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(54) **STEP APPARATUS FOR PLATFORM**

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(57) **ABSTRACT**

In order to provide a high-safety step apparatus for a platform which is easy to be installed, eliminates a difference between the top of a platform and a train floor, and fills a gap between a train body and an edge of a platform, a step **1** is placed on the top of the platform **10,** an arm is connected to the step pivotally in the horizontal direction, a cover **7** is placed over the step **1,** and the step **1** is moved from the home position to the extended position.

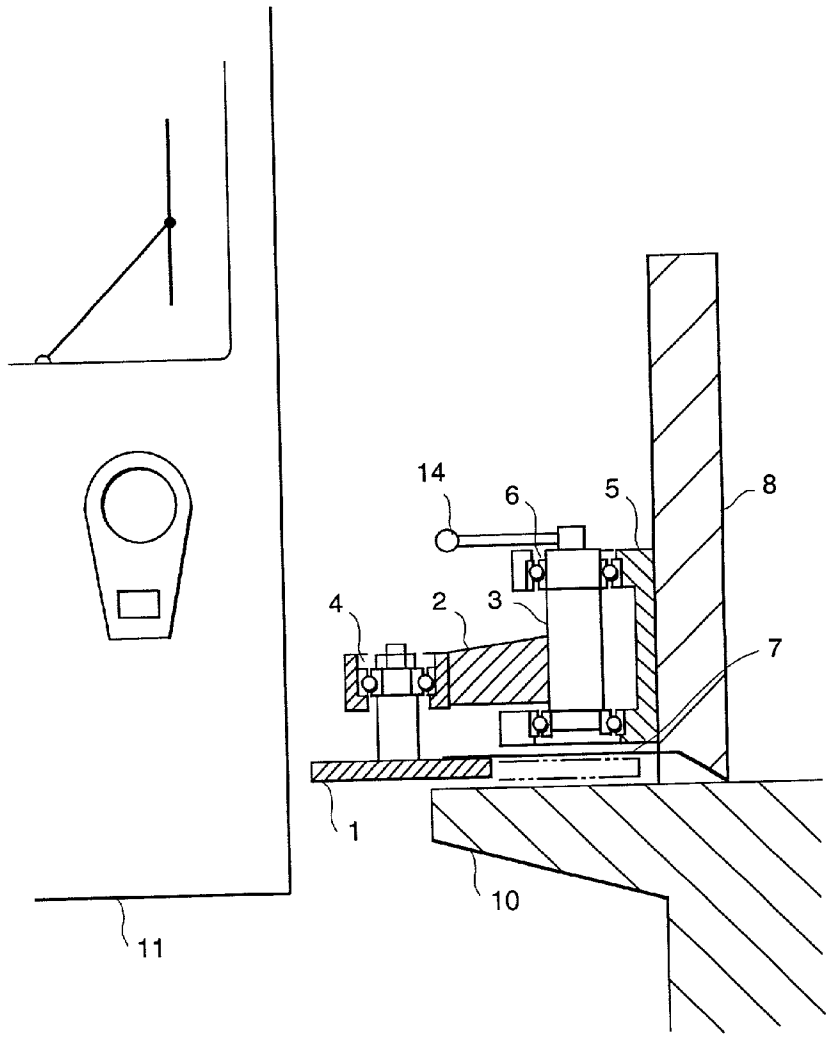


FIG. 1

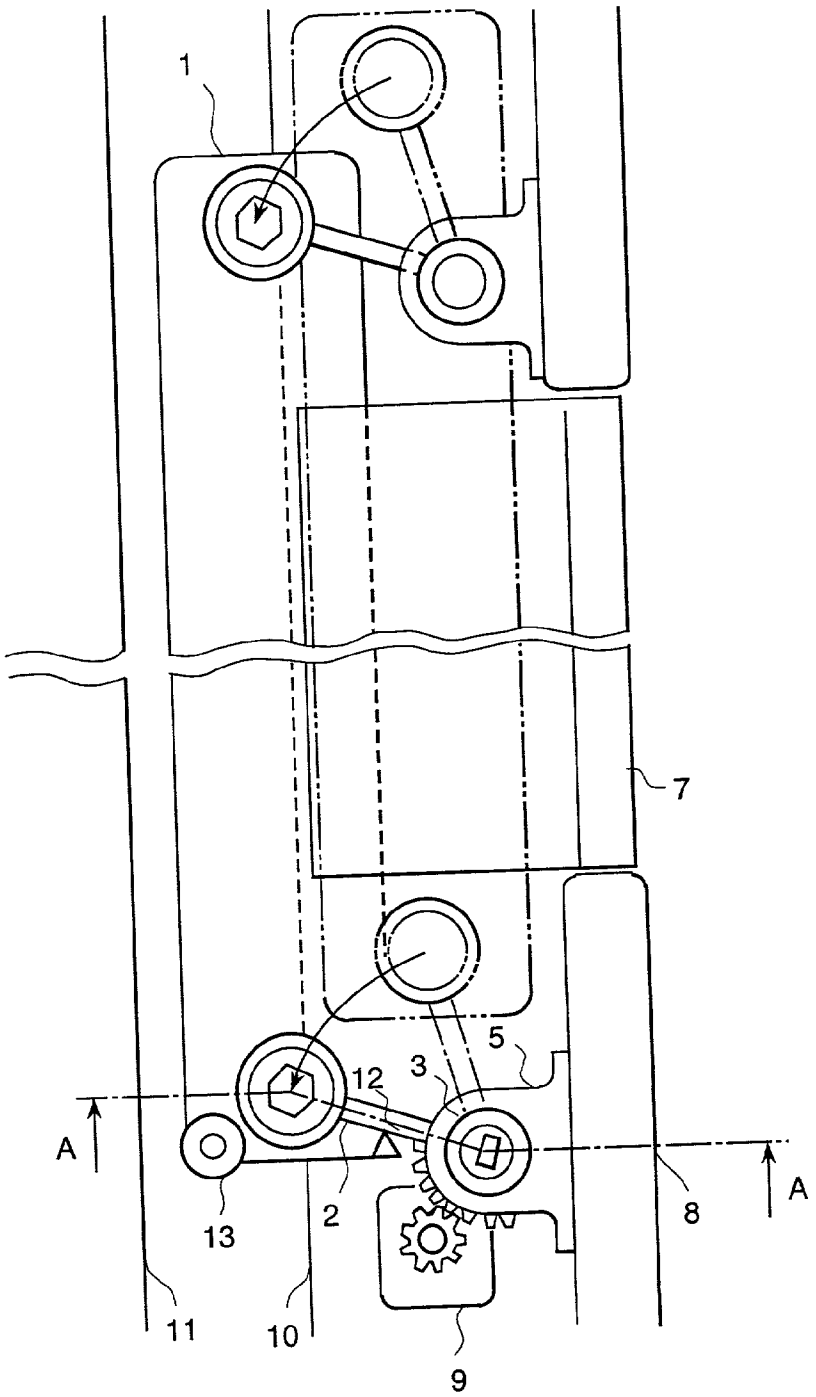


