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(54) Building safety system

(57) A method of protecting workers on elevated portions of a building comprises providing inflated bag means (10) in the interior of the building or parts thereof and/or adjacent the outside of the building or parts thereof. An air pump (11) inflates bag means (10) to provide a substantially level surface to cushion a worker falling thereon. The bag means (10) comprises a rectangular bag (10) having internal dividers (23,24) and valves (25) for controllably coupling the segments (20,21,22) together. The bag (10), or the segments (20,21,22) thereof, preferably has Internal bracing (27) for shape control. The bags (10) may be coupled together by means of pneumatic coupling means (30) and mechanical linking means (31,36,37). A cover covers the coupled bags (10). Alarm means for indicating over- and/or under-pressure may be provided.

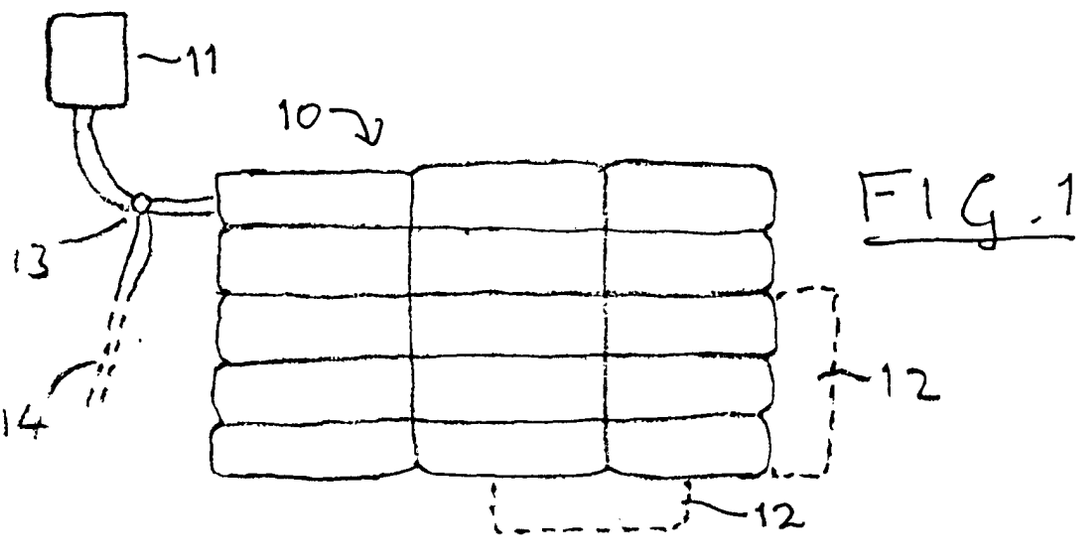

FIG. 1

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Description

[0001] The present invention relates to building safety systems, and more particularly to safety systems for protecting workers working at elevated heights.

[0002] When a brick or similar building such as a house is being built, the walls are built course by course. Scaffolding is normally erected around the outside of the building, and its height is raised as the construction of the building progresses. This scaffolding provides a reasonably sound work surface on which the workers can operate, and safety devices such as rails can be included fairly easily.

[0003] However, internal walls and floors also have to be installed. Joists for internal floors are normally installed as their heights are reached, and internal walls are constructed generally somewhat after the internal floors. There is therefore a danger of workers felling in the interior of the building. Scaffolding is not normally erected in the interior of the building, because of the complexities of constructing the internal floors and walls if scaffolding is present and the difficulties of removing such scaffolding without damage as the internal floors and walls and other fittings are installed. Further, falls from even relatively modest heights onto scaffolding, or the relatively rigid planking which scaffolding supports, can themselves be dangerous.

[0004] The main object of the present invention is to provide a safety device which reduces the risk of injury from falls inside a building being constructed.

[0005] According to one aspect, the invention provides safety apparatus for use in building construction comprising pump means and bag means inflatable thereby to provide a substantially level surface to cushion a worker falling thereon.

[0006] Preferably the bag means comprises a rectangular bag having internal dividers and valve means for controllably coupling the segments together. The bag, or the segments thereof, preferably has internal bracing for shape control.

[0007] Means for coupling bags together are preferably provided, such means comprising pneumatic coupling means and mechanical linking means. The device preferably also has cover means for covering the coupled bags.

[0008] Alarm means for indicating over- and/or under-pressure may be provided.

[0009] It will be realized that this device can also be used in other situations, eg the maintenance or repair of the interiors of buildings, or even adjacent to the outside of buildings and similar structures.

[0010] According to another aspect, the invention provides a method of protecting workers on elevated portions of a building comprising providing inflated bag means in the interior of the building or parts thereof and/or adjacent the outside of the building or parts thereof.

