[0005] Each pad includes a base and a friction lining. The lining is intended to be in contact with the disc, becoming worn by abrasion over time. The abrasion of the linings generates dust particles that can be harmful. In order to limit the emission of such particles it is known to provide means for collecting and aspirating the particles emitted. To this end each pad includes a groove in the lining near a lateral edge of the pad and a suction port opening into said groove and opening axially into the base, opposite the groove. A flexible pipe connects each suction port to a suction and filtration device.

[0006] In operation the flexibility of the pipes enables compensation of any axial movement of the pads caused by movement of the piston and/or progressive wear of the pads. However, such pipes have a spring effect tending to apply an unwanted axial force to the pads, this axial force possibly tending to move the pads toward or away from the disc in an uncontrolled manner. This can cause premature wear of the pads or lead to incomplete control of the braking torque.

Summary

[0007] The present disclosure improves this situation.

[0007a] In an aspect, the present disclosure refers to a friction braking device (10) including a caliper (12), at least one pad (16) that is mobile in translation along an axis (A) of movement relative to the caliper (12), said at least one pad (16) being intended to cooperate with a brake disc, and at least one piston (14) movably mounted on the caliper (12) and capable of moving said pad (16) axially in translation, said at least one pad (16) including at least one particle suction zone (28) that includes a suction port

(30), wherein the friction braking device (10) further includes a suction pipe (60) including a first rigid portion (64-1) having a first end (62) able to face said suction port (30) of the pad (16) and a second end (65), the suction pipe (60) including an axially extendable flexible portion (66) having a first end (67) connected to the first rigid portion (64-1) and a second end (69) intended to be connected to means for aspirating said particles.

[0008] To this end there is proposed in an example a friction braking device including a caliper, at least one pad mobile in translation along an axis of movement relative to the caliper, said pad being intended to cooperate with a brake disc, and at least one piston movably mounted on the caliper and capable of moving said pad axially in translation, said pad including at least one particle suction zone that includes a suction port, characterized in that the device further includes a suction pipe including a first rigid portion having a first end able to face said suction port of the pad, and a second end, the suction pipe including an axially extendable flexible portion having a first end connected to the first rigid portion and a second end intended to be

can be located between the second end of the flexible portion and the suction means, as in the embodiment described hereinafter).

[0017] In accordance with one example, said suction pipe can include a second rigid portion having a first end connected to the second end of said flexible portion and a second end intended to be connected to said suction means.

[0018] The flexible portion is therefore arranged between said first rigid portion and said second rigid portion. The flexible portion can therefore contract between the first rigid portion and the second rigid portion when the piston is retracted.

[0019] In this configuration the suction means are connected directly to the second rigid portion and indirectly (via the second rigid portion) to the second end of the flexible pipe.

[0020] The second rigid portion can be fixed to the caliper, for example by a substantially L-shaped arm.

[0021] In accordance with one example said flexible portion can include at least one bellows.

[0022] Thanks to the bellows, which includes pleats, the flexible portion can follow axial movement of the corresponding pad (induced by the piston and the runout of the disc) without being subjected to high traction forces that risk leading to rupture of the flexible portion. Alternatively, the flexible portion could be replaced by a telescopic flexible or rigid portion.

[0023] In accordance with one example said flexible portion can be made of an elastomer material, for example rubber. The flexible portion can therefore exhibit elastic behavior.

[0024] In accordance with one example said suction pipe can be fixed to the pad, said first end of the first rigid portion being adapted to come to bear in a sealed manner on said pad opposite said suction port of the pad in such a manner as to connect said suction pipe and said suction zone of the pad.

[0025] Bearing in a sealed manner on the pad opposite the suction port, the suction pipe enables aspiration of particles generated by the pad rubbing on a brake disc, thus limiting the quantity of particles ejected to the exterior.

[0026] The suction pipe can be fixed to the pad directly or indirectly, that is to say via an additional part.

[0027] In accordance with one example, said suction pipe can be fixed to the piston, said first end of the first rigid portion being capable of coming to bear in a sealed manner on said pad opposite said suction port of the pad in such a manner as to connect said suction pipe and said suction zone of the pad.

[0028] Thus the suction pipe is fixed to the piston and not to the at least one pad, with the result it does not exert an axial force on the corresponding pad. This avoids the aforementioned disadvantages of the prior art.

