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(54) Procedure and apparatus for producing elevator load data.

(57) Procedure and apparatus for producing elevator load data. The procedure employs one or more tension sensing detectors (14) placed on the elevator car unit (1) or on a member (33,35) carrying the weight of said unit. At least one detector is placed on the elevator car unit in a location where the tension caused by the load is high. Based on the information obtained from the detectors, a car load signal and another load signal, used especially in the start setting of a hoisting motor drive and dependent on the position of the elevator car unit, are produced.

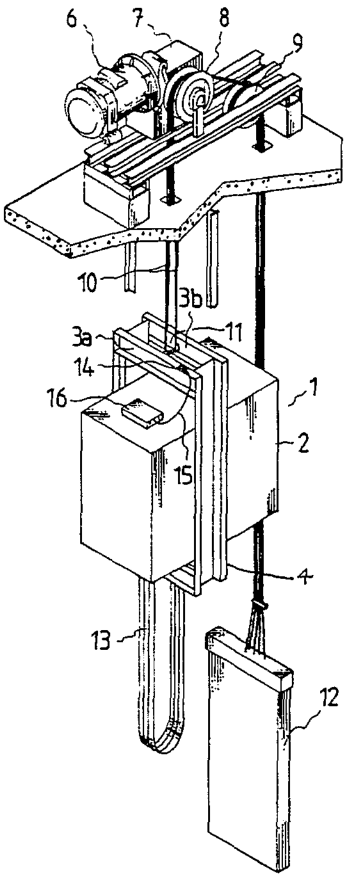

Fig.1

EP 0 427 075 A2

PROCEDURE AND APPARATUS FOR PRODUCING ELEVATOR LOAD DATA

The present invention relates to a procedure and an apparatus for producing load data in an elevator, said procedure employing one or more tension sensing detectors placed in an elevator car unit or in a member carrying the weight of an elevator car unit.

In previously known load measuring systems, the aim is to obtain signals dependent on the load of the elevator car. A load measuring instrument of this type, designed for the car of an elevator using hoisting ropes, is proposed e.g. in FI patent publication 75048. In the elevator described in this publication, the bottom of the elevator car rests on isolating elements resting on the horizontal shoulders of angle irons whose vertical shoulders are secured with screws on the bottom frame. Attached above and below each angle iron is a strain gauge. According to the publication mentioned, it is preferable to use four angle irons placed at the four corners of the bottom frame. One of the drawbacks of the solution proposed in this publication is that the strain gauges are difficult to mount by glueing, especially if they are to be mounted after first installation.

Conventional load measuring systems fitted under the elevator car provide no start setting data directly. Instead, a separate load-weighing device, e.g. a brake scale, is needed for this purpose.

The object of the present invention is to eliminate the above-mentioned drawbacks and to achieve a system for producing elevator load data that is especially applicable in the modernization of elevators.

The procedure of the invention for producing elevator load data is characterized in that at least one detector is placed in the elevator car unit in a location where the tension caused by the load is high, and that, based on the information obtained from the detectors, a car load signal and another load signal, used especially in the start setting of a hoisting motor drive and dependent on the position of the elevator car unit, are produced.

The preferred embodiments of the ivention are presented in the other claims.

The apparatus of the invention can be easily added to existing elevators. As compared to a load weighing device placed under the elevator car, the invention provides the following advantages, especially significant in the modernization of elevators. The elevator car need not be lifted to allow the mounting of the detectors, and therefore no extra space need to be provided below the overhead beam of the car frame. No additional insulating elements have to be provided under the elevator car because of the load measuring system, and no constructional changes need to be made in the structures under the elevator car. Moreover, the apparatus can be used in elevator car-frame systems in which no insulation is provided between the elevator car and the car frame.

In the following, the invention is described in detail by the aid of examples by referring to the attached drawings, in which

Fig. 1 presents an elevator provided with a load measuring. apparatus according to the invention.

Fig. 2 illustrates the apparatus of the invention.

Fig. 3 presents an elevator car provided with a load measuring apparatus according to the invention.

Fig. 4 presents another elevator car provided with a load measuring apparatus according to the invention.

Fig. 5 shows yet another elevator car provided with a load measuring apparatus according to the invention.

Fig. 6 presents the connection principle of the apparatus of the invention.

