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Kondo et al.

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[54] **HANDRAILS FOR CONVEYORS**

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[52] **U.S. Cl.** ..... **198/16 MS**; 198/110; 104/25; 104/18

[51] **Int. Cl.** **B66b 9/12**

[58] **Field of Search** ..... 198/110, 16, 16 MS, 76, 198/181; 104/18, 25, 31, 30

[56] **References Cited**

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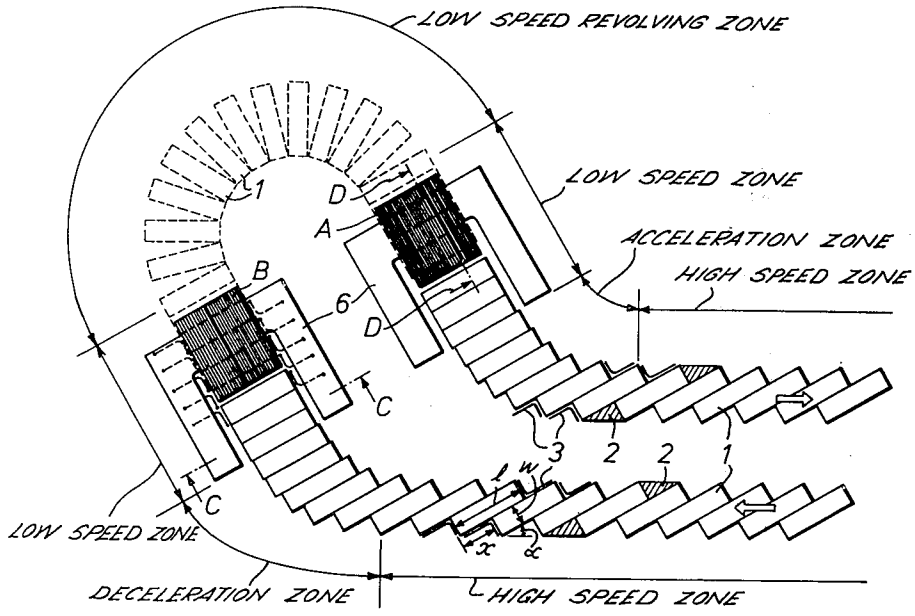
[57] **ABSTRACT**

The invention is a variable speed conveyor which comprises a plurality of movable elongate platforms whose relative displacement varies as the conveyor advances and a handrail mounted at each end of each platform, each handrail comprising a lateral portion which, when the relative displacement of the platform is zero, extends in the direction of advance of the conveyor, and a longitudinal portion at an angle to the lateral portion, the arrangement of the handrails being such that when the relative displacement of the platforms is zero the lateral portions of adjacent handrails cooperate to form safety barriers extending along the conveyor and when the relative displacement of the platforms is greater than zero the lateral and longitudinal portions of adjacent handrails cooperate to form safety barriers extending along the conveyor.

