

HOLDING BRAKE FOR A TRACTION SHEAVE ELEVATOR ✓

The present invention relates to a holding brake for a traction sheave elevator as defined in the preamble of claim 1.

The function of a holding brake is to hold an elevator stationary at a floor and also to stop the elevator car or prevent its motion during a power failure. Therefore, the braking action of the holding brake is based on a mechanical pressure element, such as a spring, which keeps the brake engaged when there are no external forces acting on it. As the holding brake is activated each time when the car arrives at a floor and releases each time the car leaves a floor, its operation must be as fast, accurate and noiseless as possible so that it will not be noticed by elevator users. For this reason, the air gap between the brake shoe of the holding brake and the traction sheave or a possible separate brake wheel must be as narrow as possible to allow the braking to occur as quickly as possible and to keep the impact energy of the brake shoe as low as possible and the locking of the brake as noiseless as possible. On the other hand, it is to be noted that there must be a definite air gap between the brake shoe and the braking surface and that the brake shoe must not chafe the braking surface as this would result in undesirable noise during elevator travel.

In holding brakes used at present in traction sheave elevators, i.e. in normal slide brakes, bearing tolerances in the brake lever systems and structural deflections impair the accuracy of the braking action, which is why it is necessary to use relatively large air gaps in holding brakes. Therefore, the required movements in the brake shoe and in the parts actuating it are large, implementing the movements requires relatively large and

expensive components, and the braking action produces a relatively noisy impact due to the large air gap. Especially the electromagnet used to release the brake is relatively large and expensive due to the long brake shoe travel upon release of the brake.

The object of the present invention is to eliminate the drawbacks described above. A specific object of the invention is to disclose a new type of holding brake for a traction sheave elevator, a brake which is accurate in operation as well as fast and noiseless, which is easy to adjust and which can be implemented using smaller, lighter and less expensive components.

As for the features characteristic of the invention, reference is made to the claims.

The brake shoe of the invention for a traction sheave elevator comprises a brake body and a brake shoe attached to the brake body. Moreover, the holding brake comprises a mechanical pressure element, which may be a spring or equivalent, arranged to press the brake shoe against a brake wheel to prevent rotation of the brake wheel. The holding brake also comprises a retractor arranged to apply a pull to the brake shoe to keep it clear of the brake wheel when the brake is not active, i.e. when the car is moving. The element used as a retractor is generally an electromagnet, but other mechanical, electrical, hydraulic or corresponding arrangements may be used as well.

According to the invention, the holding brake comprises an intermediate frame disposed between the brake body and the brake shoe, with a pressure element applying a pressure on the intermediate frame. In addition, the holding brake comprises adjusting elements between the intermediate frame and the brake shoe to allow the posi-

tion of the brake shoe to be adjusted in relation to the intermediate frame so as to maintain an air gap of exactly the desired width between the brake shoe and the brake wheel. Thus, in the holding brake of the invention, the brake shoe and the intermediate frame are connected together by the adjusting elements so that, due to the action of the electromagnet or mechanical pressure element, they move together as a rigid assembly during the braking action. The intermediate frame and the brake shoe are only moved or adjusted relative to each other when the air gap between the brake shoe and the brake wheel is to be adjusted. Thus, the holding brake of the invention has a fixed and stationary brake body while adjustment of the air gap is accomplished as an internal adjustment between brake components within the brake .

The braking surface of the brake shoe is preferably an elongated part with a curved shape in the direction of motion of the brake wheel so that it has a relatively long contact area with the braking surface of the brake wheel along the rim of the wheel. In this case, the holding brake preferably comprises two adjusting elements between the intermediate frame and the brake shoe, disposed on both sides of the middle portion of the brake shoe, preferably relatively close to its ends.

In the adjusting element between the brake shoe and the intermediate frame, preferably an adjusting spring and a clamping element are used, the clamping element being arranged to pull the brake shoe toward the intermediate frame against the pressure of the adjusting spring. As a result, there is no clearance in the joint between the intermediate frame and the brake shoe and a precise motion between them is achieved.

In another embodiment, the adjusting element is implemented using a pack of adjusting shims and a tightening means so that a pack of suitable total thickness consisting of one or more adjusting shims is formed in the adjusting element, whereupon the intermediate frame and the brake shoe are tightened to each other by means of the adjusting element, thus setting them to a position determined by the pack of adjusting shims relative to each other.