Figs. 7a - 7d represent the outputs of the amplifiers.

Figs. 8a - 8b show a hydraulic elevator provided with a load measuring apparatus according to the invention.

The elevator system illustrated in fig. 1 comprises an elevator car unit 1 consisting of an elevator car 2 and a car frame, said unit moving along guide rails in a hoistway (not shown). The car frame consists of overhead beams 3a and 3b, side beams 4 and bottom beams 5a and 5b (Fig.3).The elevator car unit is moved using hoisting ropes 10 by means of a hoisting motor 6, transmission 7, traction sheave 8 and diverting pulley 9 placed in a machine room above the hoistway, the hoisting motor being provided with a control unit. One end of the hoisting ropes is attached to a fixing point 11 between the overhead beams and the other end to a counterweight 12. A car cable 13 is connected to the elevator car unit. The overhead beams are attached to the same vertical beams, and the car is inside the car frame.

For the determination of the car load by the procedure of the invention, overhead beam 3a is provided with a strain gauge transducer 14 placed on top of the beam and connected via a conductor 15 to a central unit 16 placed on top of the elevator car.

The apparatus illustrated by fig. 2 comprises a strain gauge transducer 14, a connecting conductor 15 and an am plifier card 17 placed in a housing 18 provided with a lead-through 19. If a mains voltage supply and/or relay outputs are needed, then an adapter card 20 is also needed. The detector used may be e.g. a strain gauge transducer as proposed in FI patent publication 62904, describing a transducer which, when attached by its ends with screws to a suitable base, senses the tensile and compressive stresses of the base in the longitudinal direction of the transducer. Attached between the ends of the body of the transducer are strain gauges which bend at their fixing points due to the tensile and compressive stresses of the base.

Fig. 3 shows an elevator car unit in which the overhead beams are attached to separate vertical beams 21a and 21b or the elevator car 2 is in an unsymmetrical position relative to the car frame. In this case, two detectors 14 and 22 are used, one on each overhead beam. The detectors are connected to the central unit via conductors 15 and 23.

The detectors produce signals indicating the force (load) applied to the hoisting ropes. In addition, it is possible to obtain signals indicating changes in beam tension caused by installation errors or the guides of the elevator car. This makes it possible to determine the quality of the installation as well as the kinetic friction of the elevator car system.

Fig. 4 shows an elevator car unit corresponding to the one in fig. 1, but with a hoisting rope pulley 24 attached to the overhead beam. In addition, the unit is provided with a balancing means, which is attached to the bottom beam and consists of a beam 25 and a balancing chain 26 or equivalent. The elevator car is in a symmetrical position relative to the car frame. In this case, beam 25 is provided with a detector 27, connected to the central unit via conductor 28. The system makes it possible to check the balancing of the elevator system.

Fig. 5 shows an elevator car unit corresponding to that in fig. 4. In this case, the overhead beams are attached to separate vertical beams and or the car is in an unsymmetrical position relative to the car frame. As in the case of fig. 4, the elevator car unit is provided with a rope pulley and the balancing means is attached to the bottom beam. In addition, the unit has a compensation detector 27 providing absolute car position data.

Fig. 6 shows a diagram representing the principle of operation of the apparatus of the invention. As shown in fig. 2, the central unit 16 comprises an amplifier card 17. The amplifier is fed by a 24V d.c. voltage Vdc. The amplifier card is connected via conductors to three detectors (detector1, detector2, detector3) 14, 22, 27 and has transistor outputs T connected to the control panel. The conductors can also be replaced e.g. with a bus.

If no d.c. supply Vdc is available and potential-free contactors are needed, an adapter card 20 converting the mains voltage Vac into a d.c. voltage is used in connection with the central unit. In addition, the apparatus may have relay outputs R connected to the control panel.

Fig. 7a represents the amplified output O1 of the measuring channel(s). It shows an output LF for a full car and an output LE for an empty car, which, due to the position dependent load caused by the car cable and the balancing means, rise linearly from the lowest floor A to the highest floor Y (horizontal axis), the difference between these outputs representing the load L. In addition, the figure shows a constant output (offset) OS representing the load imposed by the weight of the elevator car unit itself. Fig. 7b shows the compensation channel output O2, which is a linearly rising signal BT representing the load caused by the balancing means and the car cable. Fig. 7c shows the load signal L, which is obtained by subtracting the offset OS and the weight of the elevator car unit, hoisting ropes and balancing means from the output O1 of fig. 7a. Fig. 7d represents the linearly changing start setting data ST with incorrect or missing compensation. The difference between the middle value and the zero level observed at the start represents the compensation error OS'.