6 Claims, 5 Drawing Figures



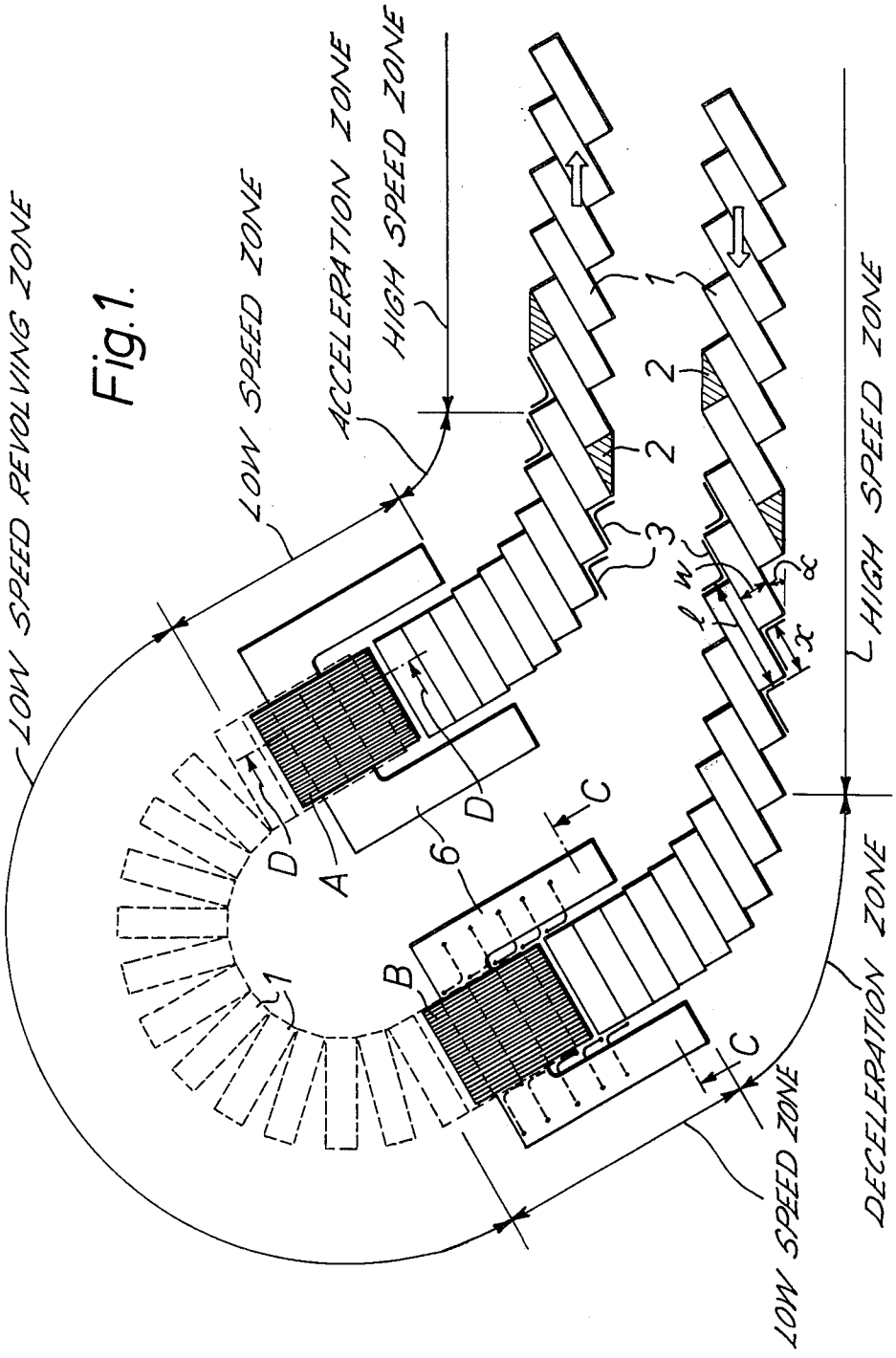

LOW SPEED REVOLVING ZONE
LOW SPEED ZONE
ACCELERATION ZONE
HIGH SPEED ZONE
HIGH SPEED ZONE
DECELERATION ZONE
LOW SPEED ZONE
A
B
C
C
D
D
1
1
2
2
3
6
W
x
α

Fig. 1.

