Fluid Cooled Brake Housing

Field of the Invention

[0001] The present invention relates to a fluid cooled brake housing and to a wall for forming a fluid cooled brake housing.

Background of the Invention

[0002] It is well known that the performance of brake systems which comprise a friction pad bearing against a braking surface deteriorates as temperature of the brake system increases. It is therefore desirable to cool brake systems to optimise performance.

[0003] Various methods have been proposed for this purpose. For example, with disc brake systems, which comprise planar brake pads and a disc brake rotor, it is known to ventilate the system by drilling holes through the rotor.

[0004] In US patent No. 6,321,882 B2 the Patentee proposes attaching a heat exchanger to the callipers of a bicycle disc brake system.

[0005] In sealed wet brake systems in which friction pads and braking surfaces are enclosed within an oil filled cavity, it is known to pass the oil through a radiator to effect cooling.

[0006] The present invention was developed to attempt to cool a brake system by providing a fluid cooled housing (or a wall thereof) which houses or is part of the brake system.

Summary of the Invention

[0007] According to the present invention there is provided a fluid cooled brake

housing including at least:

a casing defining a cavity for housing one or more friction pads, said casing having one or more walls, at least one of said walls provided with an internal fluid flow path, a fluid inlet in fluid communication with said fluid flow path, and a fluid outlet in fluid communication with said fluid flow path;

whereby, when a fluid supply is coupled with said fluid inlet, fluid flows through said wall via said fluid inlet, fluid flow path and fluid outlet, thereby cooling said housing.

[0008] Preferably said fluid flow path includes at least one channel between said fluid inlet and said fluid outlet.

[0009] Preferably said fluid flow path includes a plurality of parallel connected channels extending between said fluid inlet and said fluid outlet.

[0010] Preferably said housing further includes sealing means for sealing said cavity when said housing is mounted on an axle to provide a wet brake housing.

[0011] According to the invention there is further provided a wall for a brake housing, said wall including an internal fluid flow path, a fluid inlet in fluid communication with said fluid flow path, and a fluid outlet in fluid communication with said fluid flow path;

whereby, when a fluid supply is coupled with said fluid inlet, fluid flows through said wall via said inlet, through said fluid flow path and out said fluid outlet to cool said wall.

[0012] According to the invention there is further provided a fluid cooled brake system including:

a fluid cool brake housing having a casing defining a cavity, said casing having

one or more walls, at least one of said walls provided with an internal fluid flow path, and a fluid inlet and a fluid outlet each in fluid communication with said fluid flow path;

one or more brake pads disposed in said cavity;

a braking surface located within said cavity;

an actuator for selectively moving said one or more brake pads into contact with said braking surface; and,

a supply of cooling fluid external of said cavity and in fluid communication with said fluid inlet and said fluid outlet, whereby said cooling fluid circulates through said supply, said fluid inlet, fluid flow path and fluid outlet.

[0013] Preferably said fluid cooled brake system further includes a pump for pumping said cooling fluid through said supply and said fluid flow path.

[0014] Preferably said fluid cooled brake system includes a heat exchanger in fluid communication with said supply for cooling said cooling fluid.

[0015] Preferably said fluid cooled brake system further includes a volume of fluid sealed within said cavity and at least partially covering said braking surface, said fluid separate from said cooling fluid.

Brief Description of the Drawings

[0016] Embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 is a plan view of an embodiment of a brake housing in accordance with the present invention;

Figure 2 is a view through section A-A of the brake housing depicted in Figure 1;

Figure 3 is a section view of a wall for a fluid cooled brake housing;

Figure 4 is a view of section B-B of the wall depicted in Figure 3;

Figure 5 is a plan view of the wall depicted in Figure 3; and,

Figure 6 is a schematic representation of a brake system incorporating an embodiment of the fluid cooled housing depicted in Figure 2.

Detailed Description of Preferred Embodiments

[0017] Figures 1 and 2 depict an embodiment of a fluid cooled brake housing 10 in accordance with the present invention. The housing 10 is comprised of a casing 12 which defines a cavity 14 for housing one or more friction pads 15 (shown in Figure 6). The expression "friction pads" is used throughout this specification to denote any form of friction pad used in a braking system for example a disc brake pad used in disc brake systems or a brake shoe used in a drum brake system, or indeed any other type of pad that can be applied to a braking surface to provide a braking effect. The casing 12 is composed of a plurality of separate walls including circumferential wall 16, back wall 18 extending across one axial end of the circumferential wall 16, and a front wall 20 extending about an opposite axial end of the circumferential wall 16. The back wall 18 is composed of a main wall section 22 and a secondary wall section 24. The main wall section 22 extends for over half the radius of the circumferential wall 16 and includes an axially extending portion 26. The secondary wall 18 extends from the axially extending portion 26 to the circumferential wall 16. Axially extending studs 28 are provided on the back wall 18 outside of the cavity 14 for coupling the housing 10 to a differential housing (not shown). An axial hole 30 is formed in the back wall 18 through which an axle (not shown) can extend into the cavity 14. The hole 30 is circumscribed by a boss 32. The front wall 20 is also provided with a larger axial hole 34 for typically receiving

a wheel hub and rotor (not shown).