Fig. 8a illustrates the apparatus of the invention as applied in the case of a hydraulic elevator using a hydraulic lifting cylinder 29 for moving an elevator car unit 28. The hydraulic system comprises a movable piston 29 inside the cylinder, a pressure pipe 31 and a lifting machine 32. The latter consists of a hydraulic pump, a lifting motor and other equipment required for the lifting. The piston is connected to the elevator car unit via an arm 33. A car cable 34 is attached to the bottom of the car unit. Placed on the supporting beam 35 under the lifting cylinder is a detector 14, along with a central unit 16 and a connecting conductor 15. In the case of fig. 8b, the detector is placed on the arm near the elevator car unit.

It is obvious to a person skilled in the art that different embodiments of the invention are not restricted to the examples described above, but that they may instead be varied within the scope of the following claims. Instead of strain gauge transducers it is possible to use e.g. piezoelectric or other tension sensing detectors.

Claims

1. Procedure for producing the elevator load data, said procedure employing one or more tension sensing detectors (14,22,27) placed on the elevator car unit (1,28) or on a member (33,35) carrying the weight of said unit, **characterized** in that at least one detector (14,22) is placed on the elevator car unit in a location where the tension caused by the

load is high, and that, based on the information obtained from the detectors, a car load signal and another load signal, used especially in the start setting of a hoisting motor drive and dependent on the position of the elevator car unit, are produced.

2. Procedure according to claim 1, **characterized** in that at least one detector (14,22) is placed at the same height with the fixing point of a lifting member (3) or members (13) or at least close to it.

3. Procedure according to claim 1 or 2, **characterized** in that at least one detector (27) is placed on a balancing means (25,26) comprised in the elevator car unit.

4. Procedure according to claim 3, **characterized** in that the detector placed on the balancing means (25,26) is used to produce a signal representing the position of the elevator car unit.

5. Apparatus designed for applying the procedure of claim 1 for producing elevator the load data, comprising one or more tension sensing detectors (14,22,27) and an amplifier unit (16) which are placed on the elevator car unit (1,28) or on a member (33,35) carrying the weight of said unit, **characterized** in that at least one detector (14,22) is placed on the elevator car unit in a location where the tension caused by the load is high, and that, based on the information obtained from the detectors, the amplifier unit produces a car load signal and another load signal, used especially in the start setting of a hoisting motor drive and dependent on the position of the elevator car unit.

6. Apparatus according to claim 5, **characterized** in that it comprises at least one detector (27) placed on a balancing means (25,26) comprised in the elevator car unit, said detector serving to produce a signal indicating the position of the elevator car unit.

7. Apparatus according to claim 5 or 6 for producing elevator load data in the case of an elevator provided with hoisting ropes, **characterized** in that at least one detector is placed on a structure in the upper part of the elevator car unit, e.g. on an overhead beam (3a,3b) of the car frame.

8. Apparatus according to claim 5 or 6 for producing elevator load data in the case of a hydraulic elevator, **characterized** in that at least one detector is placed on a supporting member (33) serving to move the elevator car unit, or on a beam (35) supporting the lifting unit.

9. Apparatus according to any one of claims 5 - 8, **characterized** in that the load sensing detector functions independently and that it is attached to the base by mechanical means, e.g. screws.