FIG. 2

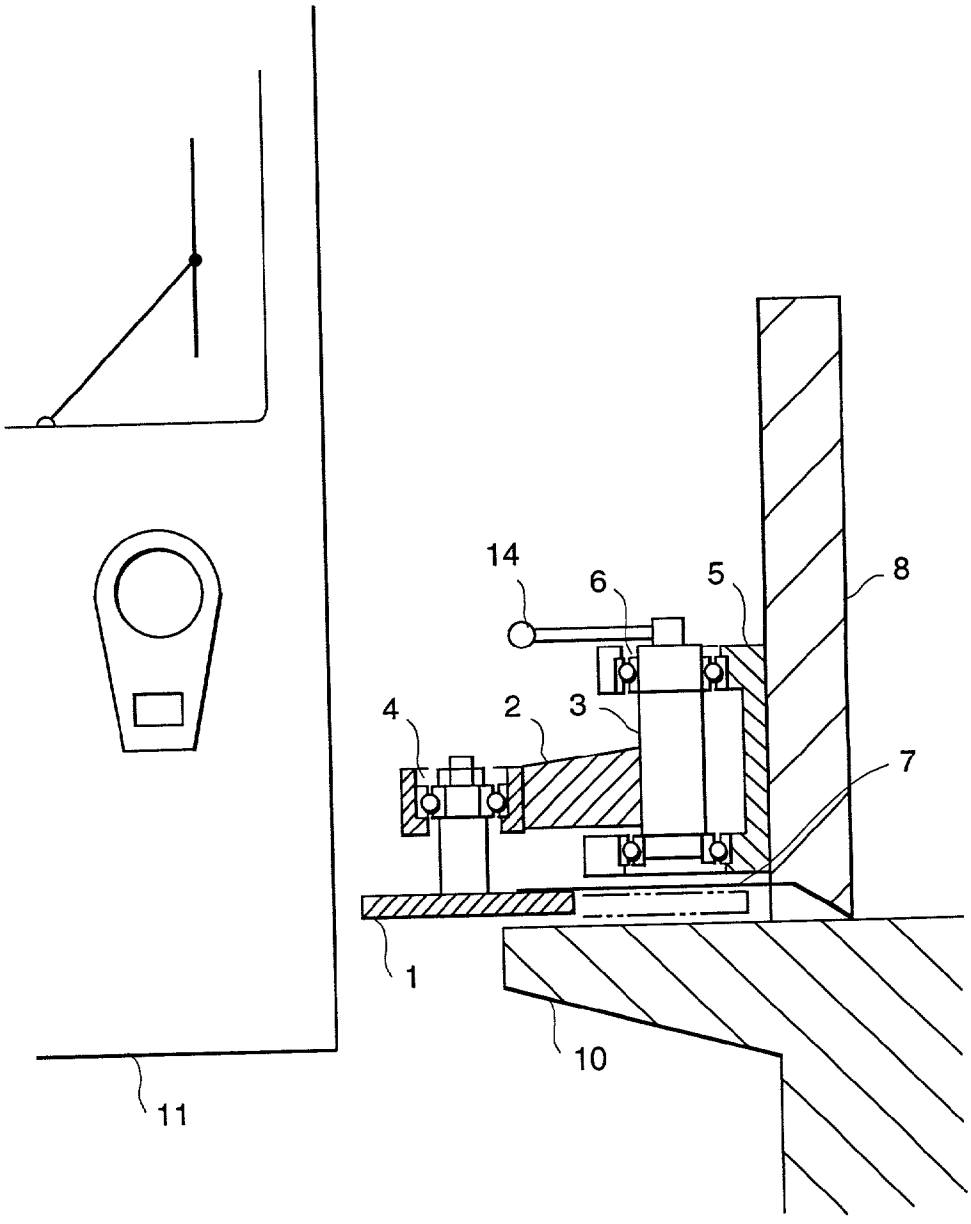


FIG. 3

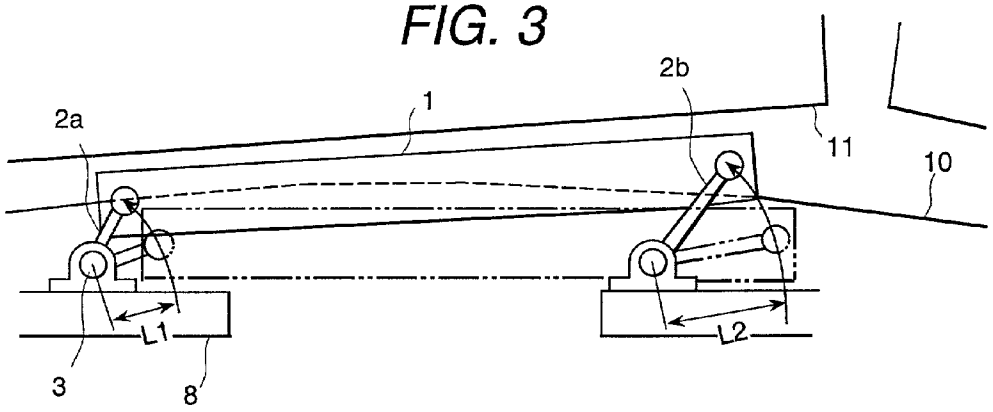


FIG. 4

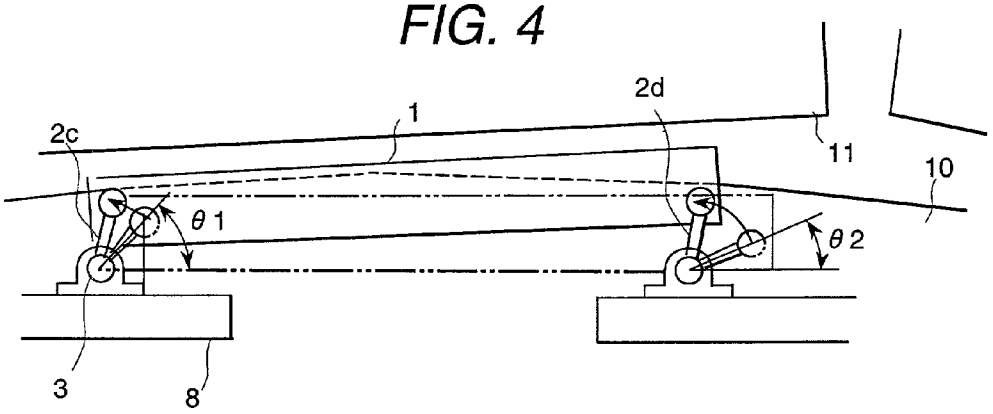


FIG. 5

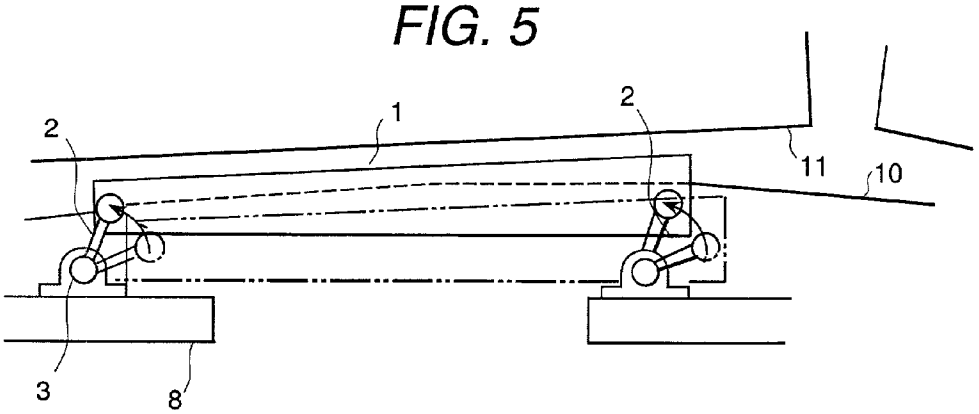
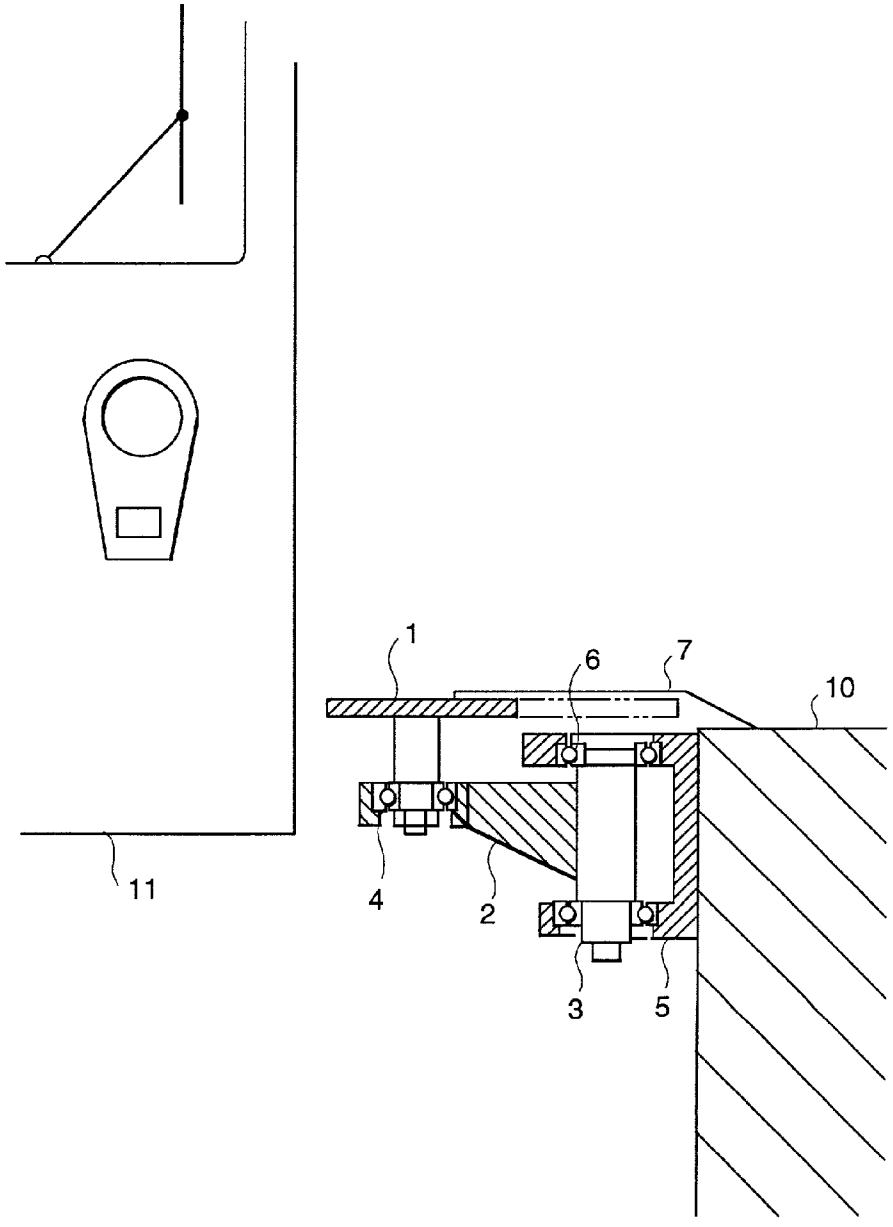


