

ESCALATOR STEPS

The present invention relates to escalators and more particularly to an improvement in the steps of escalators.

In the accompanying drawings:-

Figure 1 is a schematic vertical sectional view of an escalator;

5 Figure 2 is an enlarged side elevational view of an example of a conventional escalator step;

Figure 3 is a rear elevational view of the step shown in Figure 2;

Figure 4 is a plan view of the step shown in Figure 2;

10 Figure 5 is a partial side elevational view, on an enlarged scale, showing the relationship between two adjoining steps when they move through the region between points B and C in Figure 1;

Figure 6 is a partial plan view of the steps shown in Figure 5 as viewed in the direction shown by the arrows V in Figure 5;

15 Figure 7 is an enlarged side elevational view of another example of a conventional elevator step;

Figure 8 is a view similar to Figure 3 of the step shown in Figure 7;

Figure 9 is a view similar to Figure 4 of the step shown in Figure 7;

5     Figure 10 is a view similar to Figure 5 showing the relationship between the two adjoining steps when they move through the region between points B and C in Figure 1;

10     Figure 11 is a view similar to Figure 6 of the steps shown in Figure 10 and as viewed in the direction shown by the arrows XI in Figure 10.

15     Figures 1 to 6 of the accompanying drawings show an example of a typical conventional escalator and steps. In Figure 1, the reference numeral 1 indicates an escalator, having steps 2 to carry a passenger 3. A number of steps 2 are connected together by a linkage (not shown) at a definite pitch p (usually about 400 mm) in an endless fashion such that the treads 21 of adjoining steps 2 lie together so as to be aligned flush with each other in a plane at locations c and c' constituting upper and lower landing portions 4 and 4', and so that steps 20     2 move in a stair-like configuration between the landing portions. Steps 2 are shown in detail in Figures 2 to 4 and 6. The tread 21 for carrying a passenger usually has a width W of 600 to 1,000 mm, a number of cleats 211 having a thickness T1

(usually about 3 mm), and grooves 212 alternately disposed thereon at a definite pitch P1 (usually about 9 mm). The forward ends 213 of the cleats 211 project beyond grooves 212 a definite distance L1 (usually about 6 mm). A convex riser 22 is provided at the rear end of tread 21 so as to form a substantially L-shaped configuration therewith, and has a number of cleats 221 each having a definite thickness T1 and grooves 222 alternately disposed on the convex surface at a definite pitch P1 the same as that of cleats 211 of tread 21. The forward ends 213 of cleats 211 on tread 21 of the step directly behind any given step are arranged to engage in grooves 222 in riser 22. Brackets 23 integrally connect tread 21 with riser 22, and rollers 24 are mounted on axles 25 on brackets 23, the rollers 24 being adapted to roll on guide rails (not shown) by connecting their axles 25 to linkages (not shown).

When steps 2 are connected together in an endless fashion and are moved in the direction shown by the arrow A in Figure 1, i.e. when escalator 1 is operated upwards, when steps 2 pass through the region between points B and C shown in Figure 1, step 2 moves, as shown in Figure 5, stepwise upwards relative to preceding step 2' in the direction represented by the arrow D from a position E through a position F to a position G where the tread thereof is level with the tread on the preceding step 2'. In this case, should a passenger 3 carried on step 2 strongly thrust the toe 32 of his footwear 31 against cleats 211

of riser 22 of preceding step 2', toe 32 is forcibly bent downwards due to friction with the riser 22, particularly when the footwear 31 is made of rubber which has a relatively large coefficient of friction, and when step 2 reaches position G', i.e. a level state, because there is usually a gap 26 of width H of 3 to 5 mm left extending across the whole width of steps 2 and 2' between forward ends 213 of the tread cleats 211 of step 2 and the rear ends of tread cleats 211 of preceding step 2', the toe 32 can become caught in the gap 26; furthermore, elongate foreign objects can fall through gap 26, and if the foreign objects are made of hard metal or plastic they may cause damage to the mechanical parts of escalator 1 due to being thrust into the upper and lower landing portions 4.

