

Wear Compensating Device for a Brake Device,

And Brake Device

The present invention relates to a wear compensating device for a shoe brake having at least one brake lever, which brake lever supports a brake lining which acts on a brake body, and which brake lever is adjustable by means of an actuating arrangement about a main axis between a braking position and a ventilating position. In braking position, the brake lining acts on a brake body, for example, a brake disk or a brake drum. In the case of industrial brakes, the braking force is applied by means of a brake spring which acts on the actuating arrangement. During braking, said brake spring brings the brake lever into braking position.

In order to release or ventilate such a brake, a so-called ventilation device has been provided, which ventilation device acts also on the brake lever by means of the actuating arrangement. By overcoming the brake spring tension, said ventilation device brings the brake lever into its ventilation position. Such a ventilation device usually functions electromagnetically, mechanically and/or hydraulically.

During braking, i.e., during repeated actuation of the brake, the brake lining and/or the brake body wear off. As a result, the actuating path or travel of the brake lever is prolonged since the distance between the brake lining and the brake body is increased. In order to compensate this wear, a wear compensating device has been provided which wear compensating device acts upon a stop which has been defined to position the brake body. At the wear compensating device an adjusting device has been provided by means of which adjusting device the braking distance or travel can be adjusted in such a way that the designated ventilation position can be defined by the impact the adjusting device has on the stop. As a result, the wear can be compensated and the braking distance/actuating path can be kept constant. At the same time, the stop and adjusting device define the ventilating position of the brake arrangement.

For example, a brake arrangement featuring such a wear compensating device is known from the disk brake of type SB17MX of Company Bubenzer.

Such a brake is specified in the corporate publication "Industriebremstechnik" [Industrial Brake Systems], second edition, of Company Bubenzer.

Figure 10 shows such a brake in which two brake levers 50 have been provided, each of which is swivel-mounted at a mounting yoke 52. By means of a reference part 53, the mounting yoke itself has been retained and adjusted to the brake body. At one end, the brake levers 50 support brake linings 55, and at the other end, they support the actuating arrangement 56. The stop 58 has been attached to the mounting yoke 52.

For braking, a brake spring 60 pushes the brake levers apart on one end so that the other two ends, which support the brake linings 55, move toward each other in forcipate fashion and restraining the disk-shaped brake body 54 in order to brake.

In order to ventilate or release the brake, the ventilation device 62 contracts, for example, electromagnetically, the brake levers 50 by means of the actuating arrangement 56 so that the brake linings 55 are released from the brake body 54. The ventilation gap is delimited by two adjusting screws 64 which are attached at the brake levers 50 and which adjoin in ventilating position of the brake with their ends the stops 58. In the event of increasing wear of the brake linings 55 or the brake body 54, these adjusting screws 64 can be adjusted, so that the wear can be compensated and the amount of the ventilating gap can be kept appropriately constant. At the same time, the adjusting screws 64 are centering the position of the brake levers 50 and, consequently, the position of the brake linings 55 relatively to the brake body 54, so that the brake can be assembled in any position, without one of the brake linings 55, in released or ventilated position, resting

against the brake body 54 or grinding at the rotating brake body 54.

Here, the ventilation device acts electromagnetically. However, available are also hydraulic, mechanical and pneumatic ventilation devices. Such brakes are used, for example, as service brakes for crane undercarriages, swivel devices or lifting units.

In the known brakes, it is necessary from time to time to adjust the adjusting screws 64 according to wear, in order to compensate the wear (up to 70% of the initial thickness) at the brake linings 55, because otherwise the times of incidence of the brake would change in unacceptable fashion. In other words: the so-called ventilation gap between brake lining 55 and brake body 54 should remain as constant as possible. This manual adjustment increases the number of maintenance intervals occurring during the lifespan of a brake lining. Frequently such brakes are also located at places difficult to access, requiring extensive work of disassembly and assembly to adjust the adjusting screws 64.

US Patent 2,714,941 shows a wear compensation device which compensates the brake lining wear through brake shoes located inside a drum brake. For this purpose two ends of the brake shoes are coupled by means of two adjusting levers which push the brake levers increasingly apart according to wear. This occurs by means of a cam element arranged in the coupling joint of the two levers. Said cam element engages at the brake shoe and keeps the lever joints in expanding position according to brake lining wear. Despite the locking condition produced by the cam element, the braking action is guaranteed in that one of the joint levers is mounted in movable fashion (in the direction of brake action) in one of the two brake shoes. The bearing clearance required for the brake action is provided in that the diameter of the bearing pin is smaller than the diameter of the bearing opening. The cam element, on the other hand, is swivel-mounted in the hinge point of the two levers, but free of clearance.

