

2 9 AUG 2000

## SAFETY MECHANISM FOR MOVABLE RACKS

### BACKGROUND OF THE INVENTION

#### Field of the Invention

The present invention relates to a safety mechanism applied to a movable rack unit constructed to make a plurality of racks movable on a rail and, more particularly, to such a safety mechanism which is capable of securing a passage between adjacent racks in case of an emergency such as an earthquake.

#### Description of the Prior Art

A movable rack unit of this type is constructed to allow an operator to move racks as required and to enter a passage defined between adjacent racks for articles to be put in or taken out of a desired rack by the operator, and has an advantage over rack units of the fixed type in a space-saving characteristic.

Among such rack movable units, there is known a rack unit adapted to prevent an operator in a passage between adjacent racks from being caught between the racks unintentionally moving by locking the wheels of the racks to inhibit a movement thereof. More specifically, a chain interconnecting a handle and a wheel becomes locked in a hand-operated rack, whereas a motor becomes disabled in an electrically-driven rack.

Another known rack unit ensuring higher safety includes an elongate member having one end pivotally supported at an intermediate portion of a strut disposed at a side corner of the

entrance of a passage defined between adjacent racks. The elongate member is held upright along the strut in a usual condition, while when a person is to enter the passage, the elongate member is rotated 90° to extend horizontally toward an adjacent rack whereby the elongate member serves as a prop to secure a required passage width between the adjacent racks of interest.

With the former rack unit adapted to lock the wheels of racks, however, the wheels of racks may slip on the rail and, hence, it is difficult to secure sufficient safety in terms of a sufficient passage width in case that a rack having a large loadage collides with a rack defining the passage for some reason or in case of a great earthquake. Even with the latter rack unit using the elongate member as a prop, the reliability for safety is relatively low because it is possible that the leading end of the elongate member fails to abut a corresponding strut of the adjacent rack or is buckled due to improper abutment (not at right angles) with the corresponding strut if each rack deforms or moves askew in case of a strong earthquake or the like. Further, even if a sufficient passage width can be ensured, the elongate member horizontally extending between intermediate portions of the racks defining the passage is likely to become an obstacle to the person fleeing away from the passage.

## SUMMARY OF THE INVENTION

The present invention has been made to solve all the foregoing problems at once, and an object thereof is to provide a safety mechanism provided with a cross-spanning member spanning between respective upper ends of a pair of adjacent racks which is deformable or movable following a change in the width of a passage defined between the adjacent racks due to their movement while maintaining the spanning condition thereof between the respective upper ends of the pair of adjacent racks, the cross-spanning member being inhibited to deform or move when the safety mechanism functions, thereby enhancing the reliability of the operation of the safety mechanism, hence, providing improved safety.

The foregoing and other objects, features and attendant advantages of the present invention will become more apparent from the reading of the following detailed description taken in conjunction with the attached drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic perspective view showing the overall construction of a movable rack unit as one embodiment of the present invention;

Fig. 2 is a plan view showing a safety mechanism in the embodiment;

Fig. 3 is also a plan view showing the safety mechanism in the embodiment;

Fig. 4 is also a plan view showing the safety mechanism in the embodiment;

Fig. 5 is a side view of the safety mechanism shown in Fig. 2;

Fig. 6 is a schematic front view of the safety mechanism shown in Fig. 2;

Fig. 7 is a fragmentary perspective view, as viewed from below on the skew, of the safety mechanism in the embodiment;

Fig. 8 is a fragmentary vertical sectional view showing a retainer in the embodiment;

Fig. 9 is also a fragmentary vertical sectional view showing the retainer in the embodiment;

Fig. 10 is a schematic sectional view taken on line X-X in Fig. 8; and

Fig. 11 is a schematic sectional view taken on line Y-Y in Fig. 9.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will now be described in detail.