[0018] One of the walls, and in this particular embodiment, the circumferential wall 16, is provided with an internal fluid flow path 36, a fluid inlet 38, and a fluid outlet 40. Both the fluid inlet 38 and fluid outlet 40 are in fluid communication with, and spaced by, the fluid flow path 36. When a fluid supply (not shown) is connected with the fluid inlet 38, fluid can flow through the fluid flow path 36 and out through the outlet 40 to absorb heat from and thus cool the wall 16 and the housing 10.

[0019] It should also be noted that the configuration of the walls of the housing 10 is not in itself significant to the present invention. The walls and indeed the housing 10 are configured to meet the application at hand. The housing 10 depicted in Figures 1 and 2 is particularly well suited as a housing for a wet brake system were the cavity 14 houses a brake drum and brake shoes. Such a system is described in the Applicant's co-pending Australian provisional application No. PR 0187 the contents of which are incorporated herein by way of reference. In such an embodiment, the housing 10 is provided with appropriate seals to retain a volume of oil in which the brake components, eg the drum and the brake shoes operate. The fluid passing through the fluid flow path 36 is separate to the fluid held within the cavity 14 of the wet brake system.

[0020] The fluid flow path 36 as shown in Figure 2 is formed with four channels 42a-42d. These channels may be series connected so as to in effect form one continuous zig-zag or serpentine channel extending between the inlet 38 and outlet 40. Alternately, and preferably, the channels 42a-42d are separate parallel connected channels as shown in the embodiment depicted in Figures 3-5 described in more detail below.

[0021] The fluid flow path 36 can be made in a variety of ways including initially providing the circumferential wall 16 as a flat strip of material and machining a set of grooves on one surface corresponding to the location of the channels 42a-42d, providing a second flat strip of material in which a further set of grooves are machined and then attaching the two strips together so that the grooves overlay each other to form channels 42a-42d then rolling the strip about an axis to form a ring and welding the ends together.

Separate holes can then be drilled into the strip to form the inlet 38 and outlet 40. However different techniques can also be used.

[0022] The fluid flowing through the channels 42a-42d circulates through a fluid circuit 43 (refer Figure 6) which is connected between the inlet 38 and outlet 40. This circuit includes a reservoir or supply 45 of cooling fluid (such as water or oil), a conduit extending from the reservoir to the fluid inlet 38, and then a further conduit extending from the fluid outlet back to the reservoir. If desired, a radiator 47 or other heat exchanger may be provided in this circuit. Indeed the conduits themselves (or one of them) may be configured to act as a heat exchanger. For example one of the conduits can be made from a metal tube and located in an air draught or air flow path. A pump 49 is included in the fluid circuit to circulate the fluid through the fluid flow path 36 and the reservoir and/or heat exchanger (if provided).

[0023] Figures 3-5 depict a planar wall 16' which may be used as a component of a fluid cooled housing of a different configuration to that depicted in Figures 1 and 2. More particularly, the wall 16' can be used in a housing in the shape of a square or rectangular prism. The wall 16' is provided with an internal fluid flow path 36' comprising four channels 42'a-42'd. The wall 16' is made from two strips of material 44a and 44b (hereinafter referred to in general as strips 44). Each of the strips 44 is provided with a central region 46 inboard of its periphery in which there is formed a plurality of grooves 48a-48f. Grooves 48a-48d are parallel to each other and extend in the direction of the length of the strips 44. These grooves are connected in parallel, in terms of fluid flow, by transversely extending grooves 48e at one end and 48f at an opposite end. A hole 51 is formed in each of the strips 44 opening onto respective grooves 48e, with a second hole 53 being formed in each of the strips 44 opening onto respective grooves 48f. Conduit attachments 50 and 52 are coupled to the holes on strip 44.

[0024] The strips 44a and 44b are formed of identical configuration with the grooves 48 being one half the depth of the channels 42'. The wall 16' is completed by attaching the two strips 44a and 44b together with their respective channels in registration. The

holes 51 form fluid inlet port 38 and the holes 53 form the fluid outlet port 40 in the strip 44a. However one of each of the holes 51 and 53 is sealed so that the holes 51 and 53 open onto the outside surface of one of the walls 16' only, that being, in this case, constituted by the outside surface of strip 44b. The wall 16' can then be incorporated into a brake housing with other walls to define a casing within which there is disposed a braking system. One or more of these other walls may also be of similar construction to the wall 16'. As with the embodiment depicted in Figures 1-2, the fluid flow path 36 of the wall 16' is coupled to a fluid circuit having a reservoir, a pump and optionally, a radiator or other heat exchanger.

[0025] Instead of forming holes 51 and 53 in both strips 44a and 44b and then sealing the holes in one of these strips, the holes 51 and 53 could of course be formed in one of the strips only, with the couplings 50 and 52 being provided on the same strip.