A further problem consists of the fact that increasing wear results in decreasing spring tension and, consequently, decreasing braking force because of a change of the initial tension, since the position and length of the travel of the actuating arrangement to be overcome has been changed. This can also result in the fact that the function of the ventilation device is being affected. Possibly electromagnetically induced retention forces are no longer sufficient to overcome the spring force in order to release or ventilate the brake.

Based on these premises, it is the objective of the present invention to reduce, at least partially, the known disadvantages.

This objective is achieved by means of the wear compensating device according to Claim 1, or by means of providing a brake device according to Claim 13.

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The invention-based wear compensating device comprises a first adjusting device which has an adjusting element which engages on the stop and on which acts an adjusting force which, during braking and ventilation of the brake, holds the adjusting element in engagement with the stop and, consequently, adjusts the ventilating position of the brake lever corresponding to the wear of the brake lining and/or of the brake body in such a way that a ventilation gap L which is set between the brake lining and the brake body remains constant. In other words: by means of the adjacent adjusting force, the adjusting element(s) is (are) made to constantly follow up during brake operation. As a result, even if the absolute ventilating position of the brake levers changes, the relative ventilation gap (L) between brake lining, or brake linings, and brake body remains approximately constant. Consequently, the lifespan of a brake lining or brake body can be completely utilized without additional maintenance or adjustment intervals.

Here, a swivel-mounted cam has been provided which has an adjustment surface engaging at the stop and describing a control curve which, during the transition from ventilating position to braking position, compensates the wear by means of a pivoting movement of the cam. Here, corresponding to wear, a change of distance takes place between the working point of the adjustment surface engaging at the stop and the swivel axis (which is defined with respect to the brake lever) of the cam element.

The amount (S) is provided by means of an application of bearing defining the swivel axis of the cam, which application of bearing has two bearing elements which are adjustable to each other by the amount (S).

In a further development of the invention according to Claim 2, the adjusting force is applied by means of a spring element. As a result, the function of the adjusting device is guaranteed independent of the mounting position of the brake.

According to Claim 3, during the ventilation process, the swivel axis of the cam is displaceably defined in the direction of the braking force relative to the brake lever, by an amount (S) corresponding to the ventilation gap (L). This amount (S) is defined

according to brake geometry and ultimately results from the leverage at the respective brake device and the designated ventilation gap (L).

According to Claim 4, the swivel axis of the cam runs transverse to the direction of the braking force, and the cam itself is designed in fashion of a flat cam disk. In this embodiment, the designated control curve can be developed on a plainly designed cam which can be mounted in space-saving fashion at the brake lever in the area of the stop.

According to Claim 5, the control curve in such a cam is characterized in that the curve of the cam decreases with increasing adjustment. In this embodiment, such a control curve can be easily determined analytically or experimentally.

According to Claim 6, these bearing elements are placed torque proof and are axially fixed to the brake lever, thus defining the absolute position of the amount (S) which defines the acceptable adjustment travel of the brake levers to the stop.

According to Claim 7, a fixed bearing element has been provided which is retained toward the brake lever, and a movable bearing element which is adjustable by the amount (S) to the fixed bearing element, and which defines the relative position of the swivel axis to the brake lever and the absolute position of the swivel axis to the adjusting element or to the cam.

The further development of the invention according to claims 8 through 11 relates to a wear compensating device in which a second adjusting device has been provided which acts on the brake leverage or the actuating arrangement and which is arranged and designed in such a way that it changes the effective length of the actuating arrangement corresponding to wear of the brake lining and/or the brake body to the extent that the brake spring tension and an adjusted ventilation gap/braking distance remain constant at the brake rod. This second adjusting device guarantees that the initial tension of the spring and, consequently, the brake spring tension remains constant even if the brake

linings or the brake body are wearing out. At the same time, the amount and position of the ventilation gap at the actuating arrangement are kept constant so that the wear cannot influence the effect of the ventilation device. By means of the brake lining or brake body lifespan, this second adjusting device maintains constant important brake characteristics, such as, time of incidence, braking force and release or ventilation time.