A safety mechanism according to the present invention is applied to a movable rack unit in which a plurality of racks are movable on a rail for preventing a passage defined between any pair of adjacent racks from becoming narrower than a predetermined width. The safety mechanism of the present invention is characterized by comprising: a cross-spanning

member spanning between respective upper ends of a pair of adjacent racks which is deformable or movable following a change in the width of a passage defined between the adjacent racks due to movement of the adjacent racks while maintaining the spanning condition thereof between the respective upper ends of the adjacent racks; locking means, operable when the width of the passage is equal to the predetermined width, for inhibiting a deformation or movement of the cross-spanning member; and unlocking means for releasing the locking means from an operating condition thereof.

This construction is inherently free from the problem essential to the prior art that the leading end of an elongate member fails to abut the corresponding strut of an adjacent rack when each rack deforms or moves askew, because the cross-spanning member is disposed as constantly spanning between each pair of adjacent racks. The cross-spanning member reliably serves as a prop to secure the predetermined passage width. Even when each rack moves due to slippage between the wheels thereof and the rail, the predetermined passage width can of course be secured. Thus, the present invention can largely improve the reliability in terms of security of a passage having the predetermined width. Further, since the cross-spanning member spans between the respective upper ends of each pair of adjacent racks, the cross-spanning member does not hinder an operator from coming in and going out of the passage thereby

ensuring refuge. Additionally, the safety mechanism of the invention can be used as a locking device for securing a passage width in an ordinary operation of the rack unit as well as in case of emergency.

Preferably, the safety mechanism is constructed such that the locking means as released from the operating condition by the unlocking means is adapted to assume a stand-by condition by moving each rack so as to make the passage narrower than the predetermined passage width, whereby the locking means is necessarily automatically actuated without requiring any special operation to be performed by the operator for actuation of the locking means every time the passage is opened.

In one specific embodiment having a simplified construction for easy practice, the cross-spanning member comprises a pair of link elements each having one end rotatably connected to one end of a counterpart link element and other end rotatably connected to the upper end of a corresponding one of the adjacent racks, and the locking means functions to inhibit relative rotation of the link members thereby inhibiting the cross-spanning member to deform.

If such a cross-spanning member is constructed so that the link elements are aligned linearly when the passage has the predetermined width, the link elements may fail to rotate relative to each other when the passage is to be made narrower than the predetermined width thereby hindering the racks from

moving. To assuredly avoid such an inconvenience, it is desirable that the link elements should form a widely open V-configuration when the width of the passage is equal to the predetermined width.

For realization of the safety mechanism of a simple construction with a lower part count, it is desirable that: the locking means should comprise an engaging member provided on one link element and movable between an engaging position where the engaging member is engageable with the other link element and a non-engaging position where the engaging member is incapable of engaging the other link, and an elastic biasing member elastically biasing the engaging member toward the engaging position; and the unlocking means should comprise a fixing element for causing the engaging member in the non-engaging position to assume a predetermined posture which makes the engaging member immovably fixed, and utilize the elastic biasing member of the locking means to elastically bias the engaging member into an orientation for assuming the predetermined posture.

More specifically, the locking means comprises an engaging shaft as the engaging member which is retractably and rotatably held by a retainer mounted on one of the link elements and a coil spring as the elastic biasing member elastically biasing the engaging shaft in a protruding direction, and has a function of locking the link elements to prevent them from

rotating toward each other by causing the engaging shaft as protruded into the engaging position by an expanding force of the coil spring to engage a side edge of one end of the other link element. At the same time, the unlocking means comprises an engaging element provided on the engaging shaft and a fixing element provided on the retainer, is capable of inhibiting the engaging shaft to protrude by rotating the engaging shaft through a predetermined angle at a retracted position as the non-engaging position where the engaging shaft fails to inhibit relative rotation of the link elements to bring the engaging element and the fixing element into engagement with each other, and utilizes a torsional moment of the coil spring to bias the engaging shaft for rotation toward a direction such as to allow engagement between the engaging element and fixing element.

A feature such that the unlocking means is operable by means of a string member dangling substantially centrally of the width of the passage, is preferable since the operator going out of the passage, for example, after having finished any operation is assuredly reminded of an unlocking operation to be performed.