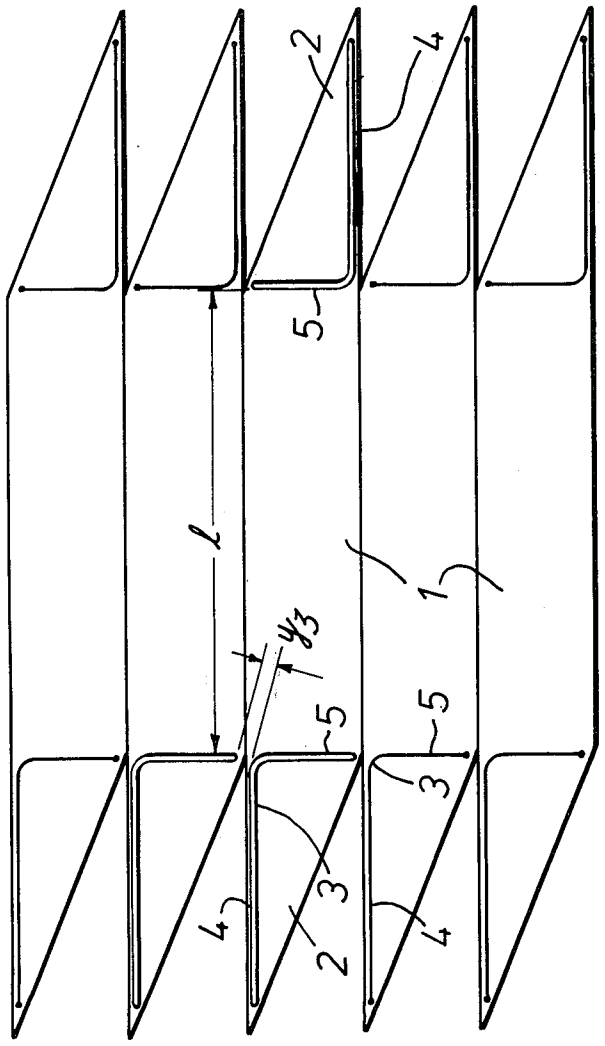


Fig.2.

Fig.3.

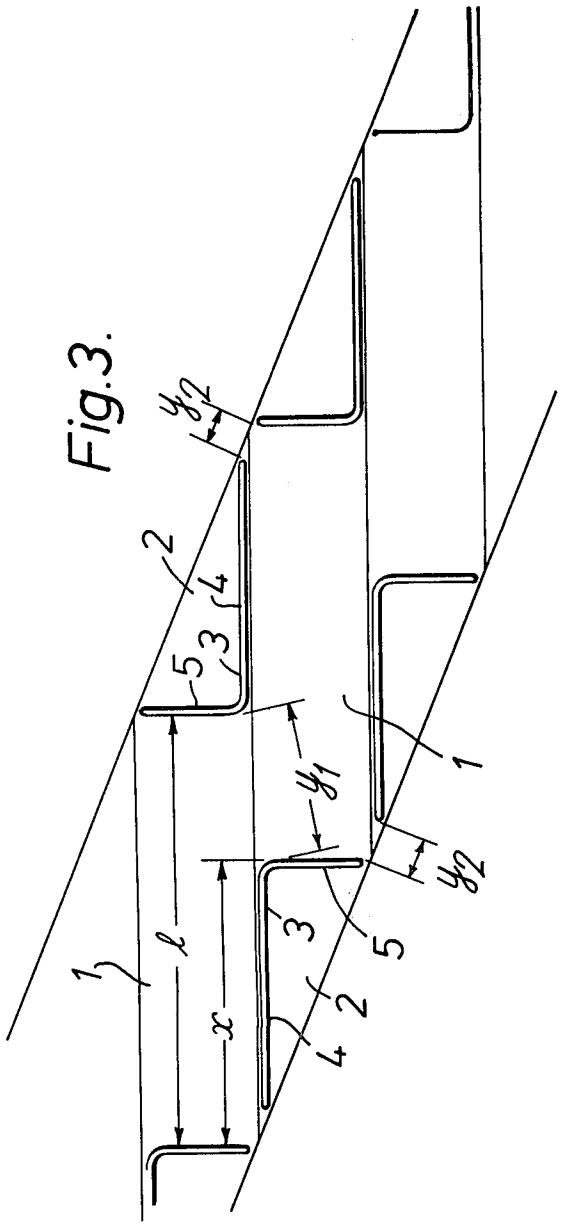
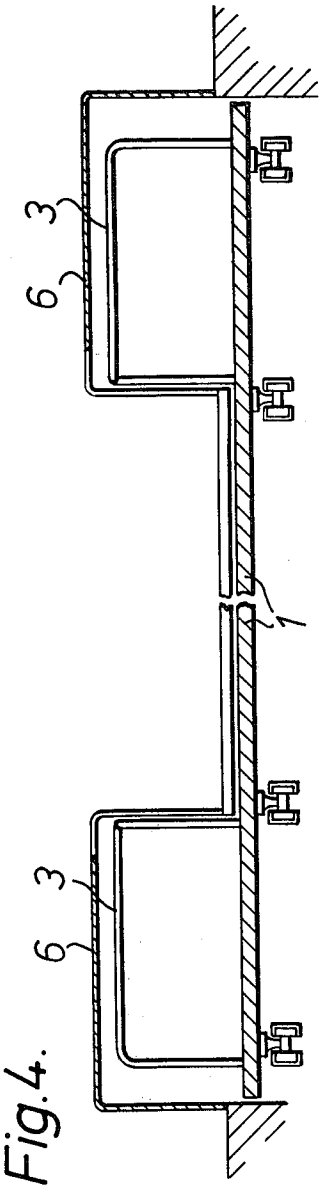


Fig.4.