The embodiment according to Claim 9 has been provided with a spindle arrangement the effective length of which, during brake operation, is being adjusted corresponding to wear through torsion of a first spindle element toward a second spindle element. Here, the second adjusting device performs the adjustment required during brake operation. Respective maintenance work is reduced and maintenance intervals are only required to exchange worn out brake linings or a worn out brake body.

Claim 10 relates to the interaction of elements by means of which linear movements performed during an actuation of the brake are converted to a respective circular motion of the first spindle element. Claim 13 relates to the concrete embodiment by means of a coupling lever having guide sections running together vertically.

Claim 12 relates to a brake device having two brake levers which has an invention-based wear compensating device. In such a brake device, the problems discussed above in the context of the known brake device are overcome at least partially. According to Claim 15, as discussed at the outset, the embodiment also allows the brake levers to be centered toward the brake body in their ventilating position so that the brake or brake device can be used in any mounting position.

To apply the adjusting force by means of a spring element (Claim 14) which is coupled to the adjusting elements guarantees that the process of centering is performed symmetrically since the adjusting force acts symmetrically on both adjusting elements.

Subsequently, a description of an embodiment of the present invention is provided by means of drawings. It is shown:

- Figure 1 a perspective schematic diagram of a brake device having an invention-based wear compensating device, whereas the brake device is in braking position,
- Figure 2 the brake device shown in Figure 1, whereas the brake device is in ventilation position,
- Figure 3 a view of the brake device (braking position) shown in Figure 1,
- Figure 4 a view of the brake device (ventilation position) shown in Figure 2,
- Figure 5 a section A-A (see Figure 7) of the brake device shown,
- Figure 6 a further view of the brake device (braking position) shown in Figure 1 and 3,

- Figure 7 a further view of the brake device (ventilation position) shown in Figure 2, 4 and 5,
- Figure 8 a view in the direction of the brake spring center on the end of the brake device shown on the right hand side of figures 1 through 7,
- Figure 9 a sectional view (section C-C in Figure 3) of the application of bearing of the adjusting element, and
- Figure 10 a brake device according to prior art.

Subsequently, the basic structure and function of an invention-based wear compensating device are described by means of figures 1-9.

Figures 1 and 2 show a perspective view of a brake device 1, which is shown in various functional positions. Figure 1 shows the brake device in braking position and Figure 2 in ventilation position.

The brake device 1 has two brake levers 2 and 4 each of which consists of two lugs. The brake levers 2 and 4 are connected in flexible fashion to a yoke 6 and, by means of bolt arrangements, they are swivel-mounted in the yoke 6 about the main axes 8. At the lower end of the brake levers 2 and 4 (at the end of the shorter lever section viewed from the main axes 8), brake lining arrangements 10 have been designed in swivel-mounted fashion, respectively. Each of the brake lining arrangements 10 has a brake lining 12. A brake body 14 (shown in Figure 5) runs between the brake surfaces of the brake linings 12 facing each other. The upper end of the brake levers 2 and 4 (at the end of the longer

lever section viewed from the main axes 8) are connected to each other by means of an actuating arrangement 16. The yoke 6 continues to support a stop 18, which is attached at the yoke 6 in symmetrical fashion to the brake levers 2 and 4. The position of the brake device 1 is defined by means of the yoke 6 relative to the brake body 14. The actuating arrangement 16 comprises a brake spring 20 and a ventilation device 22, which compresses during the process of activation the brake levers 2 and 4 by means of a mechanism (not shown in detail), thus ventilating or releasing the brake device 1. During the process of decelerating, the activation of the ventilation device is cancelled or discontinued and the brake spring pushes apart the brake levers 2 and 4 so that the brake linings 12 exert a respective braking force on the brake body 14.

Each brake lever 2 and 4 is equipped with a first adjusting device 100, each of which act on the stop 18. The brake device is also equipped with a second adjusting device 200 which acts on the actuating arrangement 16. Both adjusting devices 100, 200 are used to compensate the brake lining wear and thus guarantee constant performance of the brake device during the entire lifespan of the brake linings 12 or the brake body 14.

The first adjusting device 100 is subsequently described in figures 3, 4, 5 and 9. Structure and function of the first adjusting device 100 are described by means of the first adjusting device arranged at brake lever 4. The respective first adjusting device 100 at brake lever 2 is designed to be laterally reversed.