In a particularly preferred embodiment applicable to an electrically-driven rack unit, the cross-spanning member defines therein a wiring space for accommodating an electrical cable or the like.

#### EMBODIMENT

Hereinafter, one embodiment of the present invention will

be described with reference to the drawings.

Referring to Fig. 1, a movable rack unit 1 according to the embodiment of the present invention includes a plurality of racks 2 on a plurality of rails R disposed parallel on a floor surface. The movable rack unit 1 is constructed so that any desired pair of racks 2 can define therebetween a passage S extending perpendicular to the rails R by moving these racks 2. It should be noted that although this embodiment to be described is directed to an electrically-driven rack unit incorporating an electric motor therein, this embodiment is applicable to a hand-operated rack unit which is operable by means of a handle or by being pushed by hand.

Each rack 2 comprises a bottom plate portion 21, a top plate 25, opposite side plates 22, and a plurality of shelf plates 24. Though not shown, the bottom plate portion 21 comprises a bottom frame member as an outer frame, and a plurality of reinforcing members spanning over the bottom frame member along the rails R and attached with wheels rolling on the rails R. A plurality of equidistantly-spaced upright struts are disposed as interconnecting the top plate 25 and the bottom plate portion 21 at respective front edges and rear edges thereof. Each strut 26 is a hollow square pipe having a multiplicity of horizontally extending hooking holes (not shown) for allowing each shelf plate 24 to be mounted at a desired height selectively. The opposite side plates 22 are disposed to cover the struts standing in the

corners of the bottom plate portion 21 from the laterally outside and attached with a rubber member 221 extending vertically over each side edge of the side plates 22 for protecting a finger from being caught by the racks. Each shelf plate 24 is in the form of a thin box having an open bottom and is mounted by engaging hooks (not shown) provided on opposite edges thereof with the corresponding hooking holes of the struts.

The rack unit 1 of this embodiment is provided with a safety mechanism comprising a cross-spanning member 3 spanning between respective upper ends of each pair of adjacent racks 2 which is deformable or movable following a change in the width of a passage defined between the adjacent racks 2 while maintaining the spanning condition thereof, locking means 4 actuated when the passage S reaches a predetermined width H by a movement of the racks 2 for inhibiting the cross-spanning member to deform thereby restraining the passage from narrowing, and unlocking means 5 for releasing the locking means 5 from the operating condition thereof.

As shown in Figs. 2 to 7, the cross-spanning member 3 comprises a pair of link elements 31 and 32 mainly composed of channel members 31b and 32b, respectively, each having open top. One end portion 31a of the link element 31 is generally shaped into a disk, while one end portion 32a of the link element 32 is shaped into a plate having a smaller area than the one end portion 31a of the link element 31. The end portion 32a of the

link element 32 is superposed on the end portion 31a of the link element 31, and they are coupled to each other by means of a pin 33 for horizontal rotation. Other end portions 31c and 32c of the link elements 31 and 32 are respectively connected to corresponding top plates 25 of the adjacent racks 2 for horizontal rotation. Use of the channel members 31b and 32b as major components of the link elements 31 and 32 ensures a sufficient strength with a lighter weight while making it possible to utilize the space defined by the bottom wall and side walls of each channel member as a wiring accommodating space P.

When the adjacent racks 2 abut each other and does not define the passage S therebetween, the cross-spanning member 3 is inwardly folded into a closed configuration in plan view as shown in Fig. 2. On the other hand, when the passage S is defined to have a width equal to the predetermined width H, the cross-spanning member 3 is inwardly bent into a widely open V configuration in plan view, or an open configuration in which the angle defined between the link elements 31 and 32 is larger than the closed configuration as shown in Figs. 3 and 4.