The holding brake preferably comprises suitable guides, rails, pins, holes or equivalent disposed between the brake body and the brake shoe to keep the brake shoe accurately in the correct direction and position relative to the brake wheel, these guide elements only permitting perpendicular compressive motion of the braking surfaces against each other.

As compared with prior art, the holding brake of the invention has significant advantages. Thanks to the structure of the invention, a well-functioning brake with a very narrow air gap is achieved. The brake wheel may consist of the traction sheave, which has a relatively large diameter. As a consequence of the small air gap and advantageous diameter ratio, a smaller brake magnet and smaller brake components can be used, resulting in a lower price. The long and narrow brake shoe and the two adjusting screws at its ends allow accurate control of the brake shoe so as to achieve a precise engagement with the surface of the brake wheel, resulting in effective braking. As the adjusting elements act directly on the brake shoe, the bearing clearances and structural deflections in the brake lever mechanisms have no effect on the operation of the brake, unlike normal sliding brakes. Moreover, the small air gap means a low impact energy of the brake shoe, so the closing action of the brake is quieter than in traditional brakes. In addi-

tion, as the long brake shoe needs only two adjusting elements, the brake is very easy to adjust.

In the following, the invention will be described in detail with reference to the attached drawings, wherein

Fig. 1 presents a partially sectioned view of a holding brake for a traction sheave elevator as provided by the invention,

Fig. 2 presents a detail of the holding brake in Fig. 1, and

Fig. 3 presents a third embodiment of the invention in conjunction with a double machine.

The holding brake for a traction sheave elevator presented in the drawing comprises a brake body 1 with a brake frame 17, i.e. a sturdy bracket by which the holding brake can be attached e.g. to the frame of an elevator motor or to some other suitable fixed part. The brake body comprises a round discoid ring with an annular electromagnet 4 embedded in it. The electromagnet is located on the substantially planar lower surface of the brake body and towards the inside of the brake body. Placed against the planar lower surface of the brake body is a substantially annular intermediate frame 7. Below the intermediate frame is an elongated brake shoe 2 of a curved shape, which is pressed against a brake wheel 5 when the brake is applied. When the brake is not active, there is an air gap 3 between the brake shoe 2 and the brake wheel 5.

The intermediate frame 7 and the brake shoe 2 are connected together by adjusting elements 8 disposed near the ends of the elongated brake shoe. The adjusting element 8 comprises an adjusting spring 9, whose pressure

tends to move the brake shoe and intermediate frame away from each other, and a clamping element 10, i.e. a tightening screw, by means of which the brake shoe and the intermediate frame can be drawn toward each other against the spring force of the adjusting spring 9. Thus, the motion between the brake shoe and the intermediate frame is always precise and free of play. The adjusting spring 9 used in the embodiment in Fig. 1 is a discoid spring set, which allows a good force density and a compact size to be achieved. However, it is also possible to use e.g. spiral springs or a suitable compressible material.

Located in the centre of the discoid brake body 1 is a power transmission shaft 14. Mounted on the brake body 1 around the power transmission shaft is a pressure element 6, i.e. a disk spring set, whose lower edge rests on a shoulder 15 in the shaft. Here, too, instead of a disk spring, it is possible to use other types of springing elements. Thus, via the shoulder 15, the pressure element 6 presses the shaft downward toward the brake shoe 2. Below the shoulder, the shaft 14 has a step 16, which is pressed against the top surface of the intermediate frame 7. Thus, when the shaft 14 is pressed downward, it presses the intermediate frame and together with it the brake shoe against the brake wheel 5.

The brake shoe 2 and the shaft 14 are connected to each other via a guide element 11, which consists of a spigot 12 at the lower end of the shaft 14 and a hole 13 in the brake shoe 2. Thus, as the spigot at the end of the shaft is in the hole 13 in the brake shoe and the shaft 14 is rigidly mounted and is only vertically slidable in the brake body 1, the guide element 11 keeps the brake shoe tightly in position, preventing it from swinging and turning and only allowing precise braking movements in the braking direction. In other words, the shaft 14

receives a brake torque from the brake shoe 2 via the spigot 12 and a support moment from the brake body 1 via the sliding bearings 31,32, so that the brake shoe cannot substantially move sideways because the tolerances in the sliding bearings 31,32 and in the guide element can be small and deflections in the structure are very small. Of course, the curved shape of the brake shoe also guides and stabilises its movement so that no large lateral supports are needed in the structure. However, it is the shaft 14, the spigot 12 at its end and the hole 13 in the brake shoe that transmit the brake torque to the body of the holding brake, so it is important that these elements be sturdy and free of play. The shaft 14, the spigot 12 and the collar in the shaft, comprising an upper shoulder 15 and a lower shoulder 16, preferably form a single continuous body. The sliding bearings 31,32 between the brake body 1 and the shaft 14 are so disposed that the upper sliding bearing 31 lies between the shaft 14 and a screw part 33 engaging an internal thread in the brake body. The screw part 33 can be used to adjust the pressure of the disk spring set forming the pressure element 6 and at the same time the force with which the brake shoe 2 is pressed against the brake wheel.