The first adjusting device is designed from a cam disk 102 which is swivel-mounted at the brake lever 4 by means of a retaining clip 104 (Figure 4 and 9). In the embodiment shown, the retaining clip 104 is attached to the brake lever 4 by means of mounting screws 105. However, in some embodiments, the cam disk 102 is directly housed in the brake lever 2. The cam disk 102 is mounted to the retaining clip 104 by means of the

application of bearing 106 which penetrates an appropriate recess 107 in the cam disk 102 (Figure 5 and 9).

On the cam disk 102 acts an adjusting force which causes a pivoting movement in the direction of the arrow marked with K (see Figure 3 and 4). The cam disk 102 has an adjusting surface 108 which engages in the stop 18.

The swivel axis 110 which runs parallel to the main axis 8 is displaced in dependence of the braking position of the brake device (Figure 9). This is achieved by means of the application of bearing 106 in the following way.

Figure 9 shows a longitudinal section through the application of bearing 106. Here, a fixed bearing element 112 and a movable bearing element 114 have been provided. Each of the two elements 112, 114 have a cylindrical cup-shaped outer surface and are connected together with a gap S. In the process they are forced apart by means of the springs 116 and are connected to each other by means of the adjusting screw 118 in order to facilitate assembly and disassembly. The fixed bearing element 112 is retained in the arms of the retaining clip by means of the mounting screws 120, namely in respective mounting openings 122. Here, the fixed bearing element 112 and the movable bearing element 114 penetrate the cam disk 102 which sits, by means of a plain bearing bush 124, swiveling or pivoting on the application of bearing 106.

The gap (S) defines the ventilation gap (L) between brake lining 12 and brake body 14. The function is described in Figure 4. Here, the brake device is described by means of a sectional view. For ventilation the brake levers 2 and 4 are compressed at the longer ends (on the top) by means of the actuating arrangement 16. The cam disk 102 rests against the stop 18 with its adjusting surface 108. The force applied there by means of the ventilation process presses the cam disk 102 against the movable bearing element 114.

As a result, the gap S is closed against the expansion force applied by the springs 116 and the movable bearing element 114 is displaced by the amount S transverse to the swivel axis 110 and relative to the fixed bearing element 112, and the brake lever 4 (as well as brake lever 2) moves about the main axis 8 so that the brake lining is released from the brake body by the amount L .

During braking the process is reversed. If wear occurs on the brake lining 12 or on the brake body 14, a two-step adjusting process takes place: During the process of closing the brake the brake spring 20 first pushes the brake levers 2 and 4 apart to the extent that the fixed bearing element 112 and the movable bearing element 114 are again disconnected from each other by the amount S (the position shown in Figure 5 and 9). If, in this position, the brake lining 12 is not yet engaged to the brake body 14, i.e., if a gap (due to wear) remains between brake body 14 and brake lining 12, the brake spring 20 pushes the brake levers 2 and 4 further apart. In the process the adjustment surface 108 is released from the stop 18. However, the adjusting force acting in direction K causes it to pan to the extent that it rests again at the stop 18. The following ventilation process occurs by closing the gap S in the application of bearing 106. Consequently, through a respective design of the adjusting surface 108, the wear is compensated and the ventilation gap L between brake disk or brake body 14 and brake lining 12 is kept constant at the application of bearing 106 corresponding to the amount S of the gap.

The control curve of the cam disk 102 defining the adjusting surface 108 is designed in such a way that the cam disk 102 with increasing adjustment in the direction K has an decreasing curve so that the radial distance between the swivel axis 110 and the working point 109 of the adjusting surface 108 increases respectively at the stop 18. Here, the active pairing between stop 18 and adjusting surface 108 is designed in such a way that, with adjacent adjusting surface 108, no adjustment, i.e., no panning of the cam disk 102

occurs on the application of bearing 106. Thus, the active pairing at the working point 109 is self-restricting toward forces which, possibly through the working point 109, run transverse to the main axis 8 or transverse to the swivel axis 110. An adjustment of the cam disk 102 occurs only during the actual process of braking by means of the adjusting force. In the embodiment shown, this adjusting force is applied by means of a spring element 126 which is mounted in tension between the cam disks 102. However, the adjusting force can also be applied by means of a spring acting between retaining clip 104 and cam disk 102, or in any other way.