FIG. 6



STEP APPARATUS FOR PLATFORM

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a step apparatus for a platform to fill a large gap between a train body and an edge of a platform which is on a curved or dual gauge track or between a slender train body and an edge of a platform. Further, the present invention relates to a step apparatus for a platform to lessen a difference between the top of a platform and a train floor which is higher than the platform.

[0002] Conventional apparatuses of this kind have been disclosed by Japanese Non-examined Patent Publication No. 7-108924 (1995) and Japan Utility Model Right No. 2531567. These apparatuses horizontally rotate a step by an arm to fill a gap between a train body and an edge of a platform. However, these apparatuses provide the moving step below the platform.

[0003] Such a conventional apparatus provides a step below the platform and makes the difference between the step and a train floor which is above the top of the platform greater. This is an obstacle to wheelchairs and so on. Further, this apparatus requires a space to install the apparatus below the platform. Therefore, a lot of time and expense are required to install such an apparatus below an existing platform which does not have such a space while assuring traffic running and safety of passengers.

SUMMARY OF THE INVENTION

[0004] It is an object of the present invention to provide a step apparatus for a platform which can fill a big gap between a train body and the edge of a platform and is easy to be installed on the platform. It is another object of the present invention is to provide a step apparatus for a platform which lessens a difference between the top of a platform and a train floor which is higher than the platform. It is yet a further object to provide a step apparatus for a platform which assures the safety of passengers to the full and easy and quick repairing of the apparatus.

[0005] To provide a step apparatus for a platform which can fill a big gap between a train body and the edge of a platform, which is easy to be installed on an existing platform, and which minimizes a difference between the top of the platform and a train floor, the step in accordance with the present invention is provided above or near the top of the platform. Further to facilitate installation of the step apparatus on an existing platform, the arms, the rotary shafts, and the driving section of the step apparatus are provided above the step. Furthermore, for assurance of safety of passengers, an unmovable cover is provided above the step. The gap between a train body and the step is minimized by constructing so that two or more arms connected to rotary shafts may have different lengths and different angles between the step and each arm when the step apparatus is completed and by making the step edge facing to the train parallel to the train body. Higher safety of passengers is assured by using the step together with a guard fence which is separately provided on the platform, by interlocking the operation of the step with the movement of the movable guard fence, or by driving the step in relation to the movement of the train door.

[0006] To prevent the step in the extended position from colliding with a train, the step apparatus further comprises an alarm unit which makes alarm sounds when detecting that the step is involuntarily in the extended position. Further, to prepare against an unexpected collision with a train and to make it safer, the step apparatus is equipped with a shock-absorbing material or a rubber roller which retracts the step by a force of collision when a train body hits the rubber roller.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0007] Embodiments of the present invention will be explained below with reference to the accompanying drawings **FIG. 1** and **FIG. 2**.

[0008] Referring to **FIG. 1** and **FIG. 2**, the step **1** is installed on the top of the platform **10** and each horizontal end of the step **1** is pivotally connected to an arm **2** by means of a bearing **4**. The arm **2** is coupled to a rotary shaft **3** which is pivotally connected to a bracket **5** with bearings **6** on the upper and lower parts of the rotary shaft. In this embodiment, the bracket **5** is fixed to a movable guard fence **8** on the platform **10**. One of the rotary shafts **3** is connected to a driving section **9** which rotates the rotary shaft **3** and the arm **2**. In this case, an electric motor may be used as the driving source.

