Title
Braking unit for elevator

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Braking unit for elevator

Abstract
The invention relates to an elevator, especially to a braking unit suitable for the elevator. The unit includes a trestle fixed connected with the cabin and a guide rail arranged along the elevator shaft; the triggering unit is mounted on the trestle, the trolley wheel is freely rotatably mounted on the trestle by the supporting shaft, the guide rail is arranged between the first gear and the trolley wheel, the first gear engages with the gear surface of the guide rail, the trolley wheel rolls on the smooth surface of the guide rail, the connecting rod make the second gear revolve around the axis of the first gear and engage with the first gear, each side of the up and down sides of the first gear is provided with a second gear, the connecting rod is provided with a triggering bore pluggably matting with the triggering end, when the triggering end withdraw from the triggering bore, the elastic force makes the second gear engage with the guide rail, at this moment, the mechanism has zero freedom degree, the elevator can not move upward or downward so as to achieve that the elevator brakes when the elevator is in fault state.
Braking unit for elevator

Field of the Invention
The invention relates to an elevator, especially to a braking unit suitable for the elevator.

Description of prior art
When the elevator is in an accident under some condition, the elevator may speedily fall down or rise up, such movement may cause serious harm to the passager in the elevator, especially when rescuers evacuate passagers from the elevator stuck between two floors, the elevator may speedily move up or down, so the moving cabin combined with the static wall or floor may cut anything therebetween, such that some parts of the passager or rescuer may be cut down by the moving elevator.

How to avoid the elevator from moving up or down unexpectedly so as to reduce the chance of injury, it is a problem waiting to be solved.

Summary of the present invention
The object of the invention is to provide a braking unit suitable for the elevator so as to solve the above problem.

Therefore, the invention provides a braking unit for the elevator, the unit comprises a trestle fixedly connected with the elevator cabin, a guide rail arranged along the elevator shaft. The braking unit further comprises a first gear, a second gear, a trolley wheel, a triggering unit, a connecting rod, an elastic component and a supporting shaft. The triggering unit is mounted on the trestle, the trolley wheel is freely rotatably mounted on the trestle by the supporting shaft, the
first gear is freely rotatably mounted on the trestle by the supporting shaft, the guide rail is configured between the first gear and the trolley wheel, the first gear engages with the gear surface of the guide rail, the trolley wheel rolls on the smooth surface of the guide rail, the connecting rod makes the second gear revolve around the axis of the first gear, mean while the second gear freely rotates with respect to the connecting rod, each side of the up and down sides of the first gear is provided with one second gear engaging with the first gear, the connecting rod is provided with a triggering bore matting with the triggering end of the triggering unit, the triggering end pluggably mates with the triggering bore.

Specifically, when the triggering end inserts into the triggering bore, the second gear located below the first gear is held at the position where is below the first gear and away from the gear surface of the guide rail, and the second gear located above the first gear is held at the position where is above the first gear and away from the gear surface of the guide rail, that is the triggering end makes the second gear not contact with the gear surface. When the triggering end withdraws from the triggering bore, the elastic force from the elastic component makes the second gear on the connecting rod locate near to the gear surface of the guide rail and makes the second gear contact and engage with the gear surface of the guide rail.

Specifically, when the second gear located below the first gear do not get involved, the second gear rotates in an engagement with the first gear, which rotates in an engagement with the guide rail. When the second gear located below the first gear gets involved, the tooth of the second gear withstands the tooth of the guide rail due to each motion direction of respective tooth of the second gear and the guide rail, the limiting action of the trolley wheel arranged behind the guide rail (smooth surface) avoids the guide rail from deformation caused by the force when the second gear gets
involved, thus the first gear, the second gear and the guide rail are tightly stuck together. Because the withstanding action between the second gear and the guide rail stops the first gear rotating in an engagement with the second gear so as to stop the first gear rotating, that is the first gear stops rotating in an engagement with the guide rail so as to stop the elevator in fault state moving down unexpectedly.

Specifically, when the second gear located above the first gear do not get involved, the second gear rotates in an engagement with the first gear, which rotates in an engagement with the guide rail. When the second gear located above the first gear gets involved, the tooth of the second gear withstands the tooth of the guide rail due to each motion direction of respective tooth of the second gear and the guide rail, the limiting action of the trolley wheel arranged behind the guide rail (smooth surface) avoids the guide rail from deformation caused by the force when the second gear gets involved, thus the first gear, the second gear and the guide rail are tightly stuck together. Because the withstanding action between the second gear and the guide rail stops the first gear rotating in an engagement with the second gear so as to stop the first gear rotating, that is the first gear stops rotating in an engagement with the guide rail so as to stop the elevator in fault state moving up unexpectedly.

