collection grooves 40, 42, it is ensured that the contact time with any portion of the radially outer surface 16 of the wheel 12 is negligible compared to the time such a portion is in
30 contact with the friction material of the lining 20. The wheel 12 is thus worn uniformly, which prevents the formation of areas of excess thickness on its radially outer surface 16.

[101] Of course, the shape of the collection groove provided in the lining 20 in FIG. 5 is not a limitation. Other shapes of collection groove can be considered.

35 **[102]** As can be seen in FIGS. 6 to 10, the secondary collection groove 38 comprises a suction hole 44 which leads into a sealing chamber 50, which will be described in detail below. The collection groove formed by the main collection grooves 30, 32, the transverse collection grooves 40, 42, and the secondary collection groove 38 thus leads into the sealing chamber 50.

[103] The suction hole 44 is intended to be connected to a negative-pressure source (not shown). The negative-pressure source is, for example, a particle suction system. Communication means 45, visible in FIG. 1, may connect the negative-pressure source to the suction hole 44, in particular via the sealing chamber. The particles collected in the collection grooves 30, 32, 38, 40, 42 can thus be
5 suctioned in. The communication means 45 comprise, for example, a pneumatic hose.

[104] Preferably, the suction hole 44 is arranged at one end of the secondary collection groove 38. This concentrates the suctioning of particles at that end.

[105] The sealing chamber 50 will now be described with reference to FIGS. 4 to 11.

[106] The sealing chamber 50 comprises a sealing body 51 and a suction duct 52.

10 **[107]** The sealing chamber 50 is arranged in the space 29 that exists between the lining carrier 24 and the mounting face 22B of the lining 20. In particular, as can be seen in FIG. 4, the sealing body 51 is at least partially arranged in the space 29.

[108] As can also be seen in FIG. 4, the suction duct 52 projects from the sealing body 51 and from the space 29. The suction duct 52 is connected to the sealing body 51.

15 **[109]** The suction duct 52 is intended to be fluidly connected to the negative-pressure source. In particular, the communication means 45 may be connected to the suction duct 52 as illustrated in FIG. 1. More specifically, one end of the communication means 45 is connected to the suction duct 52, while the other end of the means 45 is connected to the negative-pressure source. As can be seen in FIGS. 4 and 5, an outer surface of the suction duct 52 may comprise at least one annular
20 protrusion 54. In the case here, three annular protrusions 54 are provided on the outer surface of the suction duct, although this is not a limitation. Such annular protrusions make it possible to secure the connection of the communication means 45 to the suction duct 52.

[110] Advantageously, when the sealing chamber 50, in particular its body 51, is installed in the space 29, the orifices 27A and 27B are not obstructed by the sealing chamber 50. It is thus always
25 possible to connect the pad 18 to the brake head 28 by inserting the pin 31 into the orifices 27A and 27B. The presence of the chamber 50 therefore does not alter the maintenance operations for the pad 18, which can be replaced when the pin 31 is removed from the orifices 27A, 27B and the communication means 45 are disconnected from the suction duct 52.

30 **[111]** As can be seen in FIGS. 6 to 11, the sealing chamber 50 may have different shapes. In FIGS. 6 to 8, the sealing chamber 50 is a component added into the space 29, while in FIGS. 9 to 11, the sealing chamber 50 is integrated into the lining carrier 24 and/or into the lining 22, as will be described below.

[112] The sealing chamber examples in FIGS. 6 to 8 will now be described.

35 **[113]** In the example in FIG. 6, the sealing body 51 comprises a shell 56. The shell 56 is advantageously made of metal. The shell 56 defines a recess 58 in which a filler block 60 is provided.

[114] In one example, the filler block 60 is made of silicone, but other materials are also possible. For example, the filler block 60 may be made of rubber that satisfies the fire and smoke requirements

of railway applications. For example, the filler block 60 may be made of NBR rubber, which offers improved thermal resistance. The filler block 60 preferably fills the entire recess 58. As shown in FIG. 6, the filler block 60 comprises a cavity 62. The cavity 62 extends between the suction hole 44 and the suction duct 52, thus allowing the suction hole 44 to be fluidly connected to the suction duct 52.

5 **[115]** To hold the sealing chamber 50 in position in the space 29, in the example of FIG. 6 the sealing chamber 50 is welded to the lining carrier 24. In particular, the shell 56 may be welded to a face of the lining carrier 24 that is positioned facing the mounting face 22B of the lining 20. A weld bead 64 thus appears between the lining carrier 24 and the chamber 50.