Figures 7 to 11 show another example of conventional escalator steps wherein the forward ends 213 of alternate cleats 211 of tread 21 project a distance L1 while the rear ends of these same cleats 211 which have projecting forward ends 213 are shortened so that the rear ends 213' of these cleats 211 are aligned with the bottom faces of grooves 222 in riser 22 each having a depth of L1, and the rear ends 214 of the intervening cleats 214, which do not have projecting forward ends, project by a distance L1 together with portions of the adjoining grooves over a width I2, whereby riser 22 has cleats 221 each having a height L1 and a width I2 aligned with rear ends 214' of the tread 21.

Thus, in this example the pitch P2 of cleats 221 and grooves 222 in riser 22 is double the pitch P1 in the first example, width I2 of cleat 221 being 1 to 4 times the width I1 of the cleat in the first example. (In the example shown the ratio is about 3.5 times.)

In the case where an escalator provided with such steps moves upwards then, as shown in Figures 10 and 11, irrespective of whether the treads of adjoining steps 2 and 2' are in a stair-like state as represented at positions E and F, or are aligned in a horizontal state as shown at position G, the forward ends 213 of tread cleats 221 of step 2 are engaged in grooves 222 of riser 22 of the preceding step 2' and indented portions of tread 21 thereof at the rear end thereof which are in communication with grooves 222. Therefore, even when the treads of steps 2 and 2' are aligned in a horizontal state as shown at G in Figure 10, the forward ends 213 of tread cleats 211 of step 2, as shown in Figure 11, engage rear ends 213' of cleats 211 of preceding step 2' (including also portions of adjoining grooves 222) to a depth J so that there is no linear gap 26 as in the first example, preventing footwear or long foreign objects from being caught between the confronting ends of adjacent steps 2 and 2' as in the first example. However, when steps 2 are in a stair-like state in the region between points B and B' shown in Figure 1, the length S of gap 27 formed between adjacent projecting ends 213 of cleats 211

(gap 27 having a clearance H of 3 to 5 mm between the confronting forward end 214 and rear end 214' of respective tread cleats 211) becomes larger than the corresponding length in the first example so that coarse dirt is apt to fall through the gap 27 and be caught in the interior of the escalator, possibly causing a breakdown.

It is an object of the present invention to provide escalator steps which make it difficult for the footwear of passengers to be caught in, or foreign objects such as dirt, etc. to fall down through, the gap formed between adjoining steps in the escalator over the whole range from the lower to the upper landing portions.

It is another object of the present invention to provide escalator steps which can provide passengers with greater safety.

According to the present invention, there is provided  
an escalator step comprising a tread having a plurality  
of cleats defining grooves therebetween alternating with the  
cleats; and a riser at one edge of said tread and having a  
5 convex surface with a plurality of projections thereon defining  
grooves therebetween alternating with said projections, the  
pitch between adjacent projections on said convex riser surface  
being the same as that between adjacent cleats on said tread  
and said projections on said convex riser surface being positioned  
10 so as to correspond to said grooves in said tread, alternate  
grooves in said riser being first shallow grooves and the  
remainder being second deep grooves, the end of said tread  
adjacent said riser having a profile corresponding to the  
first and second grooves and projections of said riser, alternate  
15 cleats on said tread being first cleats having their ends,  
at the side of the tread opposite said riser, projecting a  
short distance corresponding to the depth of said first grooves  
of said riser and being positioned to correspond to the positions  
of said first grooves in said riser, and the remaining cleats  
20 on said tread being second cleats having their ends, at the  
side of the tread opposite said riser, projecting a long distance  
corresponding to the depth of said second grooves of said  
riser and being positioned to correspond to the positions  
of said second grooves in said riser, whereby, when neighbouring  
25 steps are disposed in a stair-like relationship or with their  
respective treads horizontal and level with each other, the

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projecting ends of the first and second cleats of the tread of one of said steps at the side opposite the riser always project into the corresponding grooves in the riser of the preceding step.

