**Title:** SAFETY SYSTEM AGAINST THE RISK OF FALLING FROM HEIGHTS FOR CONSTRUCTION WORKS

**Abstract:** The present invention relates to systems against the risk of falling from heights for construction works. The system is arranged to be mounted just after the placement of shuttering beams (16). Every subsequent works with respect to the beams placement will be performed in safety. The system comprises, at least, one support part (1) with two claws (5) for attaching to the shuttering beams (16), one mechanical safety lock (2) lengthwise adjustable, one railing support element made of a primary upright (3) with three L-shaped tabs (11) for railings support and a secondary upright (12) with a smaller cross-section which locks, inside the safety lock (2), the primary upright, adjusting it in height. The upright is fitted hi the mechanical safety lock inserting it through the upper opening of the lock plate (9) and rotating it by 90 degrees in order to fit the flaps (13) under the upper plate.
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DESCRIPTION

"SAFETY SYSTEM AGAINST THE RISK OF FALLING FROM HEIGHTS FOR CONSTRUCTION WORKS"

FIELD OF THE INVENTION

The present invention relates to protection systems for the building industry, namely systems for protection against falling from heights.

BACKGROUND OF THE INVENTION

In Portugal, the building industry is the main responsible for deaths due to accidents at work.

Considering statistical data for Portugal, there were confirmed 157 deaths in 2006 and 160 deaths in 2007.

The 2007 data shows 81 deaths in the building industry, 30 in manufacturing industry, 22 in commerce and services, 14 in agriculture and the remaining divided by all of the other activity sectors. Forty seven out of eighty one deaths in the construction sector were due to falling from heights, eight due to electrocution and the remaining due to burying, collision with objects, crushing, run over by operating equipment and asphyxia.

Thus, it is crucial to develop new working methods, new techniques and new systems for protection against the risk of falling from heights which is the cause of the higher number of deaths.
Certain construction works are more favourable to this kind of accidents because they take place in high risk areas. Upper floor slab edges, pier and/or facade beam moulding, upper floor slab shuttering, are some of the most dangerous areas for workers. Usually these works are done and supported on weak frames and during the mounting stage, which raises the risk of accidents to occur. In addition to this risk factor, the fact the frames are fragile and are in assembly stage prevent the attachment of efficient safety systems or cause its constant mounting/dismounting which significantly decrease its advantage as safety system.

Currently, the protection systems of workers in works having the risk of falling from heights are: the anti-fall net; facade scaffold; railings and life lines with harnesses.

The anti-fall net is a system which shows deficiencies related to a correct use at work. It is a big size and weight system which does not allows for a resistance test, because if a body falls thereon its strength becomes weakened. Thus, it does not assure protection against a next fall. In addition, in order to assure the quality and safety the net needs to be replaced annually, as the sunlight also decreases its strength.

Facade scaffolds are a high cost option, because the system remains stationary at the workplace. It has problems with respect to weather - dynamic loads from wind and rain, its high weight could prevent its installation in certain places and gathers debris during the work, which raises the maintenance cost and its weight.

Railings have several deficiencies. They need to be attached in the working areas, which sometimes prevent the normal running of the work. Therefore they are removed, loosing the possibility of exerting its function and ceasing the workers protection. In addition, the available railing models do not present a system which allows for height adjustment. Thus, when attached in the shuttering stage, after the slab concreting, its height is not that required by law as it is attached at a lower height.
As opposed to prior systems, which are collective protection systems, the life lines and harnesses are individual protection systems. The general prevention principles for professional risks define that collective protection must be preferred in relation to individual protection. Its mounting at work presents several problems. It has to be mounted by a certified company which, in turn, certifies the line. At the shuttering stage there are no attaching points for tying the life line therein. Each floor transition causes the dismounting of the line and a new mounting on the upper floor. The workers are forced to use the harness.

The present invention is a system for collective protection against the risk of falling from heights, for construction works, which overcomes the above-mentioned problems by allowing a releasable and safe placement and having adaptability features that guarantees safety to the workers whatever the work conditions are.

Thus, the safety system of the present invention will provide a substantial increase in worker protection lifetime, productivity increase due to lower number to mounting/dismounting operations, adaptability to different heights of slab and adaptability to different pier cross-sections allowing keeping the required height of the railings in all the work stages. Its mounting avoids other protection means, which increase the profitability of work, and is adapted to different construction processes.