[0011] Further features of the invention will become apparent from the following detailed description of a safety device embodying the invention and various modifications thereof, given by way of example and with reference to the drawings, in which:

Fig. 1 is a top view of a bag together with associated components;

Fig. 2 is a partial sectional perspective view of the bag; and

Fig. 3 is a perspective view of a second form of bag.

[0012] Referring to Fig. 1, the device comprises an inflatable bag 10 which is fed by an air pump 11. The bag is primarily intended for use in the interior of partially built buildings, where it will placed in a room which is defined by partially or fully built walls. A ground sheet of protective material is preferably first laid over the floor of the room, to protect the bag from damage (eg abrasion) from roughnesses on the floor, articles on the floor, small projections through the floor, etc, and the bag is laid out in the room in the deflated condition. The pump 11 is then connected to the bag, which is thereby inflated. A cover sheet is preferably placed over the bag, either before or after inflation.

[0013] The bag has a height of around 1.5 m when inflated. If a worker working on the building in the region above the bag should accidentally fall, they will land on the bag, which will cushion their fall and reduce or prevent injury. The bag will typically be inflated to a pressure of a few psi (20 kPa), preferably 1-2 psi (20-40 kPa). This is somewhat greater than required to ensure virtually no injury to a worker falling from a height of a few metres and landing flat (prone or supine), and should largely ensure safety for workers falling awkwardly (eg at awkward angles or head first).

[0014] The bag is not intended to be perfectly air-tight. Further, it will be liable to be damaged, eg by heavy pointed tools which may be dropped on it. After the bag has been inflated, therefore, the air pump 11 will normally be kept running permanently, to maintain the inflation of the bag. To control the forces on the walls of the room, it may be desirable to control the pressure in the bag. This may be done by manually reducing the pump speed and power once the bag reaches the intended pressure, by providing a pressure relief valve which limits the pressure, or by providing a pressure sensor which controls the pump.

[0015] If desired, further bags in other rooms may be driven from the same pump 11, by providing junctions 14 and further branches 15 in the outlet pipe from the pump. One-way valves are preferably included in the piping and/or entry points to the bags if this is done.

[0016] The size of the bag 10 can conveniently be around 5×7.5 m, and it can therefore be used in a room of up to that size. For smaller rooms, the bag can be used without change. However, using the bag in that way in a smaller room will result in the top (and bottom)

surfaces of the bag bulging greatly. This effect can be reduced by providing the bag with internal bracing elements connected between the top and bottom surfaces, but folding into substantial hills and valleys will still occur. To reduce this effect, the bag is therefore divided internally into 3 × 5 segments, as indicated. These segments are connected to each other by means of valves which can be manually opened or closed. The effective size of the bag can therefore be adjusted to match the size of the room it is to be used in.

[0017] Of course, a range of bags of smaller sizes can also be produced, for use in situations where the maximum size of the rooms to be protected are known to be substantially less than 5 × 7.5 m.

[0018] The bag is shown as divided into 3 rows of 5 segments per row. The segments are shown as all of the same size, which will therefore be around 1 × 2.5 m. It may however be desirable for the segments to be of different sizes. There may for example be a large central segment, with say 3 narrow segments of say around 0.25 m width on one side and 2 or 3 medium segments of say around 1 m width on its other side. By closing off suitable combinations of narrow and medium segments, the width of the bag may thus be adjusted in 0.25 m steps over a total range of 3 or 4 m. The bag may similarly have narrow and medium segments along its other sides to adjust its length. (This may involve further small square and rectangular segments at the corners.)

[0019] As noted above, the bag has internal vertical bracing elements in at least the larger segments, to keep its upper surface reasonably flat. This will also keep the lower surface reasonably flat. The flatness of the lower surface is not so important as the flatness of the upper surface, but both surfaces should be reasonably flat, to reduce bounce when a worker falls on the bag. These bracing elements may be in the form of sheet material (with holes cut out so that air can move freely in each segment), or straps or rope-like ties. Horizontal bracing elements can similarly be provided in one or both directions to hold the sides of the segments reasonably flat in the vertical plane. It is the outside walls of the outermost inflated segments of the bag whose bulging may need to be controlled or limited; the shape of the divisions between inflated segments inside the bag are not of particular interest (and will tend to be flat anyway).

[0020] It may be desirable for the outer parts of the top of the bag to be slightly higher than the main body of its upper surface. This can be achieved by making the outer segment along each side of the bag slightly higher than the other segments, and by segment coupling means which allow the innermost and outermost segments to be inflated but allow desired intermediate segments to be closed off and left uninflated. The outer segments may also be designed to be slightly wider, ie wedge-shaped, so that they are slightly wider at the top than at the bottom.