10 **[116]** Advantageously, one will note that the filler block 60 is installed in the recess 58 of the shell 56 before the shell 56 is welded onto the lining carrier 24. One will also note that in some cases, the chamber 50 may not have a filler block 60, the seal between the suction hole 44 and the suction duct 52 being achieved by means of the shell 56.

15 **[117]** This configuration in FIG. 6 then allows the sealing chamber 50 to be installed in the space 29 without needing to modify the lining carrier 24 or the lining 20. The chamber 56, welded according to the example in FIG. 6, therefore has the advantage of being able to be installed on existing pads that comprise a space between the lining carrier 24 and the mounting face 22B of the lining 20.

20 **[118]** The example in FIG. 7 differs from that in FIG. 6 in that the sealing chamber 50 is connected to the lining carrier 25 via a connecting means 66, instead of via a weld bead 64. The connecting means 66 may be, for example, a screw, in particular a pressure screw screwed into the lining carrier 24 (which may have an internal thread) and bearing against the outside of the chamber 50. Alternatively, the connecting means 66 may be a shim that bears against the lining carrier 24 and is screwed onto the chamber 50, or a shim press-fitted between the lining carrier 24 and the chamber 50.

25 **[119]** In order to connect the chamber 50 to the lining carrier 25 by the connecting means 66, the sealing body 51 may comprise a cavity 68 comprising an internal thread (not visible in FIG. 7) that is complementary to a thread of the connecting means 66. Furthermore, the lining carrier 24 comprises a bore 70 aligned with the cavity 68 of the sealing body 51 and shaped to receive the connecting means 66. The chamber 50 can thus be connected to the lining carrier 24 by the connecting means 66, holding it in position in the space 29.

30 **[120]** The chamber 50 in FIG. 7 comprises the same elements as the chamber 50 in FIG. 6. These elements bear the same reference numbers in FIG. 7 as in FIG. 6, and, for brevity, are not described again below. It should be noted, however, that in order to avoid increasing the dimensions of the chamber 50, the recess 58 and therefore the sealing block 60 (if provided) may be smaller than in the example in FIG. 6.

35 **[121]** As in the case in FIG. 6, the filler block 60 is advantageously installed in the recess 58 of the shell 56 before connecting the shell 56 to the lining carrier 24 via the connecting means 66. As in the case in FIG. 6, the recess 58 may also have no sealing block 60.

[122] In the example in FIG. 8, the chamber 50 is press-fitted into the space 29. In particular, the chamber 50 may be shrink-fitted into the space 29. For this purpose, before being inserted into the space 29, the chamber 50, and in particular its body 51, has dimensions that prevent its insertion into the space 29. The chamber 50, or at least its body 51, is then cooled. This cooling process
5 causes the chamber 50 to contract, allowing it to be easily inserted into the space 29. The temperature of the chamber 50 then gradually increases until it reaches thermal equilibrium with its environment (particularly with the lining carrier 24 and the mounting face 22B). This temperature increase causes the chamber 50 to gradually return to its original shape and dimensions. The chamber 50 is thus clamped between the lining carrier 24 and the lining 20. In particular, the chamber
10 50 is clamped tightly to form a seal between the lining carrier 24 and the mounting face 22B of the lining 20.

[123] This configuration in FIG. 8 thus allows the sealing chamber 50 to be installed in the space 29 without needing to modify the lining carrier 24 or the lining 20.

[124] For brevity, elements in the embodiment shown in FIG. 8 that are identical or similar to those
15 in FIGS. 6 and 7 have the same numbering and are not described in detail below. Only note that in the example in FIG. 8, the recess 58 of the shell 56 has no sealing block 60, but it could comprise such a sealing block 60.

[125] The examples of sealing chambers 50 in FIGS. 9 to 11 will now be described.

[126] In the example in FIG. 9, the sealing chamber 50 is produced as a single unit with the lining
20 carrier 24. In particular, the plate used to form the lining carrier 24 is designed to be bent to form the sealing body 51. The sealing body 51 comprises a first wall 51-1 and a second wall 51-2 which are substantially perpendicular to the suction duct 52 and positioned between the first shoulder 26A and the second shoulder 26B. The suction duct 52 is, for example, carried by the second wall 51-2.

