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(71) Applicant: **Hitachi, Ltd.**
Tokyo (JP)

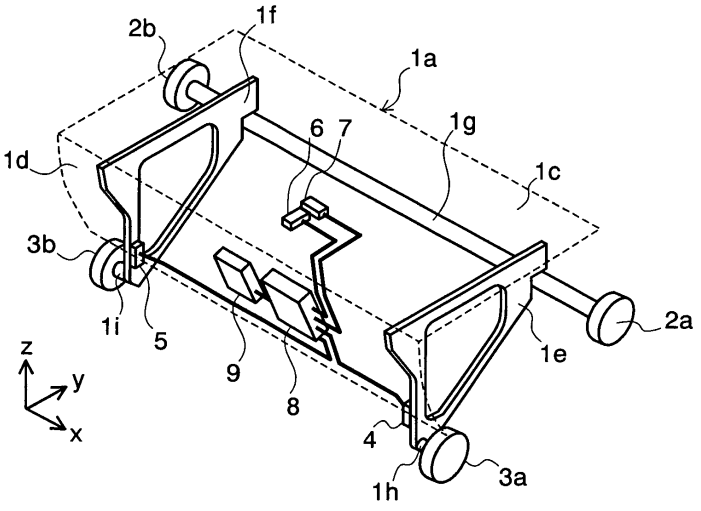
(72) Inventors:
- **Hamada, Tomoyuki,**
  c/o Hitachi, Ltd.
  Chiyoda-ku
  Tokyo 100-8220 (JP)
- **Ojima, Kazuhira,**
  c/o Hitachi, Ltd.
  Chiyoda-ku
  Tokyo 100-8220 (JP)
- **Abe, Yoshio,**
  c/o Hitachi, Ltd.
  Chiyoda-ku
  Tokyo 100-8220 (JP)
- **Yamashita, Tomonori,**
  c/o Hitachi, Ltd.
  Chiyoda-ku
  Tokyo 100-8220 (JP)

(74) Representative: **Beetz & Partner**
Steinsdorfstrasse 10
D-80538 München (DE)

(54) A passenger conveyer and a step for use of inspection thereof

(57) In a passenger conveyer apparatus, including an escalator (80), for example, passengers are carried through movement of the steps (1), which are connected endlessly. At least one piece of the steps (1) is one for use of an inspection, and within an inside thereof, i.e., on a reverse side surface of a loading surface (1c) for loading a passenger thereon; there are provided an acceleration sensor (4, 5, 6, 7) for detecting acceleration of the steps (1), a signal processor apparatus (8) for conducting signal processing upon an output signal of the acceleration sensor (4, 5, 6, 7), a transmitter means (9) for transmitting an output of the signal processor apparatus (8), an electric power supply means for supplying electric power to the signal processor apparatus (8).

FIG.1



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a passenger conveyer, such as, an escalator or a moving walk, etc., and also a step for use of inspection thereof. An example of the conventional passenger conveyer is described in Japanese Patent Laying-Open No. Hei 7-144866 (1995), for example. In an escalator described in the publication, an adjusting apparatus is attached on a step, for measuring a gap between the step and a skirt guard of the escalator, continuously. And, the gap-adjusting apparatus has a movable body, moving forward and backward while contacting a tip portion thereof on a side portion of the skirt guard, a spring for pushing the movable body towards the skirt guard, a detector portion for detecting a moving amount of the movable body, and a recording portion for recording signals from the detector portion.

[0002] With the conventional escalator, which is described in the Japanese Patent Laying-Open No.Hei7-144866(1995)mentioned above, the gap-adjusting apparatus is provided, separate from the escalator that is used normally, and therefore it needs the complicated steps as follows; i.e. , when it is used, the escalator must be stopped, so as to attach that gap-adjusting apparatus thereon. Then, the escalator is operated for sampling data, and an output of the gap-adjusting apparatus is recorded. After obtaining the data, the gap-adjusting apparatus is removed, so that the escalator can return into the normal operation thereof. As a result of this, it takes a very large amount of time for an inspection of the escalator. Also, when conducting the inspection upon the elevator, a worker or an operator for inspection must take a trouble to pay a visit to the spot. Furthermore, within such the escalator of the conventional art, although it can be made upon a carrier portion of the escalator, on which a passenger rides, however the inspection cannot be made upon a deadhead portion, which is locating within an inside of a housing of the escalator, if not disassemble the escalator.

BRIEF SUMMARY OF THE INVENTION

[0003] An object, according to the present invention accomplished by considering the drawbacks of the conventional art mentioned above into the consideration thereof, is to provide a passenger conveyer, including the escalator therein, upon which an inspection can be made easily. Other object according to the present invention is to achieve an inspection of the passenger conveyer, being remote-controllable. Further other object according to the present invention is to provide the passenger conveyer and a step thereof, which can be inspected easily, not only on the carrying portion, but also on the deadhead portion thereof.

[0004] For achieving the objects mentioned above, according to the present invention, there is provided a passenger conveyer, for moving steps connected endlessly, thereby carrying passengers thereon, within an inside of at lease one (1) piece of said steps, being defined on a reverse side surface of a loading surface thereof , for loading a passenger thereon,comprising:an acceleration sensor for detecting acceleration of said step; a signal processor apparatus for conducing signal processing upon an output signal of said acceleration sensor; and an electric power supply means for supplying electric power to said signal processor apparatus.

[0005] According to the present invention, within the passenger conveyer as described in the above, preferably, said step for use in an inspection has rollers in plural numbers thereof, and said sensor is made up with an acceleration sensor for detecting acceleration in vertical direction, which is attached in vicinity of said rollers. Also, the passenger conveyer, as described in the above, may further comprises a housing, for covering said steps so as to expose the passenger loading surfaces of said steps, wherein said electric power supply means has an induction coil, provided in said housing, extending into the traveling direction of said step, a receiving core, provided on said step to be engaged with said induction coil, whereby alternating current supplied into said induction coil excites current within said receiving core, or alternately, said step for use in an inspection may have rollers in plural numbers thereof, to be used for traveling said step circularly, and said electric power supply means may have a transmission means for transmitting rotating movement of at lease one (1) piece of the plural numbers of said rollers, and a generator means for generating electricity through the rotating movement transmitted to said transmission means.