[0009] Further the step **1** is provided in the gate part of the movable guard fence **8** with a cover **7** over the step **1**.

[0010] In this configuration, when driving section **9** rotates the rotary shaft **3**, the arm **2** rotates horizontally. As the result, the step **1** coupled with the arm **2** slides out from a home position between the cover **7** and the platform **10** which is indicated by a virtual line of **FIG. 2** toward a train body **11** which is indicated by a solid line. When the driving section **9** rotates the rotary shaft **3** in the opposite direction, the step **1** is retracted to the above home position.

[0011] The present invention can provide a step apparatus for a platform to fill a large gap between a train body and the edge of a platform which can be easily installed on an existing platform and minimize the installation work. The present invention can also provide a step apparatus for a platform which minimizes a difference between the top of the platform and a train floor which is usually high above the platform so that even a wheelchair may go in and out a train.

[0012] The step apparatus in accordance with the present invention moves the step **1** from the home position to a preset extended position as the door of a train **11** opens or as the gate of the movable guard fence **8** opens after the train **11** stops. Similarly, the step **1** is retracted from the extended position to the home position as the door of a train **11** closes or as the gate of the movable guard fence **8** closes.

[0013] Further, the step apparatus is equipped with a detection means **12** which detects the step **1** in the extended position and makes alarms when the step **1** must be in the home position.

[0014] Against incapability of the driving section **9** due to an unexpected failure, a handle **14** is already mounted or will be easily mounted on the rotary shaft **3** to manually move the step **1**.

[0015] Further, a rubber roller **13** is provided on the outer edge (facing to a train body **11**) of the step **1** which buffers the bumping force and retracts the step by the bumping force

when a train body hits the rubber roller in the extended position. This minimizes a damage of the step by collision with a train.

[0016] **FIG. 3** shows another embodiment of the present invention in which arms **2***a* and **2***b* coupled to both ends of the step **1** have different lengths L1 and L2. In accordance with this embodiment, when the step **1** slides out from a home position which is indicated by a virtual line toward a train body **11** which is indicated by a solid line, the step **1** is skewed in the extended position as shown in **FIG. 3** because the links **4***a* and **4***b* have different quantities of movement. So, even when the edge of the platform **10** is curved and is not parallel to the train body **11**, the step **1** in the extended position can be parallel to the train body **11**. Therefore, this embodiment can provide a step apparatus for a platform which can minimize the gap between the step **1** and the train body **11**.

[0017] **FIG. 4** is yet a further embodiment of the present invention in which the arms **2***c* and **2***d* coupled to both ends of the step **1** have different angles θ1 and θ2 relative to the step **1**. This embodiment can also attain the same effect as the embodiment of **FIG. 3**.

[0018] **FIG. 5** is a more particular embodiment of the present invention in which the step **11** is shaped so that the step **1** in the extended position may be parallel to the train body as shown in **FIG. 5**. This embodiment can also attain the same effect as the embodiment of **FIG. 3**.

[0019] **FIG. 6** is still another embodiment of the present invention in which the step **1** is provided below a cover **7** which extends outwards from the top of the platform **10**. Below the step **1** are provided arms **2** which are pivotally coupled with both ends of the step by means of bearings **4**, rotary shafts **3** which are respectively coupled with the arms, brackets **5** which are respectively coupled with the rotary shafts **3** pivotally by means of upper and lower bearings **6**, and the driving section **9**. The brackets **5** are fixed to the side of the platform **10** lower than the top of the platform. This embodiment as well as the embodiments of **FIG. 1** and **FIG. 2** can provide a step apparatus for a platform to fill a large gap between a train body **11** and an edge of a platform **10** and minimize a difference between the top of the platform and a train floor which is usually high above the platform so that even a wheelchair may go in and out a train. The embodiment of **FIG. 6** together with embodiments of **FIG. 3** to **FIG. 5** can attain the same effect as the embodiments of **FIG. 3** to **FIG. 5**.

[0020] The present invention can provide a step apparatus for a platform in which the step provided on the platform horizontally rotates to fill a big gap between a train body and the edge of a platform, characterized by less working steps to install the apparatus on the platform, being easy to be installed on an existing platform, and minimizing a difference between the top of the platform and a train floor which is usually higher than the platform.

[0021] An unmovable cover above the step prevents the passengers from being caught by the moving step for assurance of safety of passengers. Further, this cover also has an effect of showing no out-of-order status of the step apparatus.