Advantageous Effects
When the elevator is in a state of normal operation, the triggering unit make the second gear hold in the position where is away from the gear surface of the guide rail, the first gear engages with the gear surface of the guide rail, the first gear rotates to drive the second gear rotating, the trolley wheel rolls on the smooth surface of the guide rail, the mechanism consisting of the first gear, the second gear, the connecting rod, the guide rail and the trolley wheel has one freedom degree, so the elevator operates normally.
When the elevator is in fault state, the triggering unit is triggered, the triggering end withdraws from the triggering bore, the elastic force from the elastic component makes the second gear on the connecting rod locate near to the gear surface of the guide rail and makes the second gear contact and engage with the gear surface of the guide rail, at this moment, the first gear, the guide rail and the second gear engage with one another, the mechanism consisting of the first gear, the second gear, the connecting rod, the guide rail and the trolley wheel has zero freedom degree, so the elevator do not move up or down.

Especially, because the second gear is located below the first gear, the tendency of the elevator moving downwards makes the first gear engage downward with the guide rail, while the second gear located below the first gear is bound to exert a force with opposite direction to stop the first gear from trying to rotate. Similarly, because the second gear is located above the first gear, the tendency of the elevator moving upwards makes the first gear engage upward with the guide rail, while the second gear located above the first gear is bound to exert a force with opposite direction to stop the first gear from trying to rotate. So the braking process of the elevator is such, the triggering end is triggered, the elastic force from the elastic component make the first gear, the second gear and the guide rail build and hold a stuck engagement relationship between one another, such stuck engagement relationship stops the elevator from trying to fall or raise in fault state.

The gear engagement makes the mechanism have zero freedom degree, which is different from that the wheel makes the mechanism have zero freedom degree, the wheel is easy to slip between the first gear and the guide rail, such that the elevator may fall or raise; while the gear makes the first gear, the second gear and the guide rail tightly stuck together for avoiding the elevator from falling or raising.
**Brief description of the drawing**

In the following, the invention will be described in greater detail by means of some embodiments with reference to the accompanying drawings, in which

Fig.1 and Fig.12 are 3d-drawings of the braking unit of the invention;

Fig.2 is from Fig.1, wherein trestle of one side is hidden;

Fig.3 is a front view of the Fig.1;

Fig.4 is a front view of the Fig.2;

Fig.5 is from Fig.4, wherein the second gear is to get involved;

Fig.6-7 are drawings of the connecting rod connecting with the triggering unit;

Fig.8 is a 3d-drawing of the trestle;

Fig.9 is a 3d-drawing of the connecting rod;

Fig.10 is a secontional view of the connecting rod in Fig.9;

Fig.11 is an exploded 3d-drawing of the braking unit in Fig.1;

Fig.13-14 is a 3d-drawing of the triggering unit.

1. the first gear; 2. the guide rail; 3. the trolley wheel;

4. the second gear; 5. the supporting shaft;

6. the trestle; 7. the connecting rod; 8. the spring;

9. the triggering unit; 10. the bushing;

601. the through hole; 602. the screw hole;

701. the triggering bore; 901. the triggering end.

**Detailed description of the preferred embodiment**

Referrign to Fig.1, Fig.2, Fig.11 and Fig.12, it is a braking unit suitable for the elevator of the invention, the braking unit includes a trestle 6 fixedly connected with elevator cabin, a first gear 1, a second gear 4, a guide rail 2, a trolley wheel 3, a triggering unit 9, a connecting rod 7, a spring 8, a supporting shaft 5, a nut, a washer, a split pin and a bushing 10. The triggering unit 9 is removably mounted to the trestle 6 by screw, the trolley wheel 3 is freely rotatably mounted
between two trestles 6 by the supporting shaft 5, the first gear 1 is freely rotatably mounted between two trestles 6 by the supporting shaft 5, the guide rail is configured between the first gear 1 and the trolley wheel 3, the first gear 1 engages with the gear surface of the guide rail 2, the trolley wheel 3 rolls on the smooth surface of the guide rail 2, the connecting rod 7 makes the second gear 4 revolve around the axis of the first gear 1, meanwhile the second gear 4 freely rotates with respect to the connecting rod 7. Each side of the up and down sides of the first gear 1 is provided with one second gear 4 engaging with the first gear 1, the connecting rod 7 is provided with a triggering bore 701 matting with the triggering end 901 of the triggering unit 9, the triggering end 901 pluggably mates with the triggering bore 701. The bushing 10 adjusts the position of the second gear 4 to align the central surface of the first gear 1 with the central surface of the second gear 4, the trestles 6 on both sides of the first gear 1 are connected by the nut and washer, then the split pin avoids the nut from looseness and drop out.

Referring to Fig.3 and Fig.4, when the triggering end 901 inserts into the triggering bore 701, the second gear 4 on the connecting rod 7 is held at the present position, the second gear 4 located below the first gear 1 is held at the position where is below the first gear 1 and away from the gear surface of the guide rail 2, and the second gear 4 located above the first gear 1 is held at the position where is above the first gear 1 and away from the gear surface of the guide rail 2, that is the triggering end 901 makes the second gear 4 not contact with the gear surface, at this moment, the spring 8 is in tension state.

Referring to Fig.6, the triggering end 901 of the triggering unit 9 inserts into the triggering bore 701, the connecting rod 7 is limited at the present position, that is the connecting rod 7 located above the trestle 6 is straight up, and the connecting rod 7 located below the trestle 6 is straight down.
Referring to Fig.7, the triggering end 901 withdraws from the triggering bore 701, the elastic force from the spring 8 makes the second gear 4 on the connecting rod 7 locate near to the gear surface of the guide rail 2 and makes the second gear 4 contact and engage with the gear surface of the guide rail 2, referring to Fig.5.