[0006] In the passenger conveyer, as described in the above, said signal processor apparatus may have a step position identification portion, for dividing sections of said conveyer into a traveling section of being able to load the passengers thereon, a reversal section, locating at a time just after loading off the passengers or just before loading the passengers thereon, and a deadhead section, connecting to the traveling section while putting the reversal section therebetween, upon basis of the output of said acceleration sensor, and an abnormality detection portion for detecting abnormality in the acceleration acting upon the passenger conveyer, upon basis of an output of said step position identification portion, as well as, the output of said acceleration sensor, and further, said abnormality detection portion may have frequency filters in plural numbers thereof, each having a frequency band different from each other, thereby enabling to detection an abnormal mode different from each other, and an abnormality determining portion for determining presence of an abnormality in the traveling of said passenger conveyer, upon basis of outputs of the plural numbers of said frequency filters.

[0007] For achieving the objects mentioned above, according to the present invention, there is provided a passenger conveyer, for moving steps connected endlessly,

thereby carrying passengers thereon, within an inside of at lease one (1) piece of said steps, being defined on a reverse side surface of a loading surface thereof , for loading a passenger thereon, comprising: an acceleration sensor for detecting acceleration of said step; a signal processor apparatus for determining presence of an abnormality in said passenger conveyer, from an output signal of said acceleration sensor; an electric power supply means for supplying electric power to said signal processor apparatus; a transmitter means for transmitting an output of said signal processor apparatus; and an abnormality alarm generating means for generating an alarm of generation of an abnormality, upon basis of the output of said signal processor apparatus, which said transmitter means transmits. According to the present invention, the passenger conveyer as described in the above, may further comprise a remote communication means for transmitting a signal generated by said abnormality alarm generating means to a remote location.

[0008] According to the present invention, since the passenger conveyer has the step for use of an inspection, which installs an acceleration sensor therein, therefore it is possible to make an inspection, upon guide rails within the passenger conveyer, but only through operating the passenger conveyer. Accordingly, labors or times can be reduced, which are necessary for the inspection on the passenger conveyer, and the inspection can be made even from a remote location upon the passenger conveyer. Also, the inspection can be made upon all the traveling passages of the steps.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

[0009] Those and other objects, features and advantages of the present invention will become more readily apparent from the following detailed description when taken in conjunction with the accompanying drawings wherein:

Fig. 1 is a perspective view of an embodiment of a step for use of inspection (an inspection-use step), according to the present invention;

Fig. 2 is a side view of an escalator having the inspection-use step therein;

Fig. 3 is a flowchart for showing the operation of the inspection-use step;

Figs. 4 to 7 are time charts, for explaining the operation of an acceleration sensor, which is applied in the inspection-use step; and

Figs. 8 and 9 are partial perspective views of the step, for showing the details of an electric power supply means thereof.

DETAILED DESCRIPTION OF THE INVENTION

[0010] Hereinafter, embodiments according to the present invention will be fully explained by referring to the attached drawings.

[0011] Within the passenger conveyer, such as, the escalator and/or the moving walk, etc., for example, steps or plates, which are connected endlessly, travel circulatingly on guide rails attached on a housing frame of the escalator, thereby carrying passengers thereon. In particular, in case of the escalator, for each of the steps are attached rollers, i.e., in front and in rear and also on both sides directing into a traveling direction thereof, in total four (4) pieces. Those rollers travel on guide rails of four (4) pieces in total thereof, i.e. , two (2) pairs provided on both sides. If any warp or deviation is caused in the sizes when mounting those guide rails, it results into a reason of generation of vibrations and/or noises, and/or fluctuations of the steps on the way of traveling. For example, if the four (4) pieces of rails differ from one another, in particular, in height thereof, then the steps fluctuate. And also, when a difference in level and a gap is generated at a joint between the rails, there is a possibility of generating the vibration and/or the noises. Those warps or deviations also may cause interference between the skirt guards, which are provided on both sides of the step traveling path, or between comb-like plates provided at a portion where the passenger ride on and off and the step. Thus, there is a necessity of making an inspection, periodically, on whether changes are causes or not with the passage of time, in particular, in the sizes of mounting the guide rails, due to deteriorations with the passage of time and/or unexpected external forces thereon.

[0012] Hereinafter, explanation will be made about an example of the passenger conveyer according to the present invention, by referring to figures attached herewith. In the present embodiment, the passenger conveyer is an escalator. Fig. 1 is a perspective view of a step 1a for use of an inspection (i.e. , an inspection-use step), which will be mentioned later, and Fig. 2 is a view for showing a side view of an escalator 80, schematically, in which one (1) piece of the inspection-use step 1a is put into a carrier passage, which is made up by connecting steps 1 in plural numbers thereof, endlessly.

[0013] In the escalator 80, a large number of the steps 1, 1... are connected, endlessly, and thereby forming a loop 1b. Within this loop 1b, the inspection-use step 1a is put into, by only one (1) piece thereof. At the uppermost portion of the loop 1b, and at the right-hand side thereof in Fig. 2, there is provided a terminal gear 14, and this terminal gear 14 rotates the loop 1b. The terminal gear 14 is driven by means of a driver apparatus 16, which has a driver gear 16a. A driving chain belt 16b is suspended over the driver gear 16a and the terminal gear 14. In synchronization with the loop 1b, a handrail 17 rotates. In a lower portion of the loop 1b is provided a lower terminal gear 15 , and with this lower terminal gear is engaged the loop 1b. The steps 1, 1..., the terminal

gear 14 , the lower terminal gear 15 and the driver apparatus 16, etc., are stored within a housing frame 18.

[0014] Each step 1 has side portions, which are formed in a fan or delta-like shape, each, and in the vicinity of the pivots of those fans are attached front guide rollers 2a and 2b (hereinafter, be called by "front roller(s)") . Also, at corners on a side surface opposite to the side surface, on which the loop 1b is mounted, there are attached rear guide rollers 3a and 3b (hereinafter, be called by "rear roller(s)"). Those front rollers 2a and 2b and the rear rollers 3a and 3b are provided on both sides, by one (1) pair thereof, respectively.

[0015] The front rollers 2a and 2b differ from the rear rollers 3a and 3b, on both sides thereof, at position into width direction, as is shown in Fig. 1; i. e. , the front rollers 2a and 2b are located within an outside in the width direction, while the rear rollers 3a and 3b are within an inside thereof. Within an inside of the loop 1b, guide rails 10 for the front guide rollers (hereinafter, may also be called by "front rail (s)") are provided on a side of loading portion thereof, so that the front rollers 2a and 2b are able to run thereon, while guide rails 11 for the rear guide rollers (hereinafter, may also be called by "rear rail (s)") on a side of loading portion thereof, so that the rear rollers 3a and 3b are able to run thereon, but shifting the positions thereof in the width direction on both sides. In the similar manner, on an opposite side of loading portion thereof, there are disposed guide rails 12, on which the front roller 2a and 2b travel, and also guide rails 13, on which the rear roller 3a and 3b travel.