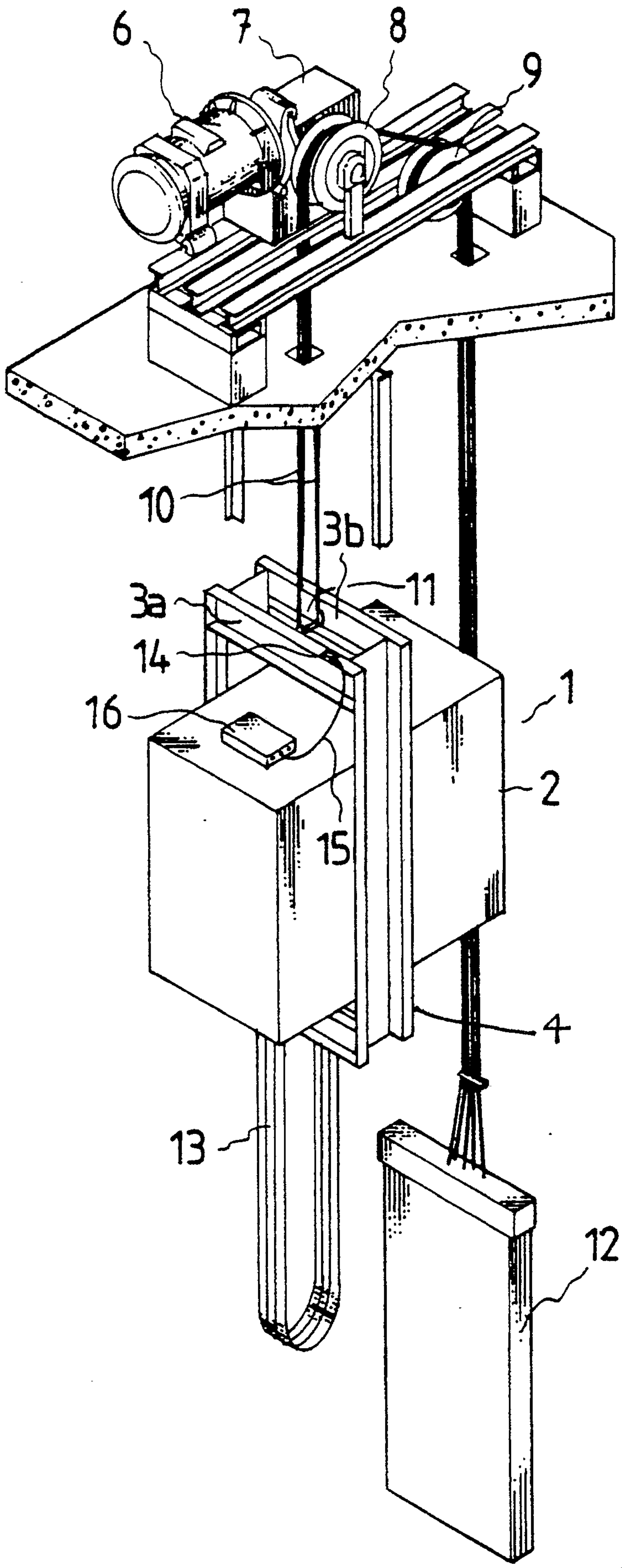

Fig.1

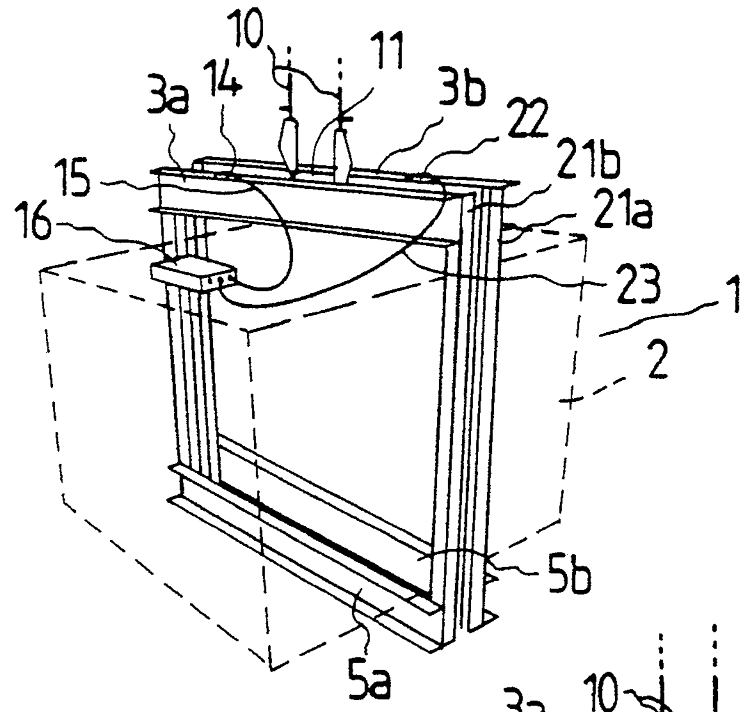

Fig.3