[0022] By changing the lengths of arms connected to the step, the angles of the arms relative to the step, or the shape of the step, the step can be made parallel to the train body and minimize the gap between the step and the train body even when the edge of the platform **10** is curved and not parallel to the train body.

[0023] Further, a driving section is connected to one of at least two arms or at least two rotary shafts of the step apparatus. This makes the apparatus simpler and more inexpensive.

[0024] Furthermore, as the arms, the rotary shaft, and the driving section of the step apparatus are installed below the step, that is, lower than the top of the platform and the step is concealed with a cover, the top of the platform is clear and has no projections.

[0025] By providing a handle on the rotary shaft or the arm in advance or later, the step can be moved manually when the driving section is disabled. This will never disturb the traffic services even when the driving section of the step apparatus is disabled.

[0026] Further the present invention can assure more safety of passenger by providing the step in the gate of a movable guard fence on the platform and causing the step move in synchronism with the movement of the movable guard fence or the movement of train doors.

[0027] Further, to prevent the step from being hit by a train, the step apparatus can be equipped with a detection means which detects the step in the extended position and makes alarms when the step must be in the home position.

[0028] Further, to prepare against an unexpected collision of the step in the extended position with a train, weaken the dumping force, and minimize damages of the step by collision, the step apparatus is equipped with a shock-absorbing material or a rubber roller. This makes the apparatus safer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] **FIG. 1** is a plan view of a step apparatus which is an embodiment of the present invention.

[0030] **FIG. 2** is a sectional view taken along the lines A-A of **FIG. 1**.

[0031] **FIG. 3** is a plan view of a step apparatus which is another embodiment of the present invention.

[0032] **FIG. 4** is a plan view of a step apparatus which is yet a further embodiment of the present invention.

[0033] **FIG. 5** is a plan view of a step apparatus which is a more particular embodiment of the present invention.

[0034] **FIG. 6** is a plan view of a step apparatus which is a still another embodiment of the present invention.

What we claim is:

1. A step apparatus for a platform comprising a step which is provided on a platform and horizontally rotates to fill the gap between a train body and the edge of the platform, an arm having one end connected to said step and the other end connected to a rotary shaft, and a driving section which

rotates said arm so that said step may move to a preset extended position; wherein said step is provided above or near the top of the platform.

2. A step apparatus for a platform in accordance with claim 1; wherein an unmovable cover is fixed to the platform to cover the step.

3. A step apparatus for a platform in accordance with claim 1; wherein a preset gap is provided between a train body and the edge of the step also in the extended position of the step.

4. A step apparatus for a platform in accordance with claim 1; wherein said step apparatus comprises two sets or more of said arm and said rotary shaft and said arms are different in length.

5. A step apparatus for a platform in accordance with claim 1; wherein said step apparatus comprises two sets or more of said arm and said rotary shaft and the angle between the step and one of said rotary shaft is different from the angle between the step and another rotary shaft.

6. A step apparatus for a platform in accordance with claim 1; wherein the edge of said step facing to the train body is parallel to the train body when the step is in the extended position.

7. A step apparatus for a platform in accordance with claim 1; wherein said step apparatus comprises two sets or more of said arm and said driving section which rotates said arm is connected to one pair of arms or rotary shafts only.

8. A step apparatus for a platform in accordance with claim 1; wherein said arms, said rotary shafts, and said driving section are provided above the step.

9. A step apparatus for a platform in accordance with claim 1; wherein said arms, said rotary shafts, and said driving section are provided below the step.

10. A step apparatus for a platform in accordance with claim 1; wherein a handle which enables manual movement of said arm and said step when said driving section is disabled is already mounted on said arm or can be mounted on the arm quickly.

11. A step apparatus for a platform in accordance with claim 1; wherein said step apparatus is provided on a movable guard fence which is separately provided on the platform.

12. A step apparatus for a platform in accordance with claim 1; wherein said step apparatus is driven interlocking with the movement of the movable guard fence which is separately provided on the platform.

13. A step apparatus for a platform in accordance with claim 1; wherein said step apparatus is driven interlocking with the movement of train doors.

14. A step apparatus for a platform in accordance with claim 1; further comprising an alarm unit which makes alarm sounds when detecting that the step is involuntarily in the extended position.

15. A step apparatus for a platform in accordance with claim 1; further comprising shock absorbing means or roller against collision with a train.

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