[0016] The front rails 10 and the rear rails 11 are so determined that the distance in the vertical direction between them is narrow in an inclined portion of the loop 1b and it is wide in vicinity of an upper horizontal portion 18a and a lower horizontal portion 18b of the housing frame 18. And, in portions transiting from the inclined portion into the horizontal portion, the distance between them is changed, continuously. With this, an upper surface on the loading side of the step 1 can be kept in horizontal direction, always.

[0017] The front rollers 2a and 2b and the rear rollers 3a and 3b of the step, loading the passenger thereon, travel on the front rails 10 and the rear rails 11, and then arrive at portions of the terminal gears 14. The step 1 arriving at the terminal gear 14 is turned round or reversed, along the terminal gears 14. The front rollers 2a and 2b and the rear rollers 3a and 3b of the step 1, being reversed, travel on the guide rails 12 and 13 on the opposite side up to the loading portion, and they are driven to portions of the lower terminal gears 15. The step 1 is turned round, again, at the portions of the lower terminal gears 16, thereby to be able to carry the passenger thereon.

[0018] By the way, if the distance between the front rail 10 and the rear rail 11 is not within a predetermined size, it results into a reason that the steps 1 are inclines, so that the steps 1 fluctuate. Also, if the steps are inclined, there is caused a possibility that it makes interference between the skirt guards (not shown in the figure), which are provided on both sides of the traveling path of the step 1, or between the comb-like plates 81a and 81b at the ride-on and off portion, which are disposed neighboring to the loop 1b. Also, if there is the difference in level and/or a gap at the joints on the rails 10-13, it comes to be a cause that the step 1 generates vibrations and noises when the rollers pass through the step-like portion and/or the gap portion. Then, according to the present invention, the inspection-use step 1a is put within the loop 1b, thereby enabling to detect an abnormality.

[0019] Details of this inspection-use step 1a are shown in Fig. 1 in the form of the perspective view thereof. In the similar manner to that of the ordinary step 1, the inspection-use step 1a has an upper surface member 1c for forming the loading surface, a rear surface member 1d formed into a curved surface, a pair of side surface members 1e and 1f, forming both side surfaces, respectively, and an axis 1g, which is attached in front lower portions of the side surface members 1e and 1f . A portion or all of the upper surface member 1c and the rear surface member 1d, the side surface members 1e and 1f may be formed in one body, as a whole, or may be a separated member. On both end portions of the axis 1g are attached the front rollers 2a and 2b mentioned above, respectively, in a rotatable manner. On rear side lower portions of the side surface members 1e and 1f , there are attached axes 1h and 1i, and at each end of the axes 1h and 1i is attached rear roller 3a or 3b, respectively, in a rotatable manner.

[0020] In vicinity of the axes 1h and 1i, in a lower portion within an inside of each of the side surface members 1e and 1f, there are provided acceleration sensors 4 and 5. Those acceleration sensors 4 and 5 detect accelerations acting upon the rear rollers 3a and 3b, in the vertical direction (i.e. , a "z" direction). In a central portion on reverse-side surface of the upper surface member 1c are attached acceleration sensors 6 and 7, which are directed into the width direction on both sides (i.e., an "x" direction) and the horizontal advancing direction (i.e., a "y" direction). The acceleration sensors 6 and 7 detect the accelerations acting upon the step 1a as awhole, in the "x" direction and the "y" direction, respectively. Also the acceleration sensors 6 and 7 can detect the accelerations, which are generated due to the gravitywhen the step 1a is inclined, and therefore they function as an inclination sensor, too.

[0021] In a central portion on reverse-side surface of the rear surface member 1d is attached a signal processor apparatus 8, for processing the acceleration signals of the acceleration sensors 4 to 7 taken therein. Also, on the reverse-side surface of the rear surface member 1d is attached a transmitter apparatus 9, for transmitting a result of processing within the signal processor apparatus to an inspection booth, which is separated from it.

[0022] Although the acceleration sensors 4 and 5 for detecting the acceleration in the vertical direction are provided in the vicinity of the rear rollers 3a and 3b, in the

present embodiment, however those acceleration sensors 4 and 5 may be provided in the vicinity of the axis 1g of the front rollers 2a and 2b. Or, the acceleration sensors for detecting the acceleration in the vertical direction may be provided in the vicinity of both the front rollers and the rear rollers.

[0023] The signal processor apparatus 8 comprises, for example, a microprocessor, an A/D converter circuit for taking the signals of the acceleration sensors, and a memory device for memorizing the acceleration data taken therein. On the housing 18 of the escalator 80 is attached a receiver apparatus 19. The receiver apparatus 19 receives the processingresults, which the transmitter apparatus 9 transmits, and it transmits the result received to a remote monitor center 20, depending upon a necessity thereof. In data transmission between the transmitter apparatus 9 and the receiver apparatus 19, there may be applied a specific small power radio communication, for example.

[0024] Operations of the inspection-use step 1a, having such the structures as mentioned above, according to the present invention, will be explained, by referring to Figs. 3 through 7 attached. Fig. 3 shows a flow of operations within the inspection-use step 1a. Time history waveforms of the acceleration sensors 4 through 7 are recorded (in a step 30) while letting the inspection-use step 1a to run. In that instance, the inspection-use step 1a is made run repetitively, thereby running on the traveling path in plural numbers of times. Thus, starting from the vicinity of the lower horizontal portion 18b of the housing frame 18 and after traveling on the rails 10 and 11, the inspection-use step 1a is turned round at the upper terminal gear 14. Thereafter, it runs on the rails 12 and 13, and then is turned round at the lower terminal gear 15. This series of circuitry traveling is conducted by plural numbers of times.

[0025] Examples of acceleration waveforms, which are obtained from a result of the circuitry traveling, are shown in Fig. 4. In an upper stage is shown the waveforms 40 of the acceleration sensor 4 or 5, for detecting the acceleration in the vertical direction, in a middle stage, the waveform 41 of the acceleration sensor 6, for detecting the acceleration in the horizontal direction (i.e., the "y" direction), and in a lower stage, the waveform 42 of the acceleration sensor 7, for detecting the acceleration in the horizontal direction (i.e., the "x" direction), respectively.

[0026] When the step 1a travels on the rails 10 and 11, the gravity acts on the acceleration sensors 4 and 5, directing downwards. As a result of this, the value of acceleration, which the acceleration sensors 4 and 5 detect, comes to be negative. On the other hand, when the step 1a travels on the rear rails 12 and 13, after being reversed at the terminal gear 14, the acceleration sensors 4 and 5 are also reversed. As a result of this, the value of acceleration detected by the acceleration sensors 4 and 5 comes to be positive.