[127] In this example, the sealing body 51 may also comprise a third wall 51-3 connecting the first
25 and second walls 51-1, 51-2, substantially parallel to the mounting face 22B. The third wall 51-3 may comprise a hole 72 arranged to be in fluid communication with the hole 44 of the lining 20. The third wall 51-3 may also comprise at least one orifice 74 for the retention of the lining 20.

[128] A recess 76, similar to the recess 58 described above, is formed between the lining carrier 24,
30 the first wall 51-1, the second wall 51-2, and the third wall 51-3. In the figures, this recess 76 is empty, but it could also comprise a filler block 60 as shown in FIGS. 6 and 7, or a filler block 60 made of the friction material of the lining 20. The suction duct 52 and the suction hole 44 are both open to the recess 58 so as to be fluidly connected to each other.

[129] In this example, the lining 20 is overmolded onto the lining carrier 24 which forms a single unit
35 with the chamber 50. This overmolding results in the hole 72 and the at least one orifice 74 of the chamber 50 being at least partially filled with the friction material of the lining 20. By introducing the friction material of the lining 20 into the hole 72 and into the at least one orifice 74, adhesion of the lining 20 to the lining carrier 24 is improved.

[130] It should be noted that in order to prevent the recess 76 from filling with friction material during the overmolding of the lining 20, the recess 76 is sealed off during the overmolding of the lining 20. The recess 76 thus allows a fluid communication between the suction hole 44 and the suction duct 52, with no need to machine an additional cavity.

5 **[131]** Similarly, one will note that in order to prevent the portion of the space 29 outside the chamber 50 from filling with friction material during the overmolding of the lining 20, this portion of the space 29 is sealed off during the overmolding of the lining 20. Thus, after overmolding the lining 20, the orifices 27A, 27B of the lining carrier 24 are free to receive the pin 31 of the brake head 28.

[132] In this configuration, since the recess 76 is not filled with friction material, the amount of
10 material required to manufacture the pad 18 is reduced.

[133] In the example in FIG. 10, a first wall 78-1 and a second wall 78-2 are welded to the lining carrier 24. The lining carrier 24, the first wall 78-1, and the second wall 78-2 thus form a single unit. In other words, they are made as one piece.

[134] The first and second walls 78-1, 78-2 extend substantially perpendicularly to the suction duct
15 52. The suction duct 52 is supported by the second wall 78-2. A recess 80 is formed between the lining carrier 24 and the first and second walls 78-1, 78-2.

[135] The lining 20 is overmolded onto the assembly comprising the lining carrier 24, the first and second walls 78-1, 78-2, and the suction duct 52. During overmolding, the recess 80 is filled with friction material from the lining 20, thereby establishing a seal in this recess 80. The sealing body 51
20 therefore comprises, in this case, the walls 78-1, 78-2 and the friction material of the lining 20 that is filling the recess 80. In order to establish the fluid connection between the hole 44 and the suction duct 52, the cavity 62 described above with reference to FIG. 6 is machined through the friction material filling the recess 80.

[136] As in the example in FIG. 9, to prevent the portion of the space 29 that is outside the chamber
25 50 from being filled with friction material during the overmolding of the lining 20, this portion of the space 29 is sealed off during the overmolding of the lining 20. Thus, after overmolding the lining 20, the orifices 27A, 27B of the lining carrier 24 are free to receive the pin 31 of the brake head 28.

[137] FIG. 11 shows another example of a sealing chamber 50. In this case, the plate of the lining carrier 24 is bent to form a wall 82 substantially perpendicular to the suction duct 52. Alternatively,
30 the wall 82 could be welded to the lining carrier 24. The wall 82 is traversed by the suction duct 52. A nut 84 is welded to the lining carrier 24. As can be seen in FIG. 11, the nut 84 is, for example, welded to the wall 82.

[138] The nut 84 comprises an inner annular face with internal threading (not shown) that is complementary to an external threading (not shown) provided on the outer surface of the suction
35 duct 52. Thus, the suction duct 52 is connected to the chamber 50 by the cooperation between the threading of the suction duct 52 and the threading of the nut.

[139] The sealing body 51 in this case therefore comprises the wall 82 and the nut 84. Furthermore, as can be seen in FIG. 11, the sealing body 51 comprises a filler block 60 formed by friction material of the lining 24. This filler block 60 may be obtained after overmolding the lining 24 onto the lining carrier 24 connected to the wall 82, the nut 84, and the duct 52. To obtain this filler block 60, during
5 the overmolding of the lining 20, a portion of the space 29 is sealed off while the other portion remains accessible to the friction material of the lining 20.