The holding brake presented in Fig. 1 additionally comprises a forced release function, which allows the brake to be released during a power failure. This is implemented by providing the upper end of the shaft 14 with an oil space 18, with an oil nipple 19 leading into the oil space. Thus, by supplying oil through the nipple 19 into the oil space 18, a hydraulic pressure is generated which lifts the shaft 14 and with it the brake shoe 2. The oil space can be vented via a bleed screw 30.

Fig. 2 presents another embodiment of the adjusting elements 8 as compared with Fig. 1. In the adjusting ele-

ments, a set of adjusting shims or, depending on the need, an adjusting shim 20 taken from the set is used, which is placed in the adjusting element between the brake shoe 2 and the intermediate frame 7. After this, the brake shoe and the intermediate frame are tightened against each other by means of the tightening element 21. Therefore, the adjusting shim 20 determines the position of the brake shoe and thus also the width of the air gap between the brake shoe and the brake wheel.

Fig. 3 illustrates a practical application of the holding brake of the invention, the brake being mounted on a double elevator machine with two permanent magnet motors mounted on the same shaft on opposite sides of a common large traction sheave 23. In this application, two holding brakes as illustrated in Fig. 1 are connected together by their brake frames 17, the brake bodies 1 being utilised as a means for rigidly binding and attaching the motor frames 22 to each other. Therefore, the basic idea of the invention that the adjustment of the brake pieces is carried out independently of the positions of the brake bodies 1 and brake frames 17 is essential.

In the foregoing, the invention has been described by way of example by the aid of the attached drawing, but different embodiments of the invention are possible within the scope of the inventive idea defined in the claims.



CLAIMS

1. Brake shoe for a traction sheave elevator, comprising
- a brake body (1),
 - a brake shoe (2) attached to the brake body,
 - a retractor (4) for keeping the brake shoe clear of a brake wheel (5), and
 - a mechanical pressure element (6) for pressing the brake shoe against the brake wheel,

characterised in that

- the holding brake comprises an intermediate frame (7) disposed between the brake body (1) and the brake shoe (2), the pressure element (6) being arranged to apply a pressure on the intermediate frame, and that
- the holding brake comprises adjusting elements (8) between the intermediate frame and the brake shoe to allow adjustment of the position of the brake shoe in relation to the intermediate frame when the air gap (3) between the brake shoe and the brake wheel is being adjusted.

2. Holding brake as defined in claim 1, **characterised** in that the brake shoe (2) comprises a curved braking surface elongated in the direction of motion of the brake wheel.

3. Holding brake as defined in claim 2, **characterised** in that, as seen in the lengthways direction of the brake shoe, the adjusting elements (8) are disposed on different sides of the centre of the brake shoe, preferably near its ends.

4. Holding brake as defined in claim 1, **characterised** in that the adjusting element (8) comprises an adjusting spring (9) and a clamping element (10) arranged to pull the between (2) toward the intermediate frame (7) against the pressure of the adjusting spring.



5. Holding brake as defined in claim 1, characterised in that the adjusting element (8) comprises a set of adjusting shims (20) and a tightening means (21) arranged to tighten the brake shoe (2) in relation to the intermediate frame (7) into a position determined by the set of adjusting shims.

6. Holding brake as defined in claim 1, characterised in that the brake body (1) and the brake shoe (2) are connected together via a guide element (11) to prevent the brake shoe from turning in relation to the brake body.

7. Holding brake as defined in claim 6, characterised in that the guide element (11) comprises a spigot (12) extending outward from the brake body (1) and a hole (13) in the brake shoe (2), corresponding to the spigot.

8. Holding brake as defined in claim 1, characterised in that the retractor (4) is an electromagnet.

9. Holding brake as defined in claim 8, characterised in that the electromagnet (4) is a circular ring and the pressure element (6) and the guide element (11) are disposed substantially successively on the centre axis of the electromagnet.