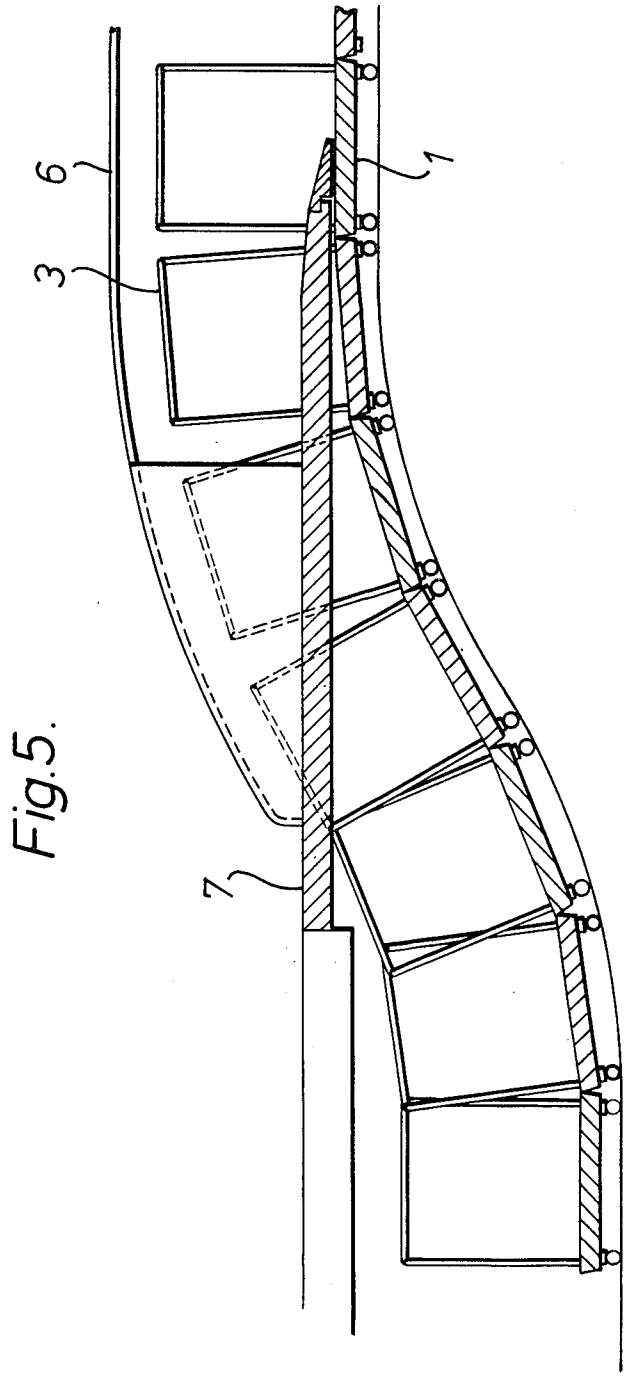


Fig.5.

HANDRAILS FOR CONVEYORS

This invention relates to conveyors and particularly to handrails for conveyors.

Among transport systems generally called "moving footways," there is known a system which was constructed by horizontally laying an "escalator" which was exhibited in the International Exposition of Osaka, Japan in 1970, and a system of belt-conveyor type on which passengers can ride. However, these systems have the disadvantage that they are of fixed speed, and in order to assure safety by mitigating the shock when a passenger steps onto the system the moving speed of the system is limited to a very low speed.

As an improved system free from the aforementioned disadvantages, a variable speed conveyor has been developed.