The second adjusting device 200 acts on the actuating arrangement 16 and is subsequently described by means of figures 3 through 8. The actuating arrangement 16 is hinged at the longer ends of the brake levers 2 and 4 by means of respective hinge pins 24 and 26. Structure and function are described also by means of the sectional view in Figure 5. The main item of the actuating arrangement 16 is the operating rod 28 which, with its one end, penetrates or extends into the ventilation device 22 and which, with its other end, is screwed into the spindle bush 30. An adjustable stop sleeve 32 is attached to another thread section. The brake spring 20 is restrained with initial tension, which can be adjusted by means of the stop sleeve, between ventilation device 22 and stop sleeve 32. The ventilation device 22 or housing is hinged in flexible fashion to the brake lever 2 by means of a connecting piece 34 (see Figure 3) and the hinge pin 24. The shaded ventilation device shown in Figure 5 comprises in its interior a ventilation mechanism, which is not shown and not described in any detail. Such a ventilation mechanism can be operated in electromechanical, mechanical, hydraulic or pneumatic fashion.

Via an intermediate bearing 36, the spindle bush 30 is hinged also in flexible fashion to the brake lever 4 by means of the hinge pin 26. The brake and/or ventilation movement of the brake device 1 is performed by means of a linear movement of the operating rod 28

which moves axially relative to the ventilation device 22 (arrow B in Figure 5). During braking the brake spring 20, supported at the housing of the ventilation device 22, pushes against the stop sleeve 32 and pushes the operating rod 28 into the spindle bush 30, which transmits by means of the intermediate bearing 36 the force on the brake lever 4. As a result, the two brake levers 2 and 4 are pushed apart at the ends supporting the hinge pins 24 and 26, and said brake levers swivel toward each other about the main axes 8 at the ends supporting the brake lining arrangements 10. The brake linings 12 engage at the brake body 14.

In order to release or ventilate the brake, a ventilation mechanism (not shown) in the interior of the ventilation device 22 acts in opposite direction on the operating rod 28. As a result, the operating rod 28 is pulled into the ventilation device against the spring force applied by the brake spring 20. In the process, by means of the spindle bush 30, the operating rod 28 pulls the intermediate bearing 36 in the direction of the ventilation device 22. The ends having the hinge pins 24 and 26 of the brake levers 2 and 4 move toward each other and the ends having the brake lining arrangements 10 correspondingly move away from each other.

In the case of increasing wear of the brake linings 12 or the brake body 14, the position of the operating rod to the ventilation device changes to the extent that said operating rod increasingly moves out of the ventilation device in the direction of the spindle bush 30. This reduces the initial tension of the brake spring 20 and, consequently, considerably changes important braking parameters. Because of the reduced spring force, the brake becomes softer, the braking force is reduced, and the times of incidence is increased. This adjustment takes place independent of whether or not the width of the ventilation gap to be bridged is kept constant by means of the first adjusting device 100.

In order to keep constant the braking action, the second adjusting device 200 has been provided. Said second adjusting device comprises an engaging piece element 202

retained on the operating rod, which engaging piece element 202 is coupled by means of a coupling lever 204 to a freewheel assembly 206 retained on the spindle bush. Figures 6 and 7 show to action of the coupling lever 204, which coupling lever is retained in flexible fashion in a plane by means of a lug coupling 208 connected to the ventilation device and which plane runs parallel to the moving direction (B) of the operating rod 28.

By means of the hinge arrangement 210, the coupling lever 204 is retained to the lug coupling 208 in such a way that in the center between lug coupling 208 and coupling lever 204 there is so much inhibitive friction that the coupling lever 204 independent of its mounting position does not change its swiveled position with regard to the lug coupling 208 independently.

During braking the brake spring 20 displaces the operating rod 28 in the direction of the spindle bush 30. In the process said brake spring picks up the engaging piece element 202 which engages with its engaging piece 212 in an adjusting fork 214 at the coupling lever running approximately transverse to the moving direction (B) of the operating rod 28. By means of the linear movement of the operating rod 28, which is transferred to the first adjusting fork 214 by means of the engaging piece element 202 and the engaging piece 212, the coupling lever 204 is panned about the hinge arrangement 210 in direction R (see Figure 6). In the process the second adjusting fork 216 engages by means of an adjusting plug 218 at the freewheel assembly 206 and twists the adjusting plug 218 relative to the spindle bush 30.