[0029] The suction pipe can be fixed to the piston directly or indirectly, that is to say via an additional part. The first end of the first rigid portion of the suction pipe can come to bear directly or indirectly on said pad in a sealed manner.

[0030] The corresponding end of the suction pipe can come in contact against the pad in a sealed manner in the event of braking, that is to say when the piston is bearing on the pad so as to push it axially toward the disc. Particles are produced and consequently must be aspirated in such braking phases. It is therefore also in these phases that a seal must be provided between the pipe and the suction zone of the pad by bearing engagement in a sealed manner.

[0031] The seal is still provided between braking phases, which makes it possible to aspirate particles after braking, at least during a so-called cleaning phase immediately following the braking phase.

[0032] In some cases the suction pipe can be rigidly connected to a support, said support being fixed onto the piston. Said support can take the form of a metal sheet. Said support can include a central opening through which the piston passes. Said support can be fixed, for example screwed, riveted or welded, to the piston. The suction pipe can be fixed to this support.

[0033] Said support can include a port facing a corresponding end of the pipe, said support being adapted to come to bear in a sealed manner on the pad so that the suction port in the pad and the port in the support face one another.

[0034] In one example the caliper can be a floating caliper capable of being moved axially in translation relative to a caliper support, the device including a first so-called interior pad and a second so-called exterior pad, the first pad being actuated directly by the piston, the second pad being actuated directly by a rear portion of the floating caliper, a first suction pipe being capable of being connected to a suction zone of the first pad, a second suction pipe being capable of being connected to a suction zone of the second pad.

[0035] Such a configuration with a floating caliper makes it possible to actuate both the first pad directly and the second pad indirectly via the floating caliper.

[0036] Particles emitted by each pad are aspirated via a dedicated pipe.

[0037] In accordance with one example the rear portion of the floating caliper can include a suction port, the second suction pipe being connected to said

diameter less than that of the suction port of the second pad the risk of particles accumulating at the interface between the two suction ports would be very high.

[0043] In some examples, a first part of the suction port of the caliper includes a substantially annular shoulder shaped to receive said suction pipe.

[0044] This improves the seal between caliper and the second suction pipe, given that the second suction pipe is partially inserted in the suction port of the caliper. This limits the risk of particles being expelled to the exterior of the braking device at the interface between the caliper and the second suction port.

[0045] Said first end portion corresponds in particular to the end portion of the suction port of the caliper opposite the second pad. Thanks to the shoulder the diameter of the suction port of the caliper is increased in its first end portion. The second suction pipe can therefore be received in the suction port of the caliper while guaranteeing that a passage in the suction pipe in which the particles flow can have a diameter equal to or greater than that of the suction port of the caliper. This limits the risk of particles accumulating at the interface between the suction port of the caliper and the second suction pipe.

[0046] The second suction pipe can in particular be a snug fit or a tight fit in said shoulder.

[0047] Said second suction pipe can be fixed to the caliper using at least one removable connecting member. The second suction pipe can therefore be replaced easily in the event of wear. For example the second suction pipe can be screwed to the caliper.

[0048] The suction port of the second pad can be in a first face of the second pad, the first face of the second pad being made of metal and coming to

bear in a sealed manner on a metal first face of the caliper onto which the suction port of the caliper opens. The seal between the second pad and the caliper is therefore assured by a metal-to-metal contact.

[0049] In accordance with one example the caliper can be a so-called fixed caliper, the device including a first so-called interior pad on the vehicle side and a second so-called exterior pad on the rim side, each pad being actuated directly by at least one piston, a first suction pipe being capable of being connected to a suction zone of the first pad, a second suction pipe being capable of being connected to a suction zone of the second pad.

[0050] In such a fixed caliper configuration each pad is actuated by at least one dedicated piston.

[0051] As before particles emitted by each pad are aspirated via a dedicated pipe.

[0052] In accordance with one example said first suction pipe and/or said suction pipe can include a first rigid portion connected to the pad and an axially extendable flexible portion.

[0053] Also, the first suction pipe and/or the second suction pipe can have the aforementioned advantages.

[0054] The present document also concerns a braking system including a brake disc and a friction braking device of the aforementioned type.

[0055] The present document also concerns a vehicle including a braking system of the aforementioned type.

[0056] The present document also concerns a stationary machine including a rotor and a braking system of the aforementioned type.