[0027] A section 43 where an output of the acceleration sensor 4 or 5 is negative in the value thereof, it corresponds to a section when the step 1a travels on the rails 10 and 11, while a section 44 where the output of the acceleration sensor 4 or 5 is positive in the value thereof, it corresponds to a a section when the step 1a travels on the rails 12 and 13, respectively. Accordingly, from the value of the output of the acceleration sensor 4 or 5, i. e . , of being positive or negative, it is possible to see on which one of the sections the steps travels.

[0028] Actually, there are cases where the acceleration signal changes in a very short time-period, due to the ill influences of noises included in the vibrations and the noises, which are generated in portions of reversing the engagement, i.e., at the terminal gear 14 and the lower terminal gear 15 . Then, determination is made upon the traveling section of the step 1a, by treating a filtering process upon the acceleration signal detected by the acceleration sensor 4 or 5.

[0029] Treating the filtering process upon the waveform of each of the acceleration sensors 4 to 7, low-frequency components are extracted (in a step 31) . An example of a result of treating that filtering is shown in Fig. 5. Thus, they are waveforms 45 to 47, which are obtained by inputting the acceleration waveforms 40 to 42 into low-pass filters not shown in the figures, thereby extracting only the low-frequency components from them. With the acceleration sensor 4 or 5, a time 48 is obtained when the low-frequency component waveforms 45 is reversed on a sign (i.e., positive or negative) thereof. Upon the basis of the time necessary for the step 1a to pass through the terminal gear 14 and the lower terminal gear 18, a predetermined time zone or band is established in front and rear of the reversal time 48, and they are set to be the reversal section 49 (in a step 32).

[0030] Upon the basis of that reversal section 49, identification is made of the step 1a, in particular, in the traveling sections 50 on the rails 10 and 11 and in the traveling sections 51 on the rails 12 and 13. If an output being equal or greater than the predetermined value is included in the revised low-frequency component waveforms 46 and 47 of the acceleration sensors 6 and 7, within those traveling sections 50 and 51, it is determined that the step 1a is inclined, abnormally or unusually (in a step 33).

[0031] For example, since such a disturbance is generated in Fig. 5, as the waveform 52 on the revised output 46 of the acceleration sensor 6, which detects the acceleration in the horizontal direction (i.e., the "y" direction), it can be seen that the step 1a is inclined, abnormally, in the front and rear direction (i.e., the "y" direction). In the similar manner, on the revised output 47 of the acceleration sensor 7 in the horizontal direction (i.e., the "x" direction), there are generated such disturbances as indicated by the waveforms 53 and 54; therefore, it can be seen that the step 1a is inclined, abnormally, in the horizontal direction (i.e., the "x" direction).

[0032] However, a reason why the revised output 46 of the acceleration sensor 6 of the horizontal direction

(i.e., the "y" direction) comes to be positive during the traveling section 51 on the rails 12 and 13 is in that the step 1a travels under the condition of being inclined into the front and rear direction during this traveling section 51. When acceleration is outputted, being shifted by a predetermined value from an acceleration, which is prospected to generate due to the inclination within the section 51, then it is determined to be an abnormality of traveling.

[0033] Fig. 6 shows high-frequency components 55 to 57, which are removed from the outputs of the acceleration sensors 4 to 7 through filtering of the low-pass filters. Thus, they are differences between the outputs 40 to 42 of the acceleration sensors 4 to 7 shown in Fig. 4 and the revised outputs 45 to 47 of the acceleration sensors 4 to 7. In those acceleration differences 55 to 57 are included the level difference at joint on the rails 10 to 13, the vibrations due to the gaps, and the accelerations caused due to the interference on the steps 1 and 1a. Further, there are also included noises 58 to 60, which are generated due to electric noises, for example. In general, the noise waveforms 58 to 60 include the high-frequency components therein, rather than the vibrations due to the level difference at joint on the rails 10 to 13 and the interference of the step 1a. Then, by removing the noise waveforms 58 to 60 from the differential acceleration waveforms 55 to 57, then it is possible to obtain the waveforms of middle-frequency components (in a step 34).

[0034] Examples of the middle-frequency components 61 to 63 obtained in this manner are shown in Fig. 7. Among the waveforms of those middle-frequency components 61 to 63, the middle-frequency component 61 corresponding to the acceleration sensor 4 or 5 comes to be an output 64, being equal or greater than the predetermined value within the traveling section 50. This is determined to be the vibrations, which are caused due to the level differences and/or the gaps on the rails 10 to 13, being equal or greater than an allowable value (in a step 35). In the similar manner, the middle-frequency components 62 and 63 corresponding to the acceleration sensors 6 and 7 come to be outputs 65 and 66, being equal or greater than the predetermined value, during the traveling section 50. Those are determined to be the vibrations, which are caused due to the interferences of the step 1a (in a step 36).

[0035] However, it can be considered that the vibrations caused due to the level difference at the joint on the rails 10 to 13 differs from the vibration generated from the interference of the step, in particular, in the frequency components thereof. Therefore, if preparing filters having the most suitable frequency responses, corresponding to each of the abnormal phenomena, it is possible to detect and/or determine the reason of the abnormality, at high accuracy. Also, kinds of the abnormalities to be detected should not be limited only to those mentioned above, but in the place thereof, it is also possible to detect abnormal vibrations of the steps 1 and 1a during the reversal section, or pulsations of traveling velocity of the steps 1 and 1a.

[0036] If performing such the abnormality detection process as was mentioned in the above, for each circular traveling of the step 1a, and further compiling the result thereof, it is possible to detect the abnormalities further at a high possibility. Namely, if the level difference at joint on the rails 10 to 13 and/or the interference of the steps is/are generated, abnormal outputs appear on the outputs of the acceleration sensors 4 to 7, periodically; however, the timing of those is in synchronism with the circular traveling of the step 1a. Accordingly, the abnormality in acceleration, which can be detected at the same timing in every time within the plural numbers of circular traveling, is determined that the abnormality is actually generated. If the detected abnormality in acceleration is generated at random, then it is determined due to an accidental external force, etc., but not the abnormality.

