Elevator brake and safety.

Two hydraulically controlled brakes (32) are attached to an elevator car (10) and each engages a guide rail (18). Each brake (32) is applied by a spring (40). The spring is compressed to release the brake, by actuating hydraulic cylinders (31a) through an electromechanically operated master cylinder (31) that responds to a signal from the motor control (16). An electromechanical release valve (52) is operated by a governor (22), when an overspeed condition exists to quickly release the pressure in the cylinders, applying the brake.
Technical Field

This invention relates to elevators, in particular, elevator brakes and safeties.

Background of the Invention

In the conventional traction elevator the brake, which is electromechanically operated, is located in the machining room, where it is attached to the drive. As a result, the braking force is limited by the traction between the cables and the drive. In an abrupt stop the drive may "slip traction", reducing the braking force significantly.

The elevator safety, a separate stopping device, is located on the elevator car. Generally consisting of a wedge device, a safety rapidly engages the elevator rail to stop the elevator car. The safeties are usually progressive; that is, they progressively reach a maximum tolerable acceleration rate. Safety operation is typically controlled by an elevator governor, which, generally speaking, is a mechanical device that is connected to the elevator car and which, upon sensing elevator car overspeed, provides a mechanical pull (actuation) to the safety, causing it to engage the rail.
Disclosure of the Invention

An object of the present invention is have both the brake and safety on the car.

According to the present invention, a brake (e.g. caliper brake) on the car engages the elevator guide rail. The brake is mechanically biased to normally freely engage the rail, but the bias is overcome or prevented by a brake control when braking is not needed. If overspeed is detected, however, the operative connection between the brake control and the brake is interrupted, allowing the mechanical bias to apply the brake.

According to one aspect of the invention, the bias is overcome by a hydraulic actuator operated by energizing a solenoid to operate a master cylinder. The line connecting the master cylinder and the actuator is vented by another valve when overspeed is detected, thereby eliminating the need to retract the master cylinder to apply the brake.

Brief Description of the Drawing

Fig. 1 is a function block diagram of an elevator according to the invention.

Fig. 2 is a function block diagram of a brake control system according to the invention.

Fig. 3 is plain view of a brake and a rail that may be used in an elevator embodying the invention.
Best Mode for Carrying Out the Invention

In the elevator in Fig. 1, there is a car 10, counterweight (CW) 12, motor 14, motor control (MCNTRL) 16 and two guide rails 18. On top of the car, there is a prime velocity transducer 20, also called in the art the primary position transducer or PPT and there is also governor 22. The governor in this application is connected to the velocity transducer, which, for illustrative purposes, senses car motion relative to a tape to provide car velocity output signals. Position and velocity measurement in that manner is well known. When the velocity or acceleration or both exceeds predetermined levels, the governor provides an ES signal to bring the car to an emergency stop. The ES signal is supplied to a brake control 28, also on top of the car. The brake control 28, which is also connected to the motor control 16 by a traveling cable 30, controls operation of two brakes 32 and they are also on top of the car. These brakes engage the rails, but are maintained in disengagement by the brake control 28 in response to a brake release (BR) signal provided from the motor control except when the car is stopping or is parked, conditions when braking is needed.

Fig. 2 shows that the brake control 28 contains an oil tank 29 containing a reservoir of hydraulic fluid, and a master cylinder (MC) 31 operated by a solenoid (SOL) 33 which receives the BR signal from the motor control 16. For illustrative purposes, the
solenoid has a plunger 33a that controls the position of the master cylinder. The master cylinder provides fluid through two lines 31a to the brakes, each of which contains brake shoes 32a that are squeezed against the guide rails by means of the caliper 32b, as shown in Fig 3. Each brake contains a spring 40 which expands outwardly so as to force the pads against the rail, an action by which the brake is applied. Each brake also contains two separate brake actuators or cylinders (BC) 32c on opposite sides of the spring. When the plunger 33a is moved in one direction, hydraulic fluid is supplied from the master cylinder to each brake actuator over one of the lines 31a, each of which is part of an independent hydraulic circuit from the master cylinder. Operation of one actuator therefore will "release" the brake. The pressure expands the caliper - overcomes the spring - and thereby disengaging or releasing the brake pads from the guide rail. This takes place in response to the BR signal - which causes the solenoid to operate the master cylinder.

If an overspeed condition occurs, the governor senses that from the transducer and provides the ES signal to the brake control. In the brake control another solenoid 50 receives the signal and operates a release valve (RV) 52, and this "vents" the master cylinder to the tank, (i.e., releases the pressure in the lines 31a). The ES signal thus interrupts the operative connection between the master cylinder and the brake cylinders. Consequently, all pressure from
brake cylinders 32c is eliminated, allowing the caliper to close immediately by operation of the spring, even if the BR signal is still applied.

In lieu of the master brake cylinder, which provides hydraulic pressure to the brake cylinders, a hydraulic pump may be used, but with a similar control that positively releases the brake cylinders. That is, even if a configuration like that is utilized, an electromechanical valve which is operated independently by the governor should still be employed to positively release the pressure on the brake actuators.

Utilizing the foregoing, one skilled in the art may make modifications and variations to the previously described embodiment or embodiments without departing from the true scope and spirit of the invention embodied therein.
Claims

1. An elevator comprising a car (10), a guide rail (18), a motor (14), a motor control (16), a governor (22), and a car speed sensor (20) characterized by:
   a brake (32) on the car comprising engaging means for causing the brake to engage the rail (18) and prevention means for preventing operation of the engaging means;
   brake control means (28) comprising stop signal means for providing a stop signal to cause operation of the prevention means in response to a signal from the motor control and safety stop means for transmitting the stop signal to the prevention means over a transmission path and being operable, in response to a signal from the governor manifesting an overspeed condition, to break the transmission path.

2. An elevator according to claim 1, characterized in that:
   the engaging means comprises a spring (40);
   the prevention means comprises a hydraulic actuator (31) to overcome the spring;
   the stop signal means comprises an electromechanical valve operable to cause operation of the actuator; and
   the safety means comprises an electromechanical valve operable to cause operation of the actuator; and
   the safety means comprises an electromechanical valve (52) operable to release pressure in the actuator.
3. A method for controlling a brake (32) and an elevator car (10), characterized by:
   mechanically biasing the brake into brake operation;
   mechanically overcoming the bias in response to the brake release signal applied on a control path from a brake control (28);
   interrupting the control path in response to a safety signal;
   whereby the brake is applied in response to the safety independent of the presence of the brake release signal on the control path.

4. A method according to claim 3, characterized by:
   in response to the safety signal, releasing pressure in the line to a device which, in response to the pressure, overcomes the bias.