Referring to Fig.8, the trestle 6 is provided with a through hole 601 matching the gap of the supporting shaft 5 and a screw hole 602 for mounting the triggering unit 9.

Referring to Fig.9 and Fig.10, each end of the head and tail ends of the connecting rod 7 is provided with a through hole 601 matching the gap of the supporting shaft 5, the side surface of the connecting rod 7 is provided with a triggering bore 701 pluggably matting with the triggering end 901 of the triggering unit 9, the triggering bore 701 is a blind bore matching the gap of the triggering end 901, the front end of the triggering bore 701 is provided with chamfer convenient to receive the triggering end 901.

Referring to Fig.13 and Fig.14, the front end of the triggering unit 9 is provided with a scalable triggering end 901 controlled by the electromagnetic coil. The triggering end 901 retracts when the triggering signal exerts on the triggering unit 9.

When the second gear 4 located below the first gear 1 do not get involved, the second gear 4 rotates in an engagement with the first gear 1, which rotates in an engagement with the guide rail 2. When the second gear 4 located below the first gear 1 gets involved, the tooth of the second gear 4 withstands the tooth of the guide rail 2 due to each motion direction of respective tooth of the second gear 4 and the guide rail 2, the limiting action of the trolley wheel 3 arranged behind the guide rail 2 (smooth surface) avoids the guide rail 2 from deformation caused by the force when the second gear 4
gets involved, thus the first gear 1, the second gear 4 and the guide rail 2 are tightly stuck together. Because the withstanding action between the second gear 4 and the guide rail 2 stops the first gear 1 rotating in an engagement with the second gear 4 so as to stop the first gear 1 rotating, that is the first gear 1 stops rotating in an engagement with the guide rail 2 so as to stop the elevator in fault state moving down unexpectedly.

When the second gear 4 located above the first gear 1 do not get involved, the second gear 4 rotates in an engagement with the first gear 1, which rotates in an engagement with the guide rail 2. When the second gear 4 located above the first gear 1 gets involved, the tooth of the second gear 4 withstands the tooth of the guide rail 2 due to each motion direction of respective tooth of the second gear 4 and the guide rail 2, the limiting action of the trolley wheel 3 arranged behind the guide rail 2 (smooth surface) avoids the guide rail 2 from deformation caused by the force when the second gear 4 gets involved, thus the first gear 1, the second gear 4 and the guide rail 2 are tightly stuck together. Because the withstanding action between the second gear 4 and the guide rail 2 stops the first gear 1 rotating in an engagement with the second gear 4 so as to stop the first gear 1 rotating, that is the first gear 1 stops rotating in an engagement with the guide rail 2 so as to stop the elevator in fault state moving up unexpectedly.

Because the triggering end 901 of the triggering unit 9 acts synchronously, the second gears 4 located on both sides of the first gear 1 get involved synchronously when the triggering end 901 withdraws synchronously from the triggering bore 701 of the connecting rod 7, such that the elevator stops at the present position, that is the elevator do not move upward or downward so as to guarantee safe evacuation.
Claims

1. A braking unit for the elevator, comprising a trestle (6) fixedly connected with the elevator cabin, a guide rail (2) arranged along the elevator shaft; characterized in that the braking unit comprises a first gear (1), a second gear (4), a trolley wheel (3), a triggering unit (9), a connecting rod (7), an elastic component (8) and a supporting shaft (5); the triggering unit (9) mounted on the trestle (6), the trolley wheel (3) freely rotatably mounted on the trestle (6) by the supporting shaft (5), the first gear (1) freely rotatably mounted on the trestle (6) by the supporting shaft (5), the guide rail configured between the first gear (1) and the trolley wheel (3), the first gear (1) engaging with the gear surface of the guide rail (2), the trolley wheel (3) rolling on the smooth surface of the guide rail (2), the connecting rod (7) making the second gear (4) revolve around the axis of the first gear (1), mean while the second gear (4) freely rotating with respect to the connecting rod (7), each side of the up and down sides of the first gear (1) being provided with one second gear (4) engaging with the first gear (1), the connecting rod (7) provided with a triggering bore (701) matting with the triggering end (901) of the triggering unit (9), the triggering end (901) pluggably matting with the triggering bore (701).

2. A braking unit for the elevator according to claim 1, characterized in that when the triggering end (901) inserts into the triggering bore (701), the second gear (4) located below the first gear (1) is held at the position where is below the first gear (1) and away from the gear surface of the guide rail (2), and the second gear (4) located above the first gear (1) is held at the position where is above the first gear (1) and away from the gear surface of the guide rail (2), that is the triggering end (901) making the second gear (4) not contact with the gear surface; when the triggering end (901) withdraws from the triggering bore
(701), the elastic force from the elastic component (8) making the second gear (4) on the connecting rod (7) locate near to the gear surface of the guide rail (2) and making the second gear (4) contact and engage with the gear surface of the guide rail (2).