As shown in Figs. 8 and 9, the locking means 4 comprises a retainer 41 attached to the underside of the one end portion 31a of the link element 31 located under the link element 32, an engaging shaft 42 vertically movably held by the retainer 41, a coil spring 43 elastically biasing the engaging shaft 42 in a protruding direction, and a through-hole 42a defined in one end

portion 31a of the link element 31 for allowing the engaging shaft 42 to be inserted therethrough. By causing the engaging shaft 42 protruding upward through the through-hole 42a to abut the other link 32, the link elements 31 and 32 are locked so as not to rotate in a direction such that the angle defined therebetween becomes smaller, thereby preventing the passage width from becoming narrower than the predetermined width H.

In more detail, the retainer 41 of the locking means 4 comprises a cylindrical retainer body 411 having a closed bottom, a collar portion 413 formed integrally with the retainer body 411 at the top end thereof, and a lid member 412 secured to the top end of the retainer body 411 by screws and closing the open top of the retainer body 411.

The engaging shaft 42 is held at its opposite ends by insertion holes 414 and 415 which are defined by the lid member 412 of the retainer 41 and by the bottom plate of the retainer body 411, respectively, and is retractable between a protruded position in which the top end of the engaging shaft 42 protrudes from the upper side of the lid member 412 and a retracted position in which the top end of the engaging shaft 42 is retracted into the retainer 41.

The coil spring 43 is mounted on the engaging shaft 42 as wrapping therearound. More specifically, the coil spring has one end secured to a fixing pin 52 radially attached to an intermediate portion of the engaging shaft 42 and the other end

secured to the bottom plate of the retainer 41. The coil spring 43 elastically biases the engaging shaft 42 toward the protruded position by its expanding force.

The through-hole 42a is substantially equal in diameter to the engaging shaft 42 and is defined in the one end portion 31a of the link element 31 at a lateral location adjacent the forward end thereof. More specifically, the through-hole 42a is located in a portion which does not overlap the one end portion 32a of the link element 32 when the cross-spanning member 3 is opened as shown in Figs. 3 and 4 and which at least partially overlaps the one end portion 32a of the link element 32 when the cross-spanning member 3 is either opened or in an intermediate position between the open position and the closed position.

That is, when the cross-spanning member 3 is in such an intermediate position between the closed position and the open position, the locking means 4 assumes a stand-by condition where the engaging shaft 42 is prevented from protruding since the top end of the engaging shaft 42 is restrained by the underside of the link element 32. When the cross-spanning member 3 is in the open position, the locking means 4 assumes a locking condition where the engaging shaft 42 protrudes upward to engage a side edge 32d of the one end portion 32a of the link element 32 as shown in Fig. 8, thereby inhibiting the link element 32 to rotate toward the closed position.

As shown in Figs. 8 to 11, the unlocking means 5 is

adapted to fix the engaging shaft 42 forming the locking means 4 in the retracted position thereby to inhibit the locking action of the engaging shaft 42, and comprises a fixing pin 52 as an engaging element provided on the engaging shaft 42, a downwardly oriented surface 53 as a fixing element which is capable of fixingly engaging the fixing pin 52 when the engaging shaft 42 is in the retracted position, an elastic biasing member elastically biasing the engaging shaft 42 into rotation such as to cause the fixing pin 52 to engage the downwardly oriented surface 53, and a string member 51 as an operating part for operating the unlocking means 5.

Specific parts of the unlocking means 5 are as follows. The fixing pin 52 is a cylindrical member attached to the aforementioned intermediate portion of the engaging shaft 42 as extending perpendicular to the axis of the engaging shaft 42 by force fit or the like.

The downwardly oriented surface 53 is formed of lower surfaces of a pair of protruding bodies 53A protruding from the underside of the lid member 412. These protruding bodies 53A are disposed symmetrically about the center of the lid member 412.

The coil spring 43 forming part of the locking means 4 serves also as the elastic biasing member. Since the coil spring 43 is fixed to the fixing pin 52 at one end thereof and to the bottom plate of the retainer 41 at the other end thereof, the

torsional moment of the coil spring 43 provides the engaging shaft 42 with a rotational force.