During brake ventilation the operating rod 28 is retracted and the engaging piece element 202 together with the engaging piece 212 is correspondingly moved back. Here, enough clearance SP has been provided between the engaging piece 212 and the first adjusting fork 214 that, with a normal ventilation gap, the engaging piece 212 is reset without acting on the first adjusting fork 214 or the coupling lever 204. As a result, the coupling lever 204 also does not act on the adjusting plug 218 and, consequently, also not on freewheel assembly 206 which remains in its swiveled position and which does not twist the spindle

bush 30 on the operating rod 28. The clearance SP has been adjusted to the designated ventilation gap or the gap S in the application of bearing 106 between brake linings 12 and brake body 14. This means that in case of a systematic ventilation gap no movement of the coupling lever 204 takes place which movement adjusts the spindle bush 30 on the operating rod 28 by means of the freewheel assembly 206.

Only if, because of increasing wear of the brake linings 12 and/or the brake body 14, the coupling lever 204 is panned further in the direction R by the engaging piece acting in the adjusting fork 214, the engaging piece 212 acts also during ventilation, i.e., during retraction of the operating rod 28, in the first adjusting fork 214 and pans the coupling lever 204 into the position shown in Figure 7. In the process the second adjusting fork 216 picks up the adjusting plug 218 at the freewheel assembly 206, and the freewheel assembly 206, which is blocked in this direction, twists the spindle bush 30 on the operating rod 28 to the extent (direction T in Figure 8) that the operating rod 28 turns the spindle bush 30 downward. This increases the actual length of the actuating arrangement 16 between the stop sleeve 32 and the connecting piece 34 so that the wear of the brake linings 12 or the brake body 14 is compensated without having changing the initial tension of the brake spring 20.

In the embodiment shown, engaging piece 212 and adjusting plug 218 are guided by means of ball joints and sliding blocks, which are designed according to the adjusting forks 214, 216. Here, a guide sleeve has been provided between ball joint and sliding block which compensates the height tolerances to the pan plane of the coupling lever 204, especially during panning of the adjusting plug 218. Here, the clearance SP in the first adjusting fork 214 is provided through a specific arrangement between the sliding block and the profile of the adjusting fork. Besides the arrangement shown, the interaction between the engaging piece 212 or the adjusting plug 218 and the adjusting forks 214, 216 can also take place by any other appropriate design. With corresponding geometry

of the adjusting fork sides, engaging piece 212 and adjusting plug 218 can even act directly in the adjusting forks 214, 216.

In the embodiment shown above, the first adjustment devices 100 and the second adjustment device 200 are provided at a brake device 1. This combination makes it possible to compensate up to 70% brake lining wear without changing the braking action (braking force, time of incidence). Maintenance work is reduced to a minimum.

Other embodiments offer the possibility to provide the first adjustment device 100 and the second adjustment device independently. This means that, in embodiments in which it is guaranteed that the brake body 14 is centered in relation to the brake linings 12, for example, by means of a specific mounting position of the brake device 1, the first adjustment devices 100 can be dispensed while the second adjustment device 200 is provided in order to guarantee constant braking force during the entire lifespan of the brake lining or brake body.

In another case, in which, for example, maintenance intervals at the brake device 1 have not been determined on the basis of brake lining wear but, instead, because of other influences, the second adjustment device 200 can possibly be dispensed if the brake lining wear to be expected is so insignificant that it cannot be expected that the wear will have an actual effect on the braking force; it is, however, desired to have a reliable wear compensating centering.

Besides the disk-shaped cams shown, it is basically also possible to use other control elements. For example, it is more or less possible that ramp or screw-shaped adjustment surfaces engage at the stop 18. With such a cam design, the swivel or rotation axis of the cam would run approximately in the direction of the braking force.

There are also other possible arrangements for providing the bearing gap S. For example, it is possible to mount a spring-loaded massive bearing bolt, which replaces the fixed bearing and movable bearing elements 112 and 114, in a respective retainer groove, which bearing bolt allows for a bearing displacement corresponding to the gap during ventilation of the brake against the stop 18.

The expert can derive other models and embodiments of the invention described above from the following claims.

Claims

1. Wear compensating device for a brake device (1) having a brake lever (2, 4) which brake lever (2, 4) supports a brake lining (12) which acts on a brake body (14), and which brake lever (2, 4) is adjustable by means of an actuating arrangement (16) about a main axis (8) between a braking position and a ventilating position.