Embodiments of the present invention are shown in Figures 12 to 20 of the accompanying drawings by way of illustration and example; in these Figures:

5 Figure 12 is an enlarged side elevational view of an embodiment of the steps in accordance with the present invention;

Figure 13 is a rear elevational view of the step shown in Figure 12;

Figure 14 is a plan view of the step shown in Figure 12;

10 Figure 15 is a partial side elevational view, on an enlarged scale, showing the relationship between the two adjoining steps when they move through the region between points B and C in Figure 1;

15 Figure 16 is a partial plan view of the steps shown in Figure 15 as viewed in the direction shown by the arrows XVI in Figure 15;

Figure 17 is a partial perspective view, on an enlarged scale, of cleats of a tread of another embodiment of the steps in accordance with the present invention as viewed from the end opposite to the riser;

- 5 Figure 18 is a partial perspective view of the cleats of the riser of the step having the cleats in Figure 17;

Figure 19 is a similar view to Figure 17 of cleats of a step of a further embodiment of the steps in accordance with the present invention; and

- 10 Figure 20 is a similar view to Figure 18 of the cleats shown in Figure 19.

- Figures 12 to 16 show a step 2 with a riser 22 which is shaped as a convex surface provided with a number of shallow first grooves 222 and a number of deep second grooves 223. Grooves 222 and 223 are disposed alternately at a pitch  $P_1$ . The tread 21 is provided on its upper surface with a number of first cleats 213 arranged so as to correspond to the shallow riser grooves 222, and protruding by  $L_1$  at the forward side of the tread. Alternating with the cleats 213 are cleats 215 arranged to correspond to the deep second grooves 223 of riser 22 and to protrude by a distance  $L_2$ , equal to twice the distance  $L_1$ , at the side opposite from riser 22, i.e. the front side. First and second cleats 213 and 214 are alternately arranged
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at a pitch P<sub>1</sub> with cleats 213 and 215 projecting into grooves 222 and 223 of riser 22 of the next preceding step 2', respectively.

Tread 21 has at the end adjacent to riser 22 a profile with recesses corresponding to the depths of first and second grooves

5 222 and 223 of the riser 22. The bottoms of the respective grooves 222 and 223 are spaced from the ends of the respective cleats 213 and 215 by a distance H, which is less than the difference between L<sub>2</sub> and L<sub>1</sub>. Thus, it will be appreciated

that, as shown in Figures 15 and 16, first and second cleats

10 213 and 215 of tread 21 of step 2 are so formed that first cleats 213 engage in first grooves 222 of riser 22 of preceding step 2', and similarly second cleats 215 engage second grooves 223 of riser 22 of step 2'. Because step 2 has this construction,

over the whole range from lower landing portion 4 to upper

15 landing portion 4 shown in Figure 1 the forward ends of first cleats 213 of tread 21 of step 2, each projecting only a small distance, always engage in the shallow first grooves 222 of

riser 22 of the preceding step, and those of second cleats 215, each projecting a larger distance, always engage in the

20 deep second grooves 223 of the preceding step, so that cleats 213 and 215 of tread 21 of step 2 and grooves 222 and 223

of the riser of preceding step 2' always engage each other.