The string member 51 is attached to the lower end of the engaging shaft 42 and allows the engaging shaft 42 to be retracted into the retracted position when pulled.

When the string member 51 is pulled to cause the engaging shaft 42 to assume the retracted position, the coil spring 43 rotates the engaging shaft 42, so that the fixing pin 52 engages the downwardly oriented surface 53 of the protruding bodies 53A to prevent the engaging shaft 42 from protruding. It is to be noted that the downwardly oriented surface 53A of the protruding bodies 53A is provided with a stopper pin 531 to stop too much rotation of the engaging shaft 42 caused by the torsional moment of the coil spring 43.

This embodiment is further provided with returning means 6 for returning the locking means 4 as unlocked by the unlocking means 5 into the stand-by condition.

The returning means 6 comprises an arm 61 mounted on a lower end portion of the engaging shaft 42, and a biasing member 62 mounted on the other link element 32 for biasing the arm 61.

The arm 61 is a circular rod extending horizontally as crossing perpendicular to the engaging shaft 42.

The biasing member 62 is an elongate member extending downwardly from the one end portion 32a of the link element 32 and comes to abut the arm 61 when the link element 32 is rotated

from the open position toward the closed position, thereby causing the engaging shaft 42 to rotate in a direction such as to release the engagement between the fixing pin 52 and the downwardly oriented surface 53 of the protruding bodies 53A.

The operation and handling of the safety device according to this embodiment are as follows.

When the passage S is not defined between adjacent racks 2, the cross-spanning member 3 is in the closed position as shown in Fig. 2 and the locking means 4 is in the stand-by condition in which the engaging shaft 42 is restrained at its upper end by the underside of the one end portion 32a of the link element 32 and hence is prevented from protruding. Thus, these racks 2 are not prevented from moving.

When one of these racks 2 is moved to define the passage S therebetween and the width of the passage S reaches the predetermined width H, the cross-spanning member 3 assumes the open position and the one end portion 32a of the link element 32 comes out of the position above the engaging shaft 42. As a result, the engaging shaft 42 is caused to protrude by the expanding force of the coil spring 43 and engage the side edge of the one end portion 32a of the link element 32, so that the locking condition shown in Figs. 3, 8 and 10, i.e., the condition where the link element 32 is inhibited to rotate toward the closed position, is assumed. In this condition, the cross-spanning member 3 is prevented from deforming by the locking means 4

and hence serves as a prop by which the adjacent racks 2 cannot move in a direction to narrow the passage S.

When, for example, the operator goes out of the passage S thus defined after having finished required operations therein, the operator pulls the string member 51 to cause the engaging shaft 42 to assume the retracted position. Since the string member 51 dangles centrally of the entrance of the passage S, it effectively reminds the operator to pull the string member 51. Pulling the string member 51 causes the unlocking means 5 to be actuated thereby releasing the safety mechanism from the locking condition, as shown in Figs. 4, 9 and 11. Specifically, the engaging shaft 42 is rotated by the torsional moment of the coil spring 43, so that the fixing pin 52 comes to engage the downwardly oriented surface 53 of the protruding bodies to prevent the engaging shaft 42 from protruding. Thus, the link elements 31 and 32 become rotatable relative to each other again and hence allow relative movement of the adjacent racks.

Thereafter, when the operator moves the racks 2 in a direction to narrow the passage S in order to open a passage S between another pair of racks 2, for example, the link elements 31 and 32 rotate to approach each other, and in response thereto, the biasing member 62 comes to abut the arm 61 located on the lower end portion of the engaging shaft 42, thus causing the engaging shaft 42 to rotate in a direction to release the engagement between the fixing pin 52 and the downwardly

oriented surface 53 of the protruding bodies 53A against the torsional moment of the coil spring 43. Upon disengagement between the fixing pin 52 and the downwardly oriented surface 53 of the protruding bodies 53A, the engaging shaft 42 is urged toward the protruded position by the expanding force of the coil spring 43. In this state, however, the engaging shaft 42 protrudes only slightly since the top end of the engaging shaft 42 is restrained by the one end portion 32a of the link element 32, as shown in Fig. 6. Thus, the locking means 4 assumes the stand-by condition.