[0026] Figure 6 depicts a brake system 56 incorporating an embodiment of the housing 10 and a fluid circuit 43 connected between the housing fluid inlet and outlet 40. This circuit also includes a supply 45 of cooling fluid, a pump 49 and a heat exchanger 47 as described hereinabove. In this particular form, the brake system 56 is a disc brake system with a brake rotor 58 mounted on the wheel hub and shaft 57 which extend into the housing 10. Disc brake pads 15 and associated pistons 17 and cylinders 19 are disposed on each side of the rotor 58 within the housing 10. The cylinders 19 may be formed integrally with the housing 10. The brake system 56 is a wet brake system where the cavity 14 retains a volume of fluid such as oil 62 which contacts the braking components such as the brake pads 15 and rotor 58 to reduce wear. It should be understood that the fluid 62 is completely separate and isolated from the fluid circulated through the circuit 43. Rotary seals 64 and 66 are provided to seal against wheel hub and shaft 57 to prevent loss of the fluid 62, with the bearings 65 providing rotational decoupling between the housing 10 and shaft 57.

[0027] Now that embodiments of the present invention have been described in detail, it will be apparent to those skilled in the relevant arts that numerous modifications and variations may be made without departing from the basic inventive concepts. For

example, in the illustrated embodiments, the fluid flow path 36 is depicted as being formed by two opposing grooves formed in separate components placed in facing relationship where each groove is one half the depth of the channels. However the full depth of the channels may be formed in one component with a second plain strip being sealed thereover to seal the channels. Further, the fluid flow path 36 may be formed by other techniques such as forming or casting.

[0028] The housing 10 may also of course house a wet disc brake system comprising one or more brake disc pads and rotors. In such an embodiment, it is likely that the actual configuration of the housing 10 will vary from that depicted in present Figures 1 and 2.

[0029] All such modifications and variations are deemed to be within the scope of the present invention the nature of which is to be determined from the above description and appended claims.

The Claims Defining the Invention are as Follows:

1. A fluid cooled brake housing including at least:

a casing defining a cavity for housing one or more friction pads, said casing having one or more walls, at least one of said walls provided with an internal fluid flow path, a fluid inlet in fluid communication with said fluid flow path, and a fluid outlet in fluid communication with said fluid flow path;

whereby, when a fluid supply is coupled with said fluid inlet, fluid flows through said wall via said fluid inlet, fluid flow path and fluid outlet, thereby cooling said housing.

2. The housing according to claim 1, wherein said fluid flow path includes at least one channel between said fluid inlet and said fluid outlet.

3. The housing according to claim 1, wherein said fluid flow path includes a plurality of parallel connected channels extending between said fluid inlet and said fluid outlet.

4. The housing according to any one of claims 1-3 further including sealing means for sealing said cavity when said housing is mounted on an axle to provide a wet brake housing.

5. A wall for a brake housing, said wall including an internal fluid flow path, a fluid inlet in fluid communication with said fluid flow path, and a fluid outlet in fluid communication with said fluid flow path;

whereby, when a fluid supply is coupled with said fluid inlet, fluid flows through said wall via said inlet, through said fluid flow path and out said fluid outlet to cool said wall.

6. The wall according to claim 5, wherein said fluid flow path includes at leat one channel between said fluid inlet and said fluid outlet.

7. The wall according to claim 5, wherein said fluid flow path includes a plurality of parallel connected channels extending between said fluid inlet and said fluid outlet.

8. A fluid cooled brake system including:

a fluid cool brake housing having a casing defining a cavity, said casing having one or more walls, at least one of said walls provided with an internal fluid flow path, and a fluid inlet and a fluid outlet each in fluid communication with said fluid flow path;

one or more brake pads disposed in said cavity;

braking surface located within said cavity;

an actuator for selectively moving said one or more brake ads into contact with said braking surface; and,

a supply of cooling fluid external of said cavity and in fluid communication with said fluid inlet and said fluid outlet, whereby said cooling fluid circulates through said supply, said fluid inlet, fluid flow path and fluid outlet.

9. The brake system according to claim 8 further including a pump for pumping said cooling fluid through said supply and said fluid flow path.

10. The brake system according to claim 9 further including a heat exchanger in fluid communication with said supply for cooling said cooling fluid.

11. The brake system according to any one of claims 8-10 further including a

volume of fluid sealed with in said cavity and at least partially covering said braking surface, said fluid separate from said cooling fluid.

12. The brake system according to any one of claims 8-11 wherein said fluid flow path includes at least one channel between said fluid inlet and said fluid outlet.

13. The brake system according to nay one of claims 8-11 wherein said fluid flow path includes a plurality of parallel connected channels extending between said fluid inlet and said fluid outlet.

14. The brake system according to any one of claims 8-13 further including sealing means for sealing said cavity when said housing is mounted on an axle to provide a wet brake housing.