Therefore, when adjacent steps 2 and 2' are disposed in a stair-like configuration, i.e. steps 2 and 2' are located

25 in the region between B and B' shown in Figure 1, the gap 28 formed between projections 221 of riser 22 of step 2' and the

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forward end of tread 21 of step 2 located directly below step 2' is so small that it not only prevents footwear from being caught in it, but also makes it difficult for foreign objects such as dirt, etc. to fall through it, because pitch P<sub>1</sub> of the riser cleats 221 is small and gap 28 has a zigzag configuration as it extends through the first and second riser grooves 222 and 223 between the surfaces of the grooves and the forward ends of second and first cleats 215 and 213 of tread 22 of the step 2 directly below. This condition is also maintained when steps 2 and 2' move from their stair-like configuration to a position where the treads are in a horizontal configuration, that is, from state F to state G in Figure 15. Further, in the state where the treads of steps 2 and 2' are flush with each other in the horizontal direction, i.e. in the state shown at G in Figure 15, since the forward ends of second tread cleats 215 of step 2 and the rear ends of first cleats 213 of preceding step 2' are alternately intermeshed with each other, and because dimension H is less than the difference between L<sub>2</sub> and L<sub>1</sub>, the ends of cleats on one step actually overlap the projections on the riser on the next preceding step by a dimension equal to J, so that the gap 28 between steps 2 and 2' has a zigzag configuration, and is not a straight-line gap. Therefore, there is no possibility of footwear 31 being caught in the gap formed between steps 2 and 2' or of foreign objects, such as coarse dirt, etc. falling through the gap. Thus over the whole range of the upper and lower landing portions only fine dust, which is not a source of

trouble, falls through the gap formed between steps 2 and 2', thus improving the safety of passengers and the durability of the escalator.

5 Although the present invention has been described above in connection with the upwards movement of the escalator, the same effects are also achieved in the region between points B' and C' shown in Figure 1 during the downward movement of the escalator.

10 Further, in the above embodiment, tread 21 and riser 22 can be manufactured of metallic material in a conventional way, and riser 22 can be fabricated from sheet metal by a shaping process to produce a shape as shown in Figure 17 and 18. Alternatively, riser 22 can be fabricated by a cutting process or shaped by a moulding process to produce a shape as shown  
15 in Figures 19 and 20, respectively.

While certain preferred embodiments of the present invention have been described and illustrated herein it will be understood that various modifications may be made without departing from the scope of the present invention.

**CLAIMS**

1. An escalator step comprising a tread having a plurality of cleats defining grooves therebetween alternating with the cleats; and a riser at one edge of said tread and having a convex surface with a plurality of projections thereon defining grooves therebetween alternating with said projections, the pitch between adjacent projections on said convex riser surface being the same as that between adjacent cleats on said tread and said projections on said convex riser surface being positioned so as to correspond to said grooves in said tread, alternate grooves in said riser being first shallow grooves and the remainder being second deep grooves, the end of said tread adjacent said riser having a profile corresponding to the first and second grooves and projections of said riser, alternate cleats on said tread being first cleats having their ends, at the side of the tread opposite said riser, projecting a short distance corresponding to the depth of said first grooves of said riser and being positioned to correspond to the positions of said first grooves in said riser, and the remaining cleats on said tread being second cleats having their ends, at the side of the tread opposite said riser, projecting a long distance corresponding to the depth of said second grooves of said riser and being positioned to correspond to the positions of said second grooves in said riser, whereby, when neighbouring steps are disposed in a stair-like relationship or with their respective treads horizontal and level with each other, the



projecting ends of the first and second cleats of the tread of one of said steps at the side opposite the riser always project into the corresponding grooves in the riser of the preceding step.

2. An escalator step as claimed in claim 1, wherein said cleats and grooves are pressed from a thin metal sheet.

3. An escalator step as claimed in claim 1 or 2, wherein said longer distance is L2, said short distance L1, and the ends of said projecting portions of said treads are spaced a distance H from the bottoms of the grooves in the next preceding step when said steps are assembled into a stair, which distance H is less than the difference between said distances L2 and L1, whereby the cleats which project a short distance overlap the projections on the riser of the next preceding step.

4. An escalator step substantially as herein described with reference to Figures 12 to 16 or any of Figure 17 to 20 of the accompanying drawings.

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