With the safety mechanism thus constructed according to this embodiment, the cross-spanning member 3 is disposed as constantly spanning between each pair of adjacent racks 2 and hence assuredly serves as a prop to secure a passage having the predetermined width even when the racks 2 deform or move askew. It is needless to say that the predetermined width of the passage can be secured even when the racks 2 move due to slippage between the rails R and the wheels. Therefore, the invention can highly enhance the reliability of safety in terms of security of a passage having the predetermined width. Further, the cross-spanning member is disposed between the upper end portions of the racks 2 and hence fails to interfere with the operator coming in and going out of the passage S even when it works and to hinder the operator fleeing away from the passage S, and provides the rack system with good appearance.

With the prior art, it is conceivable that the safety mechanism does not work due to handling mistakes; for example, the operator forgets locking the wheels or making the elongate member to assume the horizontal position. With the embodiment of the present invention, by contrast, the locking means 4 is automatically actuated without requiring any special operation every time racks 2 that do not define a passage S are moved to define a passage S having the predetermined width H since the locking means 4 associated with racks 2 not defining the passage S is always in the stand-by condition. Thus, improved safety can be ensured.

It should be noted that the present invention is not limited to the foregoing embodiment and may be variously modified. For example, a rack system having a larger rack width may be provided a plurality of such cross-spanning members at plural locations including the location adjacent the entrance of a passage. Further, it is possible that the cross-spanning member is arranged to be slidable relative to the associated racks, while the locking means is arranged to prevent the cross-spanning member from moving relative to the racks. The unlocking means may be modified to accommodate various forms of the cross-spanning member, and it is possible to utilize an electromagnetic mechanism for the unlocking means. While the foregoing embodiment is arranged such that the locking means is automatically actuated every time the passage is opened to the

predetermined width, the locking means may be adapted for hand actuation, or a mechanism may be provided such as to allow the user to actuate the locking means either automatically or by hand according to his or her choice.

As to specific features of other parts also, the present invention is not limited to the foregoing embodiment, and various modifications and changes may be made without departing from the spirit of the invention.

According to the present invention thus described, there cannot be raised the problem essential to the prior art that the leading end of an elongate member fails to abut the corresponding strut of an adjacent rack when each rack deforms or moves askew, because the cross-spanning member is disposed as constantly spanning between each pair of adjacent racks. The cross-spanning member reliably serves as a prop to secure the predetermined passage width. Even when each rack moves due to slippage between the wheels thereof and the rail, the predetermined passage width can of course be secured. Thus, the present invention can largely improve the reliability in terms of security of a passage having the predetermined width as compared with the prior art. Further, since the cross-spanning member spans between the respective upper ends of each pair of adjacent racks, the cross-spanning member does not hinder an operator from coming in and going out of the passage thereby ensuring refuge.

If the safety mechanism is constructed such that the locking means as unlocked by the unlocking means is made to assume the stand-by condition by moving each rack so as to make the passage narrower than the predetermined passage width, the locking means is necessarily automatically actuated every time the passage is opened. Since such an automatic actuation requires no special operation to be performed by the operator for actuation of the locking means, such an inconvenience as to failure to actuate the locking means due to any missing operation can be avoided, thus ensuring further improved safety.

If the cross-spanning member comprises a pair of link elements each having one end rotatably connected to one end of a counterpart link element and other end rotatably connected to the upper end of a corresponding one of the adjacent racks, and the locking means functions to inhibit relative rotation of these link members thereby inhibiting the cross-spanning member to deform, the safety mechanism of a simplified construction for easy practice can be realized.

If such a cross-spanning member is arranged so that the link elements are aligned linearly when the passage has the predetermined width, the link elements may fail to rotate relative to each other when the passage is to be made narrower than the predetermined width, thereby hindering the racks from moving. Such an inconvenience can assuredly be avoided, if the link elements form a widely open V-configuration when the

passage opens to the predetermined width.