The variable speed conveyor includes respective rectangular platforms. In a low speed zone the shortest sides of the rectangular platforms are parallel to the direction of advance of the platforms. In a high speed zone the shortest sides of the rectangular platforms are transverse to the direction of advance. In the acceleration and decleration zones each platform moves relative to adjacent platforms in the direction of the longest sides of the rectangles. Thus through the acceleration and decleration zones the relative displacement of the platforms varies, being zero or small in the low speed and a maximum in the high speed zone. Since the respective platforms are adapted to be displaced relative to each other, the handrails used in the conventional fixed-speed conveyors are not suitable for use with a variable speed conveyor, and therefore, it was dangerous to transport continuously a large number of passengers.

According to the present invention there is provided a variable speed conveyor which comprises a plurality of movable elongate platforms whose relative displacement varies as the conveyor advances and a handrail mounted at each end of each platform, each handrail comprising a lateral portion which, when the relative displacement of the platforms is zero, extends in the direction of advance of the conveyor, and a longitudinal portion at an angle to the lateral portion, the arrangement of the handrails being such that when the relative displacement of the platforms is zero the lateral portions of adjacent handrails cooperate to form safety barriers extending along the conveyor and when the relative displacement of the platforms is greater than zero the lateral and longitudinal portions of adjacent handrails cooperate to form safety barriers extending along the conveyor.

Thus the invention provides handrails for assuring safety of a variable speed conveyor which can continuously transport a large number of passengers.

In the low speed zone where the relative displacement of the respective platforms in their lengthwise direction is zero or small, the lateral pieces of the handrails are positioned along the opposite sides of the conveyor so that the conveyor is bounded on both sides by the lateral pieces. In the high speed zone where the relative displacement of the respective platforms in their lengthwise direction is large, both the longitudinal and lateral pieces of the handrails are positioned along the opposite sides of the conveyor so that the conveyor is bounded on both sides by both said longitudinal and lateral pieces. Thus the handrails extend over the entire length of the conveyor in the low speed and in the high speed zones.

The invention will be further illustrated by reference to the accompanying drawings showing, by way of example, an embodiment of the invention, in which:

FIG. 1 is a schematic plan view of a conveyor provided with preferred handrails, only some of the handrails being shown;

FIG. 2 is an enlarged plan view of an essential part of the low speed zone in FIG. 1;

FIG. 3 is an enlarged plan view of an essential part of the high speed zone in FIG. 1;

FIG. 4 is a transverse cross-Section side view taken along line C—C in FIG. 1; and

FIG. 5 is a longitudinal cross-section side view taken along line D—D in FIG. 1.

Reference numeral 1 designates platforms of elongate rectangular shape which jointly forms a conveyor. The platforms 1 are adapted to be displaced in their lengthwise direction with respect to each other while their opposite side edges directed in the lengthwise direction are kept in tight contact with each other, except in a low speed revolving zone shown in FIG. 1.

In a low speed zone the platforms 1 are moved along their widthwise direction while their relative displacement in the lengthwise direction is maintained at zero. In a high speed zone they are moved along a direction transverse to their widthwise direction and the relative displacement in the lengthwise direction is a maximum. In an acceleration or deceleration zone the direction of movement of the platforms 1 relative to their widthwise direction is varied continuously while the relative displacement in the lengthwise direction is also varied continuously.

At the opposite ends in the lengthwise direction of the platform 1 are integrally formed handrail mounting spaces 2 of right-angled triangular shape and handrails 3 that are bent at a right angle as viewed from above are integrally mounted on the spaces 2.

One piece, a longitudinal piece 4 of the handrail 3, is directed along an extension of one side edge of the platform 1, while the other piece, a lateral piece 5 of said handrail 3 is directed to extend from the inner end of the longitudinal piece 4 along a terminal edge of the platform 1. In the neighborhood of a mounting or dismounting station, there is provided over the handrail 3 a handrail cover 6 of doorcase type as shown in FIGS. 4 and 5.

As shown in FIGS. 1 and 3, the distance l between the lateral pieces 5 of the handrails 3 disposed at the opposite ends in the lengthwise direction of a platform 1, is selected to be equal to the sum of the maximum relative displacement x of the platforms 1 in the high speed zone plus the width y_1 through which a passenger can pass readily.