SUMMARY OF THE INVENTION

The present invention discloses a safety system against the risk of falling from heights for construction works, characterized by comprising:

- at least one horizontal support part made of at least one frame having tops, and attaching means on at least one of its tops; and at least one mechanical safety lock comprising at least one integral fitting member,
• at least one railing support vertical element, made of at least one primary upright and at least one secondary upright, the primary upright, having at least one railing fastening means,

wherein

said attaching means of said support part are arranged for attaching to shuttering beams or to floor crossbars in order to prevent said support part to move outward and/or upwards, in use,

said fitting member of said mechanical safety lock, is arranged to receive and lock said railing support element while keep it upwards,

said primary upright and said secondary upright are connected to each other in order to form a railing support unitary element,

the railing support element is fixedly but releasably connected to the mechanical safety lock by means of said secondary upright.

In an embodiment of the invention, the safety system is characterized by comprising at least two said parallel frames joined at said tops (15) by joining elements.

In another embodiment, the safety system is characterized by the attaching means being lengthwise and crosswise adjustable in relation to said horizontal support part, allowing matching to various cross-sections and/or distances between shuttering beams or floor crossbars.

In still other embodiment, the safety system is characterized by the attaching means being attaching claws.
In yet other embodiment, the safety system is characterized by said mechanical safety lock being lengthwise adjustable in relation to the horizontal support part, allowing to approach or drive railings away without the need to remove them.

In still another embodiment, the safety system of the present invention is characterized by said mechanical safety lock being made of at least two, upper and lower, horizontal plates joined by at least two vertical plates forming two U-shaped horizontal openings, said upper horizontal plate having one opening and said lower horizontal plate having said integral fitting member.

In a further embodiment, the safety system is characterized by said mechanical safety lock being connected to said support part by means of fitting said U-shaped horizontal openings of lock on parallel frames of part.

In a still further embodiment, the safety system is characterized by said fitting member receiving and locking said railing support element by means of a male-female type fitting.

In a further embodiment, the safety system of the invention is characterized by said railing support vertical element being height adjustable.

In a yet other embodiment, the safety system is characterized by said at least one primary upright and at least one secondary upright being connected in a telescopic way.

In a still yet other embodiment, the safety system of the present invention is characterized by the cross-section of said secondary upright being smaller than that of the primary upright.

In still another embodiment, the safety system of the invention is characterized by said at least one secondary upright being crosswise perforated along its height, allowing locking said at least one primary upright by means of a stud with a safety tab.
In another embodiment, the safety system of the invention is characterized by said secondary upright having at its base at least one frontal flap and at least one rear flap arranged to block the railing support vertical element at the safety lock part after fitting therein.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is hereinafter described with detail by way of example without limitative purposes, in the accompanying drawings, in which:

- Fig. 1 is a schematic representation of a preferred embodiment of the system of the present invention;

- Fig. 2 is a representation of a support part, with a mechanical safety lock and claws for engagement to the shuttering beams or the like;

- Fig. 3 is a representation of a preferred mechanical safety lock of the invention;

- Fig. 4 is a representation of the primary and secondary uprights;

- Fig. 5 is a schematic representation of the operation of primary and secondary uprights, which are fitted and adjusted in height by means of a crosswise stud with a safety tab;

- Fig. 6 is a representation of a preferred system of the present invention, mounted at work, and in the stage it should be installed, showing the distance caused by adjustment of the mechanical safety lock in relation to the vertical plane of the works to be performed;
- Fig. 7 is a representation of the operation of a mechanical safety lock in the support of the invention and of the locking of a secondary upright in the support by means of said mechanical safety lock;

- Fig. 8 represents a different perspective of fig. 7;

- Fig. 9 represents an alternative embodiment for attachment and support of the uprights.

DETAILED DESCRIPTION OF THE INVENTION

The system of the present invention is particularly suited to be mounted at the start of the upper floor shuttering works. The shuttering works comprise several stages in which the risk of falling is permanent. The first stage comprises the placement of support beams 16 of the upper floor shuttering frame. Wood beams or the like are fixed between several piers which are part of the building frame. This work is performed with workers being in a protected state in the finished floor. After the placement of the beams 16, the worker climbs the beam, where he will attach wood crossbars which will be used as a support for the bottom of the concrete beams or slab. These works are usually performed without protection against the risk of falling from heights or, if not, the used protection shows the above-mentioned deficiencies with respect to the chosen system.

The advantage of the present invention is that, contrary to other systems, it allows for a mounting of the railings collective protection at the stage the beams 16 are attached between the piers, because the system is ready to be attached to the shuttering beams 16 or the like, by means of its own adjustable fitting.