[140] It should be noted that, as in the cases of FIGS. 9 and 10, after the overmolding of the lining 20, the orifices 27A, 27B of the lining carrier 24 are free to receive the pin 31 of the brake head 28.

[141] As can be seen in FIG. 11, to improve the seal established between the sealing body 51 and
10 the suction duct 52, a sealing member 90 may be arranged at the end of the suction duct 52 that is received in the sealing body 51. The sealing member 90 is, for example, an O-ring.

[142] The embodiments shown in FIGS. 9 to 11 offer the advantage that the seal established between the chamber 50, the hole 44, and the suction duct 52 is achieved using the friction material of the overmolded lining 20. Therefore, no additional materials are required to establish the seal.

15 **[143]** A method for assembling the pad 18 according to one of the examples described above will now be described.

[144] The method first comprises supplying the lining 20, the lining carrier 24, and the sealing chamber 50. Next, the method comprises connecting the lining carrier 24 to the mounting face 22B of the lining 20, and arranging the sealing chamber 50 in the space 29 so that the suction hole 44
20 leads into the sealing chamber 50.

[145] As explained above, the sealing chamber 50 may be arranged in the space 29 by:

- welding the sealing chamber 50 to the lining carrier 24, as in the example in FIG. 6;
- attaching the sealing chamber 50 to the lining carrier 24 via the connecting means 66, as in the example in FIG. 7;
- 25 - shrink-fitting the sealing chamber 50 between the lining carrier 24 and the lining 20, as shown in the example in FIG. 8;
- overmolding the lining 20 onto an assembly comprising the lining carrier 24 and the suction duct 52, as in the example shown in FIGS. 9 to 11.

[146] In the example embodiments shown in FIGS. 6 and 7, it is possible to first connect the lining
30 carrier 24 to the mounting face 22B of the lining 20, and then to install the sealing chamber 50 in the space 29. In these examples, it is also possible to first connect the chamber 50 to the lining carrier 24 (by welding or by the connecting means 66), and then connect the lining carrier 24 to the mounting face 22B of the lining 20. In this case, the step of connecting the lining carrier 24 to the mounting face 22B and the step of arranging the chamber 50 in the space 29 are carried out simultaneously.

35 **[147]** As stated above, in the examples of FIGS. 6 and 7, the filler block 60 is installed in the recess 58 of the shell 56 before the chamber 50 is positioned in the space 29.

[148] In embodiments in which the lining 20 is overmolded onto the assembly comprising the lining carrier 24 and the suction duct 52, the step of positioning the chamber 50 in the space is therefore carried out concurrently with the step of connecting the lining carrier 24 and the lining 20. As explained above, in the case in FIG. 9, the chamber 50 is entirely supported by the lining carrier 24.

5 In the case in FIGS. 10 and 11, the chamber 50 is partly formed by friction material of the lining 20 when the latter is overmolded onto the assembly comprising the lining carrier 24 and the suction duct. 52. Also, in all cases shown in FIGS. 9 to 11, the chamber 50 is installed in its final position inside the space 29 once the overmolding of the lining 20 onto the lining carrier 24 has been completed.

[149] It should be noted that several of these techniques for arranging the sealing chamber 50 in the
10 space 29 may be combined in a single pad 18. For example, a same chamber 50 may be welded to the lining carrier 24 and be fixed to the lining carrier 24 by connecting means 66. This provides a better guarantee that the sealing chamber 50 will remain in position in the space 29.

[150] FIG. 12 shows an alternative configuration (or one that can be combined with those in FIGS. 4 to 11), in which sealing chambers 50 are arranged at two circumferential ends of the pad 18. As in
15 the examples mentioned above, a suction duct 52 connects the respective groove 30, 32 via a respective suction hole 44.

[151] This arrangement allows for greater flexibility in the placement of the pneumatic lines connecting the suction source to the suction lines 52. Furthermore, the placement of the pneumatic lines is not hindered by the attachment elements fastening the brake head to the shoe (leaf spring).
20 In addition, in this case the suction is located as close as possible to the leading edge of the particle emission, thus reducing the length of the grooves.