[0037] However, for noticing the abnormality to a manager of the escalator 80 when it is generated, an abnormal signal is transmitted from the transmitter apparatus 9 to the monitoring booth. In that instance, since the result of processing within the signal processor apparatus 8 is also included in the signal transmitted from the transmitter apparatus 9, an abnormal alarm signal generator means is provided in the vicinity of the monitoring booth or the escalator 80 for enabling to generate an alarming signal of generation of abnormality depending upon the contents of that signal. If the abnormal alarm signal generator means is provided in the vicinity of the escalator 80, the signal generated by the abnormal alarm signal generator means is transmitted to a remote location through a remote communication means.

[0038] Explanation will be made about a manner for supplying electric power to the signal processor apparatus 8 and the transmitter apparatus 9, which are attached onto the inspection-use step 1a, in the embodiment mentioned above, by referring to Figs. 8 and 9. Since the inspection-use step 1a circularly travels within an inside of the housing 18 of the escalator 80, it is difficult to supply the electric power through fixed things, such as, wires, etc. Then, in an example shown in Fig. 8, the electric power is supplied from a stationary side to a side of the movable inspection-use step 1a through the function of electromagnetic induction.

[0039] Namely, the housing 18 is disposed at the position where the escalator 80 is constructed, and in a middle portion of this housing 18 is disposed an induction coil 21, so that it does not interfere the traveling position of the loop, which is made up with the steps 1 and 1a. This induction coil 21 is formed extending into the traveling direction of the inspection step 1a. On the other hand, a receiving coil (or core) 22 is provided on the rear surface member 1d or the upper surface member 1c of the inspection-use step 1a, so that it is engaged with the induction coil 21 attached on the housing 18.

[0040] To the receiving core (or coil) 22 disposed in this manner is connected a battery of a re-chargeable

type (not shown in the figures). This battery is mounted on the inspection-use step 1a; therefore, the respective sensors 4 to 7, and the signal processor apparatus 8 and the transmitter apparatus 9 operate with the electric power of this battery, during when conducting a normal inspection operation. When the escalator 80 is stopped or suspended in the operation, the inspection-use step 1a is stopped at such a position that the receiving coil 22 is engaged with the induction coil 21. And, under this condition, the receiving coil 22 is excited when an alternating current flows through the induction coil 21; thereby charging the battery of the inspection-use step 1a.

[0041] As a method for stopping the inspection-use step 1a at the position of the induction coil 21, there is one of using the acceleration sensor 4 or 5. In this method, the sign of the acceleration sensor 4 or 5 is obtained through the manner mentioned above, and the reversal timing of the inspection-use step 1a is determined from the reversal timing of the sign of the acceleration sensor 4 or 5. Using the moving velocity of the inspection-use step 1a, the moving time of the inspection-use step 1a from the reversal timing up to the position of the induction coil 21. Upon basis of the moving time obtained, the steps 1 and 1a are stopped. However, for controlling the stopping position of the inspection-use step 1a, correctly, a large-scaled apparatus is needed; therefore, from a practical viewpoint, the induction coil 21 is formed, extending to be long in the traveling direction of the inspection-use step 1a, as is shown in Fig. 8.

[0042] Other example for supplying the electric power to the respective sensors 4 to 7 will be shown in Fig. 9. This Fig. 9 is a perspective view of detailed portions on side portion of the inspection-use step 1a. A generator 24 is attached on the rear surface member 1d or the side surface member 1e, penetrating through an opening portion 1j formed on the side surface member 1e of the inspection-use step 1a. On an axial end portion of the generator 24 is attached a roller 23, and this roller 23 is in contact with the rear roller 3a of the inspection-use step 1a.

[0043] When the inspection-use step 1a travels, the roller 23 in contact with the rear roller 3a moves rotationally, and then the generator 24 generates electricity. The electric power generated by the generator 24 is supplied to the sensors 4 to 7, etc..directly, or indirectly through the battery. In the latter, the electric power generated by the generator 24 is stored into the battery, to be supplied when the inspection-use step 1a stops in traveling thereof. According to the present embodiment, it is possible to supply the electric power to the sensors, etc., with certainty, but by means of a simple apparatus. However, the generator 24 may be disposed on an axial line of the rear roller 3a, so that the rear roller 3a is attached on the axis of the generator 24, directly.

[0044] The present invention may be embodied in other specific forms without departing from the spirit or essential feature or characteristics thereof. The present embodiment(s) is/are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the forgoing description and range of equivalency of the claims are therefore to be embraces therein.

Claims

1. A passenger conveyer, for moving steps (1) connected endlessly, thereby carrying passengers thereon, within an inside of at least one piece of said steps (1), being defined on a reverse side surface of a loading surface (1c) thereof, for loading a passenger thereon, comprising:

   an acceleration sensor (4, 5, 6, 7) for detecting acceleration of said step (1);
   a signal processor apparatus (8) for conducing signal processing upon an output signal of said acceleration sensor (4, 5, 6, 7); and
   an electric power supply means for supplying electric power to said signal processor apparatus (8).

2. The passenger conveyer, as described in the claim 1, wherein said step (1) for use in an inspection has rollers (2a, 2b, 3a, 3b) in plural numbers thereof, and said sensor is made up with an acceleration sensor (4, 5) for detecting acceleration in vertical direction, which is attached in vicinity of said rollers, (3a, 3b) and further said rollers are used for letting said step

   (1) for use in an inspection to travel circularly.

3. The passenger conveyer, as described in the claim 1, wherein a transmitter apparatus (9) is provided within an inside of said step for use in an inspection, for transmitting an output of said signal processor apparatus (8), in a contact-free manner.

4. The passenger conveyer, as described in the claim 1, further comprising a housing (18), for covering said steps (1) so as to expose the passenger loading surfaces (1c) of said steps (1), wherein said electric power supply means has an induction coil (21), provided in said housing (18), extending into the travelling direction of said step (1), a receiving core (22), provided on said step (1) to be engaged with said induction coil (21), whereby alternating current supplied into said induction coil (21) excites current within said receiving core (22).

5. The passenger conveyer, as described in the claim 1, wherein said step (1) for use in an inspection has rollers (2a, 2b, 3a, 3b) in plural numbers thereof, to be used for travelling said step (1) circularly, and said electric power supply means has a transmission means for transmitting rotating movement of at least

one piece of the plural numbers of said rollers (2a, 2b, 3a, 3b), and a generator means (24) for generating electricity through the rotating movement transmitted to said transmission means (23).

6. The passenger conveyer, as described in the claim 1, wherein said signal processor apparatus (8) has a step position identification portion, for dividing sections of said conveyer (80) into a travelling section of being able to load the passengers,thereon, a reversal section, locating at a time just after loading off the passengers or just before loading the passengers thereon, and a deadhead section, connecting to the travelling section while putting the reversal section there between, upon basis of the output of said acceleration sensor, and an abnormality detection portion for detecting abnormality in the acceleration acting upon the passenger conveyer (80), upon basis of an output of said step position identification portion, as well as, the output of said acceleration sensor.