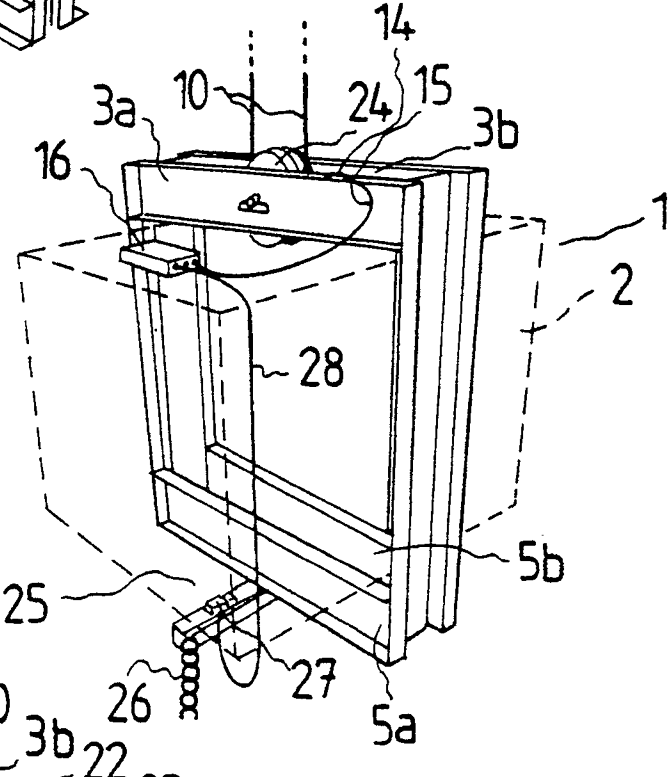

Fig.4

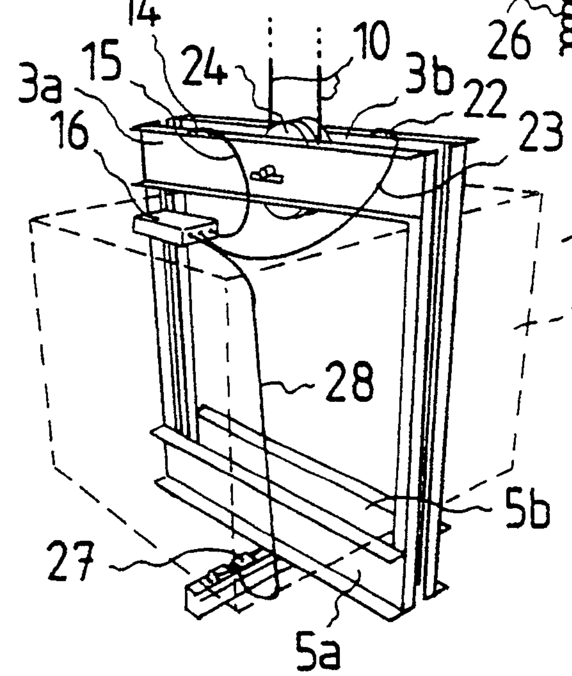

Fig.5

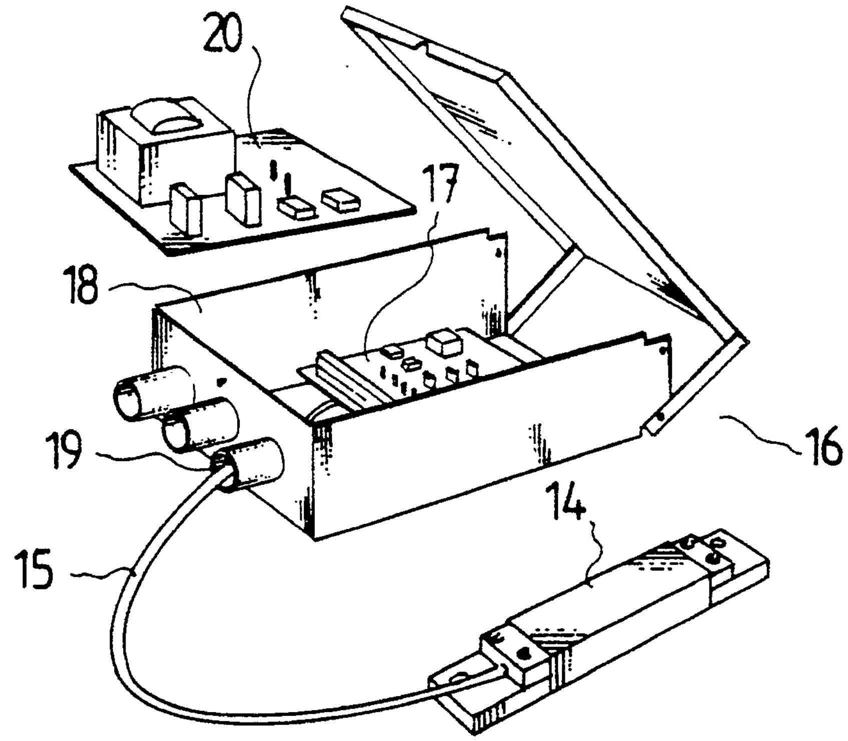