In the high speed zone shown in FIG. 3, the space y_2 between a free end of a longitudinal piece 4 of a handrail on one platform and a free end of a lateral piece 5 of another handrail on the next adjacent platform, is preselected at such a size that the hand of a passenger will not be pinched therebetween but the body of the passenger will not pass the space. A suitable space is in the range of from 50 – 100 mm.

As shown in FIG. 2, in the low speed zone where there is no relative displacement between the platforms, the size of the space y_3 between a corner of a handrail 3 and a free end of a lateral piece 5 of another

handrail 3 on an adjacent platform 1, is preselected so that the hand of a passenger will not be pinched therebetween but the body of the passenger will not pass through. Suitably the size of the space is in the range of 50 – 100 mm.

Assuming that the platforms 1 are conveyed at a rate of n platforms per unit time, in the low speed zone the platforms 1 move at a speed of nW per unit time (where W represents the width of the platform 1), while in the high speed zone the platforms 1 move at a speed of $nW/\sin\alpha$ per unit time (where α represents the angle formed between the lengthwise direction of the platform 1 and the direction of movement of the platforms 1). Thus, for instance, if the angle α is chosen at 30°, the speed in the high speed zone is twice the speed in the low speed zone.

Therefore, by using a low speed zone upstream of a high speed zone as a mounting station A and another low speed zone downstream of the same high speed zone as a dismounting station B, it is possible to transport efficiently a large number of passengers without subjecting the passengers to an abrupt acceleration.

In the low speed zone, as will be apparent from FIGS. 1, 2 and 5, the passengers can get on or off the conveyor through the space l between the opposite side of handrails 3 of the conveyor consisting of a large number of platforms. Since the lateral pieces 5 of the handrails 3 are aligned in a straight line with only the small space y_3 therebetween, there is formed a safety barrier so that the passengers will be safely guarded by the handrails 3 without having their hands pinched by the handrails nor falling out of the conveyor.

In the high speed zone, since the passenger is guarded on the opposite sides by the longitudinal and lateral pieces 4 and 5 of the handrails as shown in FIG. 3, again there is formed a safety barrier and there is no risk that the passengers will fall out of the conveyor, and thus this conveyor is very safe. Furthermore, since the shortest distance y_1 (see FIG. 3) between the handrails 3 on the opposite sides of the conveyor in the high speed zone is chosen at such dimension that the passenger may easily pass through the narrowest neck portion, in an emergency the passengers can freely walk along the conveyor stepping on the successive platforms.

While the present invention has been described above in connection to its preferred embodiment, it is intended that the present invention should not be limited only to the illustrated embodiment but various changes in design could be made without departing from the scope of the invention as defined in the appendant claims.

We claim:

1. A variable speed conveyor which comprises a plurality of movable elongate platforms whose relative displacement varies as the conveyor advances and a handrail mounted at each end of each platform, each handrail comprising a lateral portion which, when the relative displacement of the platforms is zero, extends in the direction of advance of the conveyor, and a longitudinal portion at an angle to the lateral portion, the arrangement of the handrails being such that when the relative displacement of the platforms is zero the lateral portions of adjacent handrails cooperate to form safety barriers extending along the conveyor and when the relative displacement of the platforms is greater than zero the lateral and longitudinal portions of adjacent handrails cooperate to form safety barriers extending along the conveyor.

2. A conveyor as claimed in claim 1 wherein the platforms are rectangular in shape and when the relative displacement of the platforms is zero the shorter sides of the rectangle are parallel to the direction of advance of the conveyor and wherein there are provided on the shorter sides of the said rectangular platforms handrail mounting spaces.

3. A conveyor as claimed in claim 2 wherein the handrail mounting spaces are right-angled triangular in shape.

4. A conveyor as claimed in claim 1, wherein there is a space of from 50 to 100 mm between adjacent handrails cooperating to form a safety barrier.

5. A conveyor as claimed in claim 2 wherein there is a space of from 50 to 100 mm between adjacent handrails cooperating to form a safety barrier.

6. A conveyor as claimed in claim 3 wherein there is a space of from 50 to 100 mm between adjacent handrails cooperating to form a safety barrier.

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