7. The passenger conveyer, as described in the claim 6, wherein said abnormality detection portion has frequency filters in plural numbers thereof, each having a frequency band different from each other, thereby enabling to detection an abnormal mode different from each other, and an abnormality determining portion for determining presence of an abnormality in the travelling of said passenger conveyer (80), upon basis of outputs of the plural numbers of said frequency filters.

8. A passenger conveyer (80), for moving steps (1) connected endlessly, thereby carrying passengers thereon,
within an inside of at least on piece of said steps (1), being defined on a reverse side surface of a loading surface (1c) thereof, for loading a passenger thereon, comprising:

an acceleration sensor (4, 5, 6, 7) for detecting acceleration of said step (1);
a signal processor apparatus (8) for determining presence of an abnormality in said passenger conveyer, from an output signal of said acceleration sensor;
an electric power supply means for supplying electric power to said signal processor apparatus (8);
a transmitter means (9) for transmitting an output of said signal processor apparatus (8); and
an abnormality alarm generating means for generating an alarm of generation of an abnormality, upon basis of the output of said signal processor apparatus (8), which said transmitter means (9) transmits.

9. The passenger conveyer (80), as described in the claim 8, further comprising a remote communication means (9) for transmitting a signal generated by said abnormality alarm generating means to a remote location (20).

10. A step for use of an inspection of said passenger conveyer as is described in at least one of claims 1-9.

FIG.1

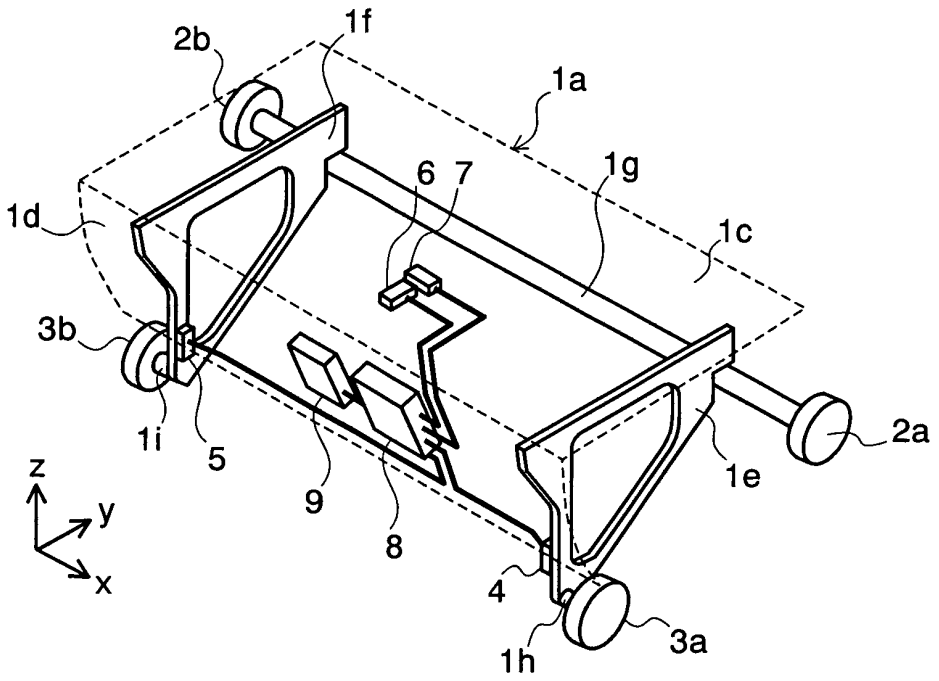
2b
1f
1a
1g
6
7
1d
1c
3b
1i
5
9
8
1e
2a
z
y
x
4
1h
3a

FIG.2

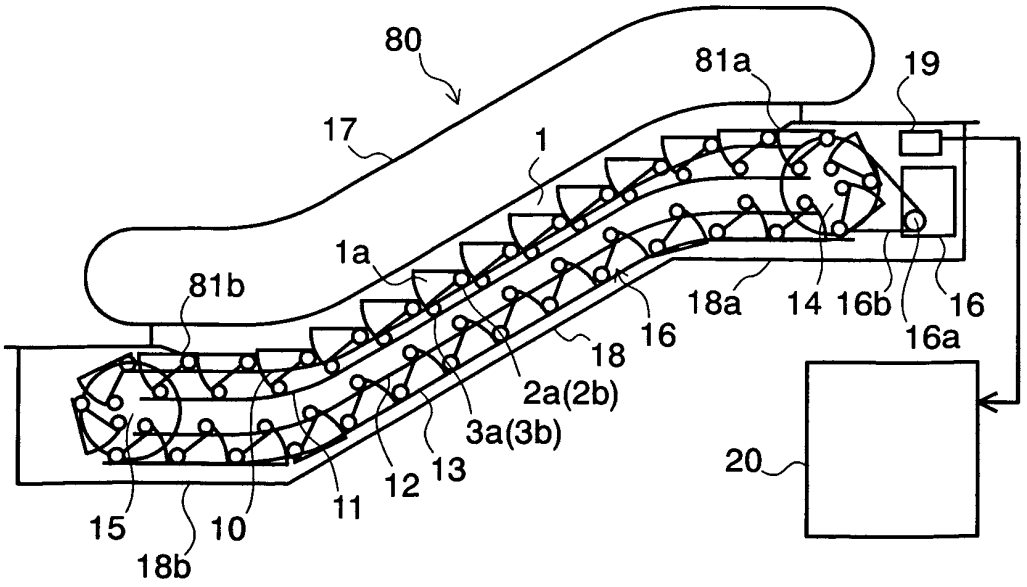
80
81a
19
17
1
1a
81b
18a
14
16b
16
16a
18
16
2a(2b)
3a(3b)
20
15
10
11
12
13
18b