Fig.2

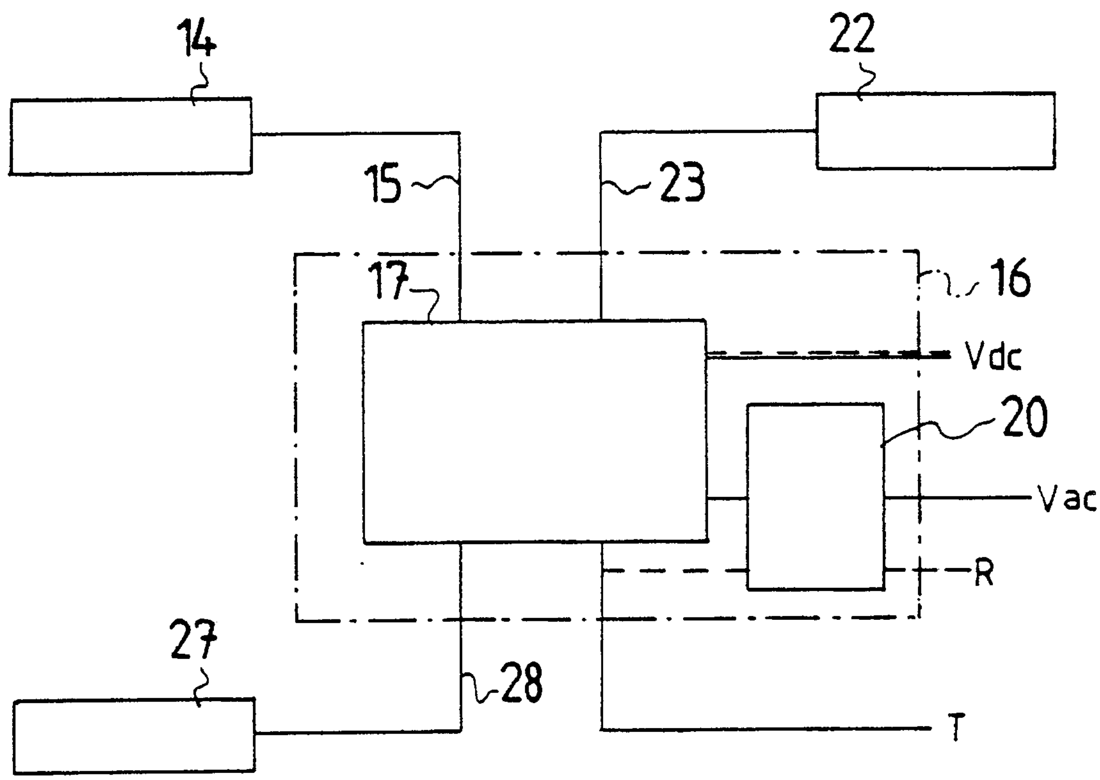

Fig.6

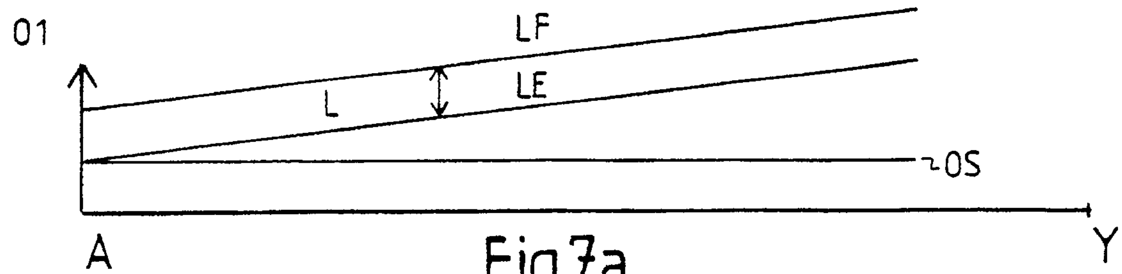

Fig.7a