In addition to the advantage in relation to the start time of the works, protecting the workers since the very beginning, the system allows for an adjustment of the distance from the
railings to the vertical plane of works. This allows the work at the slab edges to be performed with the workers suitably protected and without the need for removing the protections, as otherwise happens with systems which are mounted in the edge of slab.

Other advantage is the fact that at least one railing support vertical element is height adjustable, which allows to meet the yard safety law, even when its support is mounted under the working plan. The vertical element is made of 2 uprights; the primary 3 comprising at least one railing fastening means 11; and the secondary 12. These uprights 3, 12 form a unitary part.

The system according to the present invention comprises one horizontal support part 1 which may be made of only one frame, but it is usually made of at least two parallel frames which are transversally joined at its tops 15 by joining elements. Support part 1 has attaching means 5 at least in one of tops 15, either it is formed by one or more of said frames and has at least one mechanical safety lock 2, fixed or moving, which comprises, in turn, at least one integral fitting member 10.

The attaching means 5 of said support part 1 are arranged for attaching on the shuttering beams 16 or floor crossbars 18 so as to prevent said support part 1 to move outward and/or upwards, in use.

With respect to fitting member 10, it is arranged to receive and lock said railing support element, namely said secondary upright 12, while keeping the latter upwards. The connection between secondary upright 12 and the fitting member 10 should be releasable.

Thus, the system of the present invention is a mechanical system designed for protection against the risk of falling from heights for construction works, particularly in stages including moulding works and concrete shuttering; concreting; moulding and shuttering of concrete elements at the slab edge or the like; raising of masonry walls, etc.
PREFERRED EMBODIMENTS OF THE INVENTION

In Figures 1 to 8 one preferred embodiment of system of the present invention is represented. Thus, the system comprises one horizontal support part 1 made of two parallel frames (Fig. 1 and 2), being supported by two parallel and level beams 16 from the shuttering (Fig. 6) and attached in the latter by means of two claws 5 attached in one base 15 thereof. Claws 5 embrace the inside beam 16 so as to prevent the system to move outward and/or upwards. The claws 5 are adjustable, allowing them to match to several sizes and types of beam cross-section 16 or the like. The support part 1 further comprises one mechanical safety lock 2 for blocking one railing support vertical element which, in turn, is made of one primary upright 3 e one secondary upright 12.

The mechanical safety lock 2 is fitted and slides in the interior of the horizontal support part 1 (Fig2), being lengthwise adjustable with respect to the support part 1 so as to drive away the railings from the works to be performed without requiring to remove the protections.

The operation principle of the mechanical safety lock 2 is that of male/female type fitting. In Fig. 3, it may be seen the preferred mechanical safety lock 2 which comprises two horizontal and metal plates 6, parallel to each other, joined by two vertical plates 8. The assembly of these plates 6, 8 provides two U-shaped horizontal openings which can be fitted in the parallel frames of the support part 1, acting as guides therein. The upper plate 6 has an opening 9 and the lower plate 6 has a fitting tube 10. The opening 9 of the upper plate 6 allows the reception of said secondary upright 12 with respective flaps 13 deflected by 90 degrees in relation to the final working position. The fitting tube 10 attached to the lower plate 6 of the lock 2 receives a rod 14 of the secondary upright 12 while acting as a stop, and level the secondary upright 12 so as to remain blocked inside the mechanical safety lock 2. After inserting into safety lock 2, the secondary upright 12 should rotate by 90 degrees in order to achieve its final working position. At this position, said flaps 13 of secondary upright 12 will remain under the upper plate 6 of the mechanical safety lock 2, thereby prevent the railing
support vertical element to fall or move out from its suitable working position. The fitting tube 10 acts as a stop with respect to the secondary upright 12, while keeping the latter upwards.

The figures 4 and 5 show primary and secondary uprights 3, 12. These uprights 3, 12 are designed to be telescopically connected. The secondary upright 12 which fits into safety lock 2, has crosswise perforations at certain heights so as to allow the height adjustment and the fastening of the primary upright 3 by means of a stud 15 with safety tab. The primary upright 3 has an opening at its base which enables fitting the lower cross-section secondary upright 12, allowing its blocking in a proper position and height for a suitable protection of the workers. In addition, primary upright 3 is the part which supports and retains the railings by means of three L-shaped tabs 11.