If the safety mechanism is of such an arrangement wherein: the locking means comprises an engaging shaft retractably and rotatably held by a retainer mounted on one link element and a coil spring elastically biasing the engaging shaft in a protruding direction and has a locking function such as to prevent the link elements to rotate toward each other by causing the engaging shaft as protruded by the expanding force of the coil spring to engage the other link element; and the unlocking means comprises an engaging element provided on the engaging shaft and a fixing element provided on the retainer, is capable of inhibiting the engaging shaft from protruding by rotating the engaging shaft through a predetermined angle in a retracted position where relative rotation of the link elements is not inhibited, and utilizes a torsional moment of the coil spring to bias the engaging shaft for rotation in a direction to achieve engagement between the engaging element and the fixing element, the locking means and the unlocking means use common components, thereby contributing to simplification of the structure with a lower part count.

If the unlocking means is operable by means of a string member dangling substantially centrally of the width of the passage, the operator going out of the passage, for example, after having finished any operation can effectively be reminded of an unlocking operation to be performed.

If the cross-spanning member defines therein a wiring space for accommodating an electrical cable or the like, wiring to each rack of an electrically-driven rack system can advantageously be achieved without need of providing any special wiring system.



What is claimed is:

1. A safety mechanism applicable to a movable rack unit in which a plurality of racks are movable on a rail for preventing a passage defined between any pair of adjacent racks from becoming narrower than a predetermined width, the safety mechanism comprising:

a cross-spanning member spanning between respective upper ends of a pair of adjacent racks which is deformable or movable following a change in the width of a passage defined between the adjacent racks due to movement of the adjacent racks while maintaining the spanning condition thereof between the respective upper ends of the adjacent racks;

locking means, operable when the width of the passage is equal to the predetermined width, for inhibiting a deformation or movement of the cross-spanning member; and

unlocking means for releasing the locking means from an operating condition thereof.

2. A safety mechanism as set forth in claim 1, wherein the locking means as released from the operating condition by the unlocking means is adapted to assume a stand-by condition by moving each rack so as to make the passage narrower than the predetermined passage width.

3. A safety mechanism as set forth in claim 1 or claim 2,



wherein: the cross-spanning member comprises a pair of link elements each having one end rotatably connected to one end of a counterpart link element and other end rotatably connected to the upper end of a corresponding one of the adjacent racks; and the locking means functions to inhibit relative rotation of the link members thereby inhibiting a deformation of the cross-spanning member.

4. A safety mechanism as set forth in claim 3, wherein the cross-spanning member is arranged such that the link elements form a widely open V-configuration when the width of the passage is equal to the predetermined width.

5. A safety mechanism as set forth in claim 3 or claim 4, wherein: the locking means comprises an engaging shaft which is retractably and rotatably held by a retainer mounted on one of the link elements and a coil spring elastically biasing the engaging shaft in a protruding direction, and has a function of locking the link elements to prevent them from rotating toward each other by causing the engaging shaft as protruded by an expanding force of the coil spring to engage the other link element; and

the unlocking means comprises an engaging element provided on the engaging shaft and a fixing element provided on the retainer, is capable of inhibiting the engaging shaft to



protrude by rotating the engaging shaft through a predetermined angle at a retracted position where the engaging shaft fails to inhibit relative rotation of the link elements to bring the engaging element and the fixing element into engagement with each other, and utilizes a torsional moment of the coil spring to bias the engaging shaft for rotation toward a direction such as to allow engagement between the engaging element and fixing element.

6. A safety mechanism as set forth in any one of claims 1 to 5, wherein the unlocking means is operable by means of a string member dangling substantially centrally of the width of the passage.

7. A safety mechanism as set forth in any one of claims 1 to 6, wherein the cross-spanning member defines therein a wiring space for accommodating an electrical cable or the like.