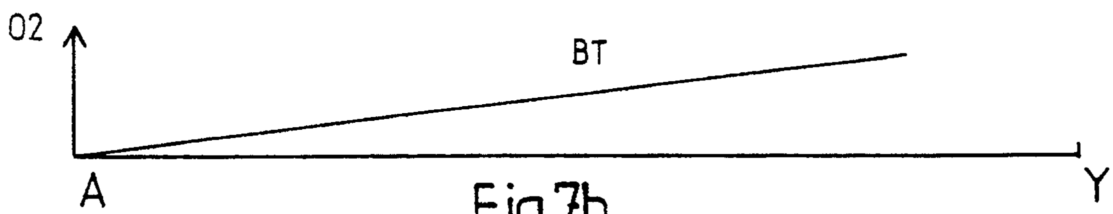

Fig.7b

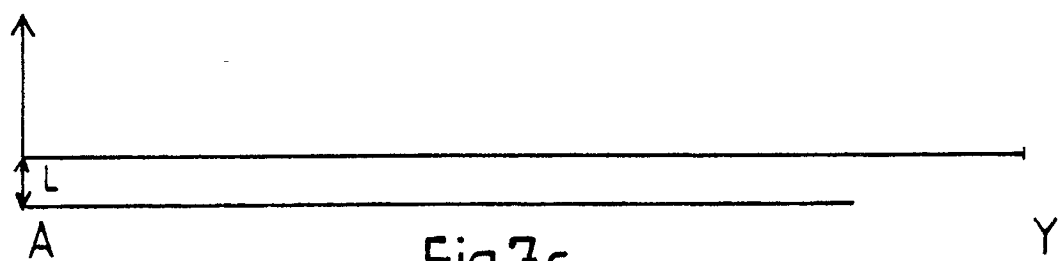

Fig.7c

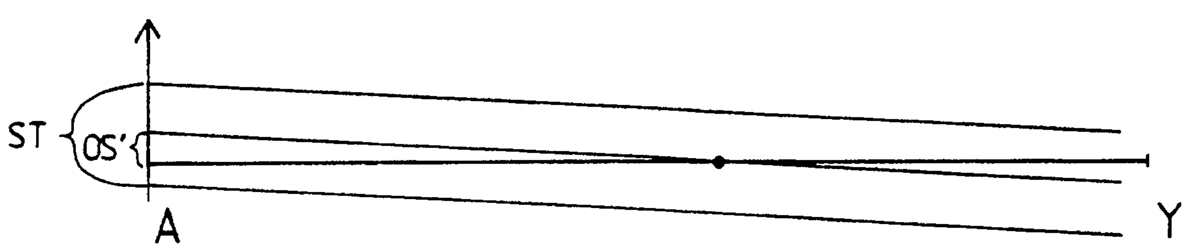