FIG.3

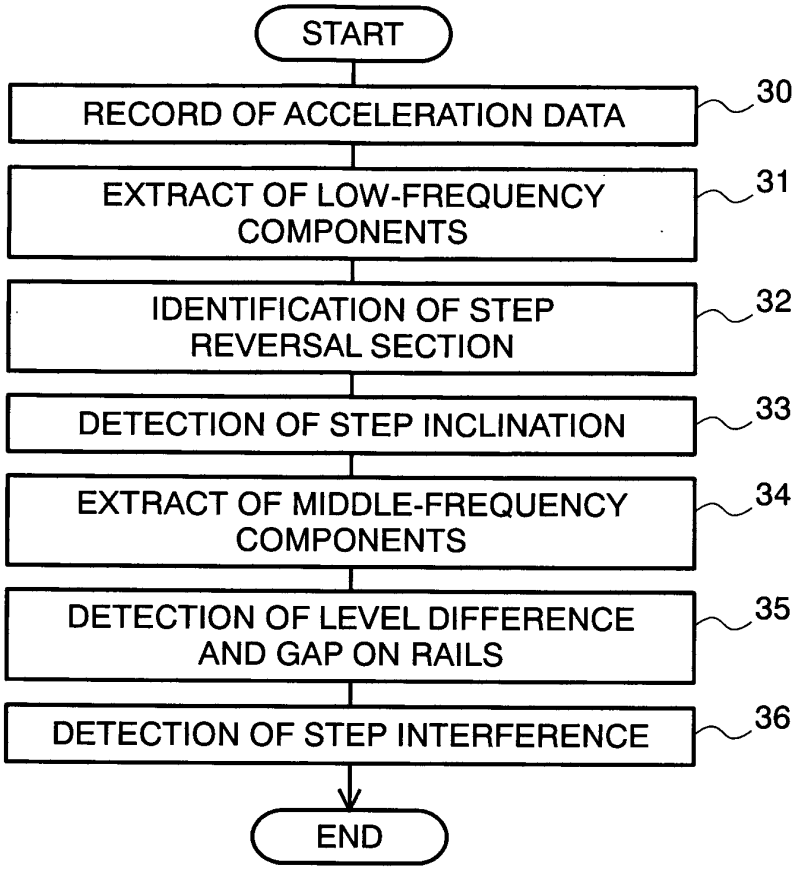
START
RECORD OF ACCELERATION DATA
30
EXTRACT OF LOW-FREQUENCY COMPONENTS
31
IDENTIFICATION OF STEP REVERSAL SECTION
32
DETECTION OF STEP INCLINATION
33
EXTRACT OF MIDDLE-FREQUENCY COMPONENTS
34
DETECTION OF LEVEL DIFFERENCE AND GAP ON RAILS
35
DETECTION OF STEP INTERFERENCE
36
END

FIG.4

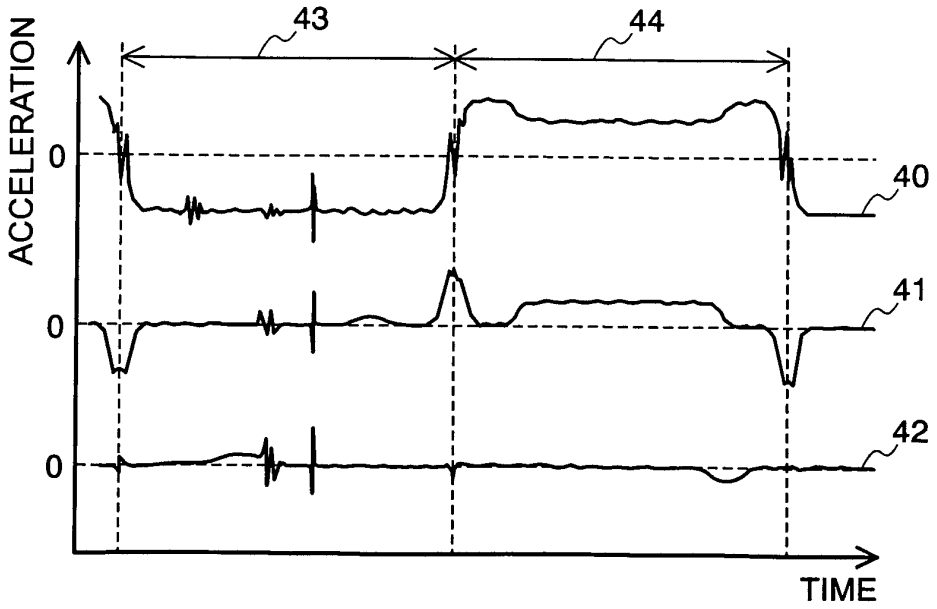
43
44
ACCELERATION
0
0
0
40
41
42
TIME

FIG.5

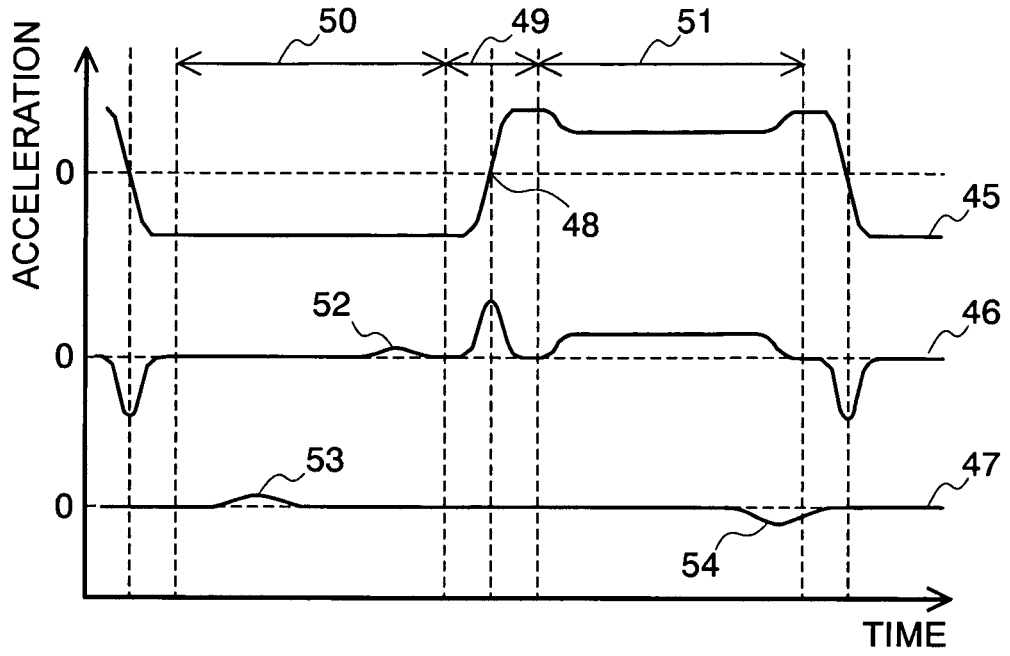
ACCELERATION
0
0
0
50
49
51
48
45
52
46
53
47
54
TIME