Here, the wear compensating device has a first adjusting device (100) which is arranged on the brake lever and which acts on a stop (18) in such a way that the latter, as an actuating travel delimitation, acts on the first adjusting device (100) and therefore at the same time on the brake lever (2, 4) and defines a corresponding ventilating position.

The first adjusting device (100) has an adjusting element (102) which engages on the stop (18) and on which acts an adjusting force (126) which, during braking and ventilation of the brake (1), holds the adjusting element (102) in engagement with the stop (18) and varies the ventilating position of the brake lever (2, 4) corresponding to the wear of the brake lining (12) and/or of the brake body (14) in such a way that a ventilation gap (L) which is set between the brake lining (12) and the brake body (14) remains constant (L).

The adjusting element (102) has been designed as a swivel-mounted cam, the adjusting surface (108) of which engages at the stop (18) and describes a control curve which, during the transition from ventilating position to braking position, compensates the wear by means of a pivoting movement of the cam. Here, corresponding to wear, a change of distance takes place between the working point (109) of the adjustment surface (108) engaging at the stop (18) and the swivel axis (110) of the cam element (102), characterized in that the cam (102) is pivoting on an application of bearing (106) defining the swivel axis (110) and which application of bearing (106) has two bearing elements (112, 114) which can be adjusted toward each other.

2. Wear compensating device according to Claim 1, in which the adjusting force is applied by means of a spring element (126).

3. Wear compensating device according to Claim 1, in which, during the ventilation process, the swivel axis (110) of the cam (102) is displaceably defined in the direction of the braking force relative to the brake lever (2, 4), by an amount (S) corresponding to the ventilation gap (L).
4. Wear compensating device according to one of claims 1 through 3, in which the swivel axis (110) of the cam (102) runs transverse to the direction of the braking force, and the cam (102) is designed in fashion of a flat cam disk.
5. Wear compensating device according to Claim 4, in which the curve of the control curve decreases with increasing adjustment.
6. Wear compensating device according to one of claims 1 through 5, in which the bearing elements (112, 114) are placed torque proof and are fixed axially to the brake lever (2, 4).
7. Wear compensating device according to one of claims 1 through 6, in which a fixed bearing element (112) and a movable bearing element (114) have been provided, whereas the fixed bearing element (112) has been retained relative to the brake lever (2, 4), and the movable bearing element (114) is adjustable by the amount (S) to the fixed bearing element and defines the swivel axis.
8. Wear compensating device according to one of the preceding claims in which a second adjusting device (200) has been provided which acts on an actuating arrangement (16) which transfers brake spring tension, which is coupled to a ventilation device (22), and which acts on the brake lever (2, 4), and which is arranged and designed in such a way that it changes the effective length of the actuating arrangement (16) corresponding to wear of the brake lining (12) and/or the brake body (14) to the extent that the brake spring tension and an adjusted ventilation gap remains constant at the actuating arrangement (16).
9. Wear compensating device according to Claim 8, in which the actuating arrangement (16) acts between two brake levers (2, 4) and which actuating arrangement (16) has a spindle arrangement (28, 30) which is designed in such a

way that, during brake operation (1), the second adjusting device (200) adjusts the effective length of the actuating arrangement (16) corresponding to wear through torsion of a first spindle element (30) toward a second spindle element (28).

10. Wear compensating device according to Claim 8 or 9, in which the second adjusting device (200) converts, by means of respective engaging piece elements (202, 212; 206, 218) a linear movement (B) of the actuating arrangement (16) performed relative to one of the brake levers (2), into a circular motion of the first spindle element (30), whereas the engaging piece elements (202, 212; 206, 218) interact by means of respective coupling elements (204, 208).
11. Wear compensating device according to Claim 10, in which the coupling elements (204, 208) comprises a swivel-mounted coupling lever (204) the swivel axis (210) of which has been defined with regard to its position of a brake lever (2), and in which the coupling lever (204) has approximately two working sections (214, 216) running together vertically, each of which interacts with the engaging piece elements (202, 212; 206, 218).
12. Brake device (1) having two brake levers (2, 4) which have a wear compensating device according to one of the preceding claims.
13. Brake device according to Claim 12, in which both brake levers (2, 4) have a first adjusting device (100), whereas the first adjusting devices (100) center the brake levers (2, 4) in their respective ventilation position relative to the brake body (14) at the stop (18).
14. Brake device according to Claim 12 or 13, in which the adjusting force is applied by means of a spring element (126) couple with the adjusting elements (102).