[152] In FIG. 12, the suction ducts 52 have an axial orientation, i.e., they are aligned with an axis parallel to the axis of rotation of the disc.

[153] FIG. 13 illustrates the same example as FIG. 12, except that the orientation of the suction ducts
25 52 is substantially radial.

[154] FIG. 14 illustrates a variant (which may also be combined with the elements presented in the figures described above). In this example, to meet the need for flexibility in the central area of the pad, the lining is sectioned into two parts 18A, 18B. In this case, a respective duct 52 for each part 18A, 18B may be arranged at a circumferential end of each lining, in conjunction with a respective
30 groove element 38A, 38B. The numbers 30, 32, 40, and 42 are provided to facilitate one's understanding of the figure in relation to FIG. 5 described above.

[155] To minimize the length and number of hoses connecting the ducts 52 to the suction source, it is advisable to arrange the suction ducts 52 close to each other as shown in FIG. 14. Alternatively (or additionally), a duct (and a corresponding groove) may be arranged at another end of each of
35 lining portions 18A, 18B.

[156] This disclosure is not limited to the examples of brake pads and of methods for assembling these pads that are described above solely by way of example, but encompasses all variations conceivable to a person skilled in the art within the context of the protection sought.

Claims

[Claim 1] A brake pad (18), the pad (18) comprising a lining (20) and a lining carrier (24), the lining (20) being made of friction material and having at least one particle collection groove (30, 32, 38, 40, 42), the lining carrier (24) being connected to a face (22B) of the lining (20), called the mounting face, in which a space (29) is provided between the lining carrier (24) and the mounting face (22B) of the lining (20), characterized in that a sealing chamber (50) is arranged in the space (29), the sealing chamber (50) comprising a suction duct (52) intended to be fluidly connected to a negative-pressure source, wherein the at least one particle collection groove (30, 32, 38, 40, 42) comprises a suction hole (44) that leads into the sealing chamber (50) and is fluidly connected to the suction duct.

[Claim 2] Brake pad (18) according to claim 1, wherein the sealing chamber (50) is welded to the lining carrier (24) and/or to the lining (20).

[Claim 3] Brake pad (18) according to any one of the preceding claims, further comprising a connecting means (66) which connects the sealing chamber (50) to the lining carrier (24) and/or to the lining (20).

[Claim 4] Brake pad (18) according to any one of the preceding claims, wherein the sealing chamber (50) is press-fitted into the space (29) provided between the lining carrier (24) and the mounting face (22B) of the lining (24).

[Claim 5] Brake pad (18) according to any one of the preceding claims, wherein the sealing chamber comprises a nut (84) welded to the lining carrier (24) and/or to the lining (20), the nut comprising an inner annular face provided with an internal threading that is complementary to an external threading on an outer surface of the suction duct (52).

[Claim 6] Brake pad (18) according to any one of the preceding claims, wherein the sealing chamber (50) includes a filler block (60) comprising a cavity (62) fluidly connecting the suction hole (44) of the at least one collection groove (30, 32, 38, 40, 42) to the suction duct (52).

[Claim 7] Brake pad (18) according to claim 6, wherein the filler block (60) is made of silicone and/or is made in the friction material of the lining (20).

[Claim 8] Brake pad (18) according to any one of the preceding claims, wherein the sealing chamber (50) is made as a single unit with the lining carrier (24).

[Claim 9] A method for assembling a brake pad (18) according to any one of the preceding claims, the method comprising:

- supplying the lining (20), the lining carrier (24), and the sealing chamber (50);
- connecting the lining carrier (24) to the mounting face (22B) of the lining (20);
- arranging the sealing chamber (50) in the space (29) provided between the lining carrier (24) and the mounting face (22B) of the lining (20), such that the suction hole (44) of the at least one particle collection groove (30, 32, 38, 40, 42) leads into the sealing chamber (50) and is fluidly connected to the suction duct (52).

[Claim 10] Method according to claim 9, wherein the sealing chamber (50) is arranged in the space (29) by at least one of the following techniques:

- welding the sealing chamber (50) to the lining carrier (24) and/or to the lining (20); and/or
- attaching the sealing chamber (50) to the lining carrier (24) and/or to the lining (20) via a connecting
5 means (66); and/or
- shrink-fitting the sealing chamber (50) between the lining carrier (24) and the lining (20); and/or
- overmolding the lining (20) onto an assembly comprising the lining carrier (24) and the suction duct (52).