FIG.6

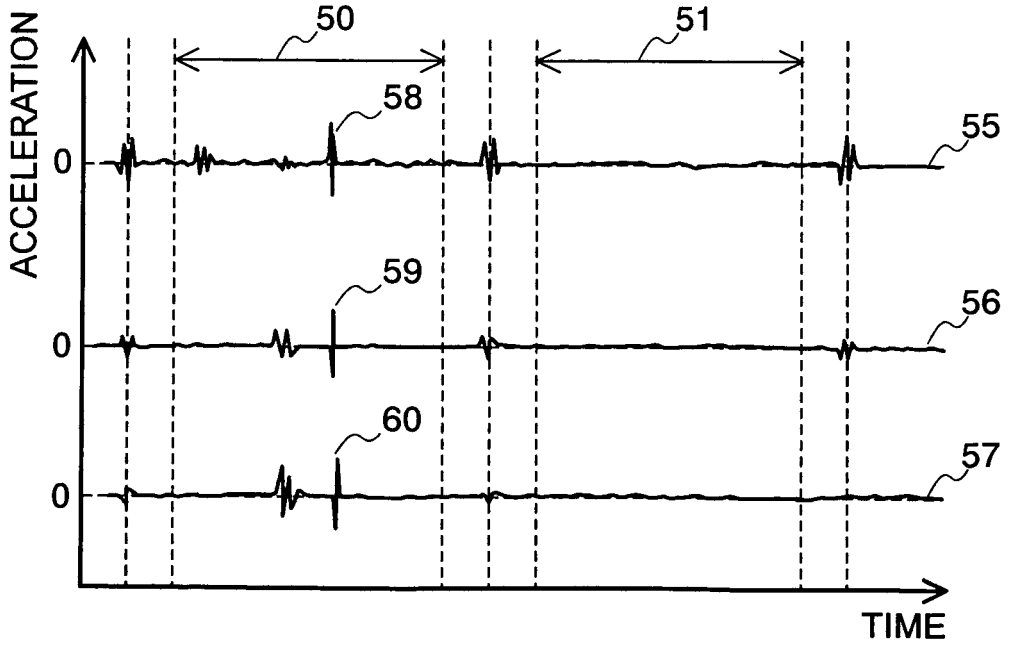
ACCELERATION
0
0
0
50
51
58
55
59
56
60
57
TIME

FIG.7

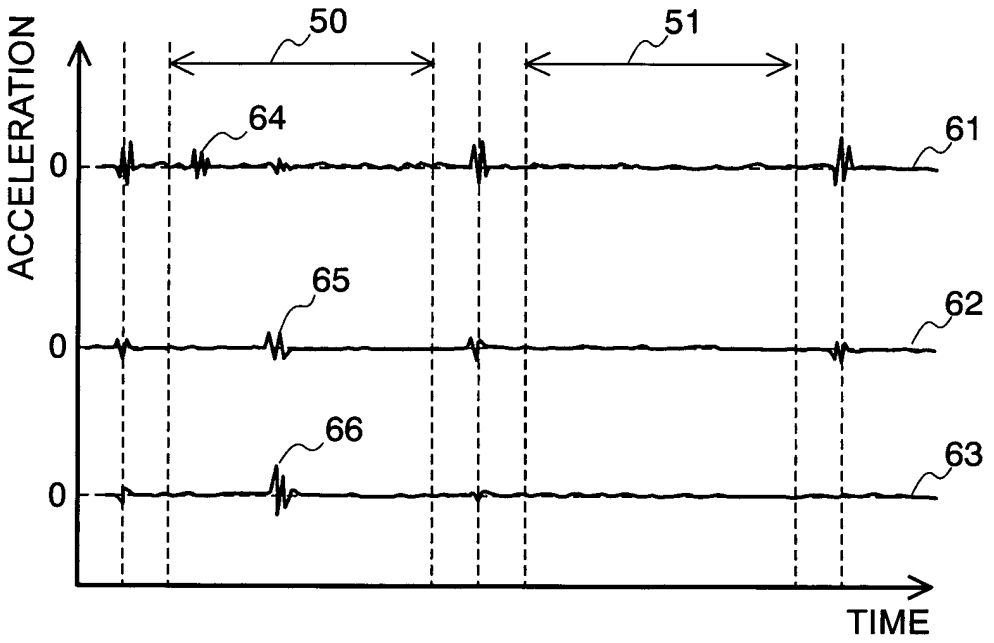
ACCELERATION
50
51
64
61
0
65
62
0
66
63
0
TIME

FIG.8

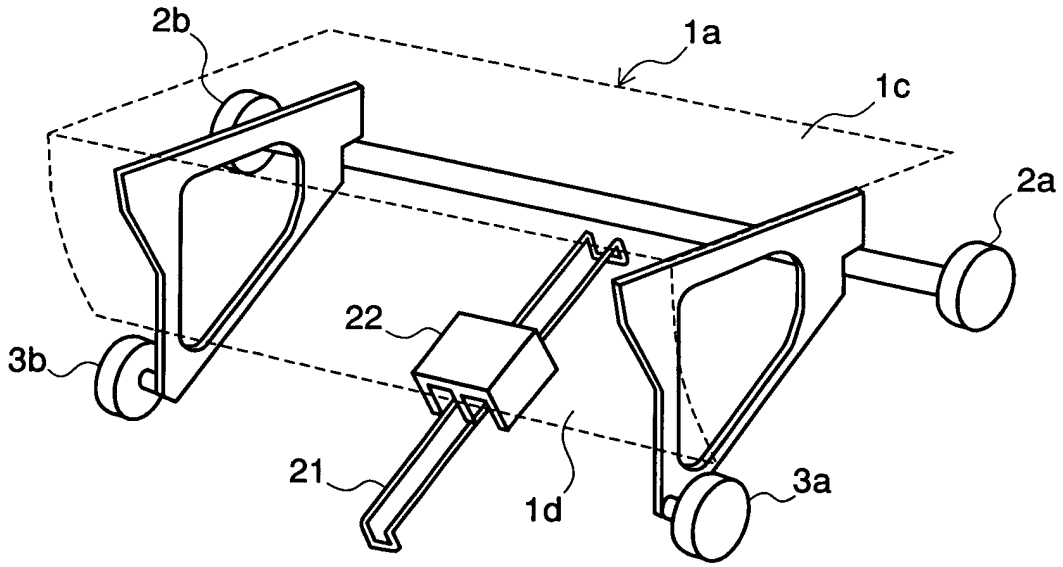
2b
1a
1c
2a
22
3b
21
1d
3a

FIG.9