Fig.7d

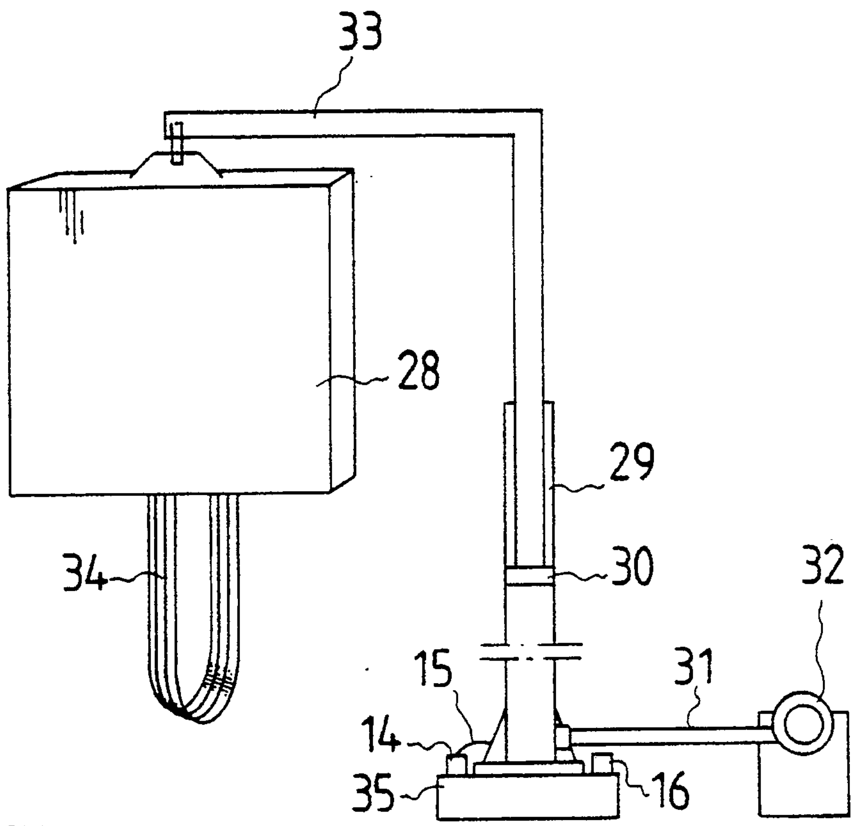

Fig.8a

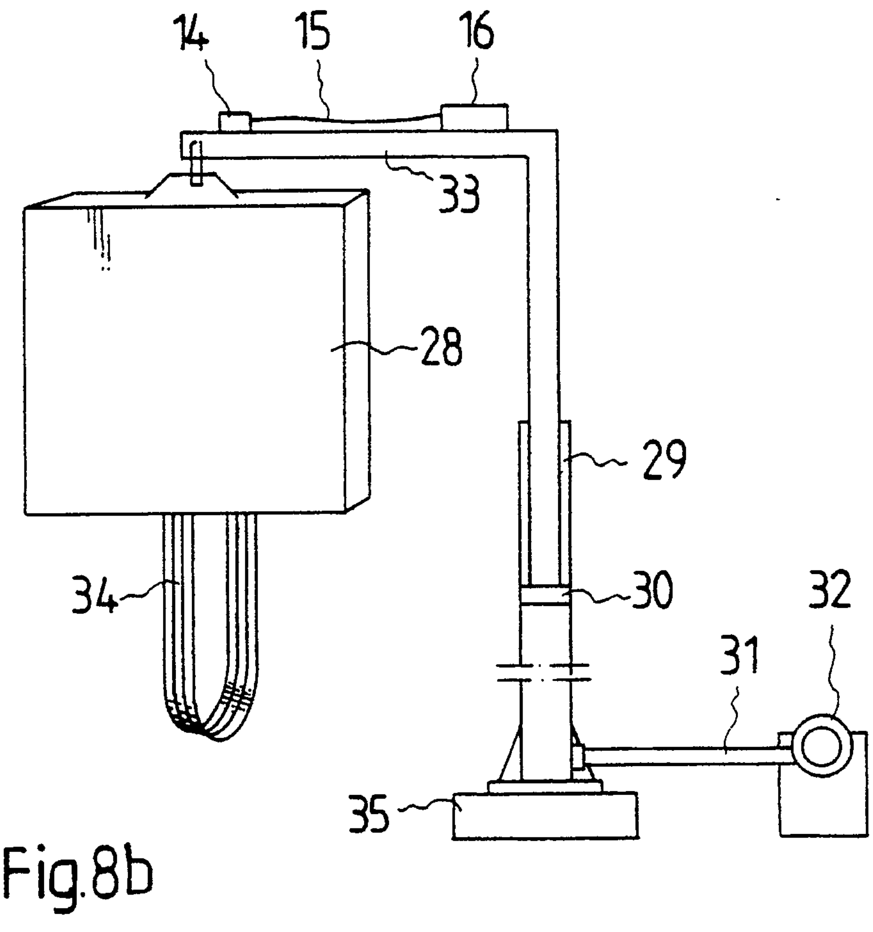

Fig.8b