Fig. 9 shows another embodiment of the invention, wherein the only difference with respect to above is the horizontal support part which, in this case, is an alternate support part 19 of the uprights, having attaching means 5 in both tops so that they extend under the floor crossbars 18 while keep the part 19 attached thereon. The arrangement by which the crossbars 18 are perpendicularly attached to the shuttering beams 16, allows the mechanical safety lock 2 being fixedly integrated in the support part 19, as in this case is the support part 19 itself that moves on said floor crossbars 18. With respect to the remaining parts, this system is similar to the preceding embodiment.

The system for protection of the present invention is able to be modified by a person skilled in the art, without, however, departing from the scope of the appended claims. As above-mentioned the system may have several adjustments, namely the attaching claws can be adjusted in relation to the shuttering beams or the like so as to allow fitting and attachment in beams with different sections and/or distance between them, depending on the cross-section of the construction structural piers. The mechanical safety lock may run along the support part, allowing adjustment in relation to the moulded beam and/or drive away the protections from the works to be performed without removing them, which allows the works to continue in safety. The uprights assembly allows for height adjustment so as to compensate the lower
height at which is mounted. Shuttering works are moulding works in order to apply concrete. The height adjustment of the uprights enables the system, when attached to the shuttering and after concreting, to achieve the railing height required by current construction safety laws.
1. A safety system against the risk of falling from heights for construction works, characterized by comprising:

- at least one horizontal support part (1) made of at least one frame having tops (15), and attaching means (5) on at least one of its tops (15); and at least one mechanical safety lock (2) comprising at least one integral fitting member (10),

- at least one railing support vertical element, made of at least one primary upright (3) and at least one secondary upright (12), the primary upright (3), having at least one railing fastening means (11),

wherein

said attaching means (5) of said support part (1) are arranged for attaching to shuttering beams (16) or to floor crossbars (18) in order to prevent said support part (1) to move outward and/or upwards, in use,

said fitting member (10) of said mechanical safety lock (2), is arranged to receive and lock said railing support element while keep it upwards,

said primary upright (3) and said secondary upright (12) are connected to each other in order to form a railing support unitary element,

the railing support element is fixedly but releasably connected to the mechanical safety lock (2) by means of said secondary upright (12).
2. A safety system according to claim 1, characterized by comprising at least two said parallel frames joined at said tops (15) by joining elements.

3. A safety system according to claims 1 and 2, characterized by the attaching means (5) being lengthwise and crosswise adjustable in relation to said horizontal support part (1), allowing matching to various cross-sections and/or distances between shuttering beams (16) or floor crossbars (18).

4. A safety system according to claims 1 to 3, characterized by the attaching means (5) being attaching claws.

5. A safety system according to claims 1 and 2, characterized by said mechanical safety lock (2) being lengthwise adjustable in relation to the horizontal support part (1), allowing to approach or drive railings away without the need to remove them.

6. A safety system according to claim 1, characterized by said mechanical safety lock (2) being made of at least two, upper and lower, horizontal plates (6) joined by at least two vertical plates (8) forming two U-shaped horizontal openings, said upper horizontal plate (6) having one opening (9) and said lower horizontal plate (6) having said integral fitting member (10).

7. A safety system according to claims 5 and 6, characterized by said mechanical safety lock (2) being connected to said support part (1) by means of fitting said U-shaped horizontal openings of lock (2) on parallel frames of part (1).

8. A safety system according to preceding claims, characterized by said fitting member (10) receiving and locking said railing support element by means of a male-female type fitting.
9. A safety system according to claim 1, characterized by said railing support vertical element being height adjustable.

10. A safety system according to claims 1 and 9, characterized by said at least one primary upright (3) and at least one secondary upright (12) being connected in a telescopic way.

11. A safety system according to preceding claim, characterized by the cross-section of said secondary upright (12) being smaller than that of the primary upright (3).

12. A safety system according to claims 10 and 11, characterized by said at least one secondary upright (12) being crosswise perforated along its height, allowing locking said at least one primary upright (3) by means of a stud (15) with a safety tab.

13. A safety system according to claims 1 and 8 to 12, characterized by said secondary upright (12) having at its base (13) at least one frontal flap and at least one rear flap arranged to block the railing support vertical element at the safety lock part (2) after fitting therein.
A. CLASSIFICATION OF SUBJECT MATTER

INV. E04G21/32

According to International Patent Classification (IPC) or to both national classification and IPC

B. RELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E04G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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See patent family annex.

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Name and mailing address of the ISA:
European Patent Office, P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer
Andlauer, Dominique
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