[0021] The bag as so far described is adapted for use in rectangular rooms. For rooms which are irregularly shaped, the bag may be adjusted to match the maximum dimensions. It is however desirable to be able to couple bags together, so that additional and separate small bags may be attached to the main bag, as indicated at 12 in Fig. I. For this, it is desirable to provide the bags with mechanical coupling means so that they may be attached to each other along the top and bottom edges, and also with pneumatic coupling means so that they form a common pneumatic space. The small bags may be rectangular, as shown, or other shapes.

[0022] The mechanical coupling means may have any convenient form, typically consisting of male and female elements such as such as hooks and eyes, or may comprise short straps and buckles.

[0023] As stated above, it is desirable to provide a cover sheet over the bag. This will protect the bag itself to a considerable extent from damage from articles dropped on it. It will also effectively seal any slight gaps between coupled bags, and also the gaps between segments of a bag if an intermediate segment is kept deflated as described above. Fixing means may be provided for fixing the cover in place; such fixing means may be similar to the coupling hooks for coupling bags together, or the coupling hooks may also be used as cover fixing means. As an alternative to a single large cover, cover strips may be used which can be fixed along the joins between bags or across uninflated segments. For such cover strips, the fixing means may be of the hook and eye material type.

[0024] To minimize the chance of a worker falling between the bag and a wall, it is desirable to use a bag which is slightly larger than the room in which it is used, to ensure that the bag presses against the wall. However, excessive loading on the walls should generally be avoided.

[0025] If the main bag assembly is chosen or adjusted to be slightly smaller than the room, it may be convenient to use a border bag, placed around the border or periphery of the main bag assembly (the main bag 10, together with any auxiliary bags 11) to fill in any gap between the main bag assembly and the walls of the room. The border bag will be placed at the top edge of the main bag assembly, preferably being attached to fixing points part way down the sides of the main bag assembly or along the bottom edges of that assembly, eg by suitable straps. The border bag will preferably be profiled to protrude above the general surface level of the main bag assembly and to have its upper surface sloping downwards towards the main bag assembly. The cover or cover strips may also be used to cover the join between the main bag assembly and the border bag.

[0026] Alarm means may be provided for indicating loss of pressure in the bag. To avoid the complications of electronic sensing, a whistle may be used, in conjunction with a pressure valve which closes if the pressure exceeds the lower safe limit. This may be connected in series with a control valve which can only be opened slowly. When the bag is being inflated, the control valve

will be closed. The control valve will be manually opened when the bag is fully inflated; as the control valve opens, so the pressure at its outlet will rise slowly, and the whistle will sound briefly before the pressure rises to the point at which the pressure valve closes. This will prevent the whistle from sounding continuously while the bag is being inflated, but will provide a check on the operation of the alarm. (The alarm may be checked at any time by closing and re-opening the control valve.) Smilar alarm means may be provided for indicating excessive pressure.

[0027] Fig. 2 is a simplified sectional view of one end of the bag 10. The bag is divided into 3 segments 20-22 by internal walls 23 and 24, which may be made of the same material as the outer walls of the bag. These internal walls include valves 25, which can conveniently be around 100 to 150 mm in diameter. One or more valves may be provided between each pair of adjacent segments. Each valve may consist of a screw-threaded neck and a cap which can be screwed onto the neck to close the valve or unscrewed and removed from the neck to open the valve. A cord preferably attaches the cap to the neck, so that the cap cannot become lost in the bag segment when the valve is opened. The segment adjacent to the valve has a slot 26 in its surface as shown. This slot has a zip or the like to keep it normally closed, but can be opened to allow an operator access to the valve to open or close it.

[0028] Each segment also has an internal brace 27 which helps to keep its top and bottom surfaces from bulging excessively when inflated. The braces 27 may conveniently be made of the same material as the outer walls of the bag, with a suitable number of holes 28 in them to ensure that there is no significant restriction on the distribution of air throughout the segment. These braces also control the bulging at the ends of the segments.

[0029] Horizontal braces (not shown) may also be provided if desired, running across the segments. Such braces will have to be of the cord or strap type, passing through the holes 28 in the vertical braces 27.

[0030] Valves 30, similar to the valves 25, are provided at suitable points around the periphery of the bag 10. One of these valves may be used as the air inlet from the pump 11. Others may be used to couple auxiliary bags 12 to the main bag 10 (or to couple auxiliary bags together), using short lengths of connecting hose similar to the hose from the pump 11. These outer valves may also be used to deflate the bag when it is being removed from the room. The slots 26 may also be used for this purpose, and further similar slots (not shown) may be provided if desired.

[0031] The valves 30 may be of any convenient form, such as male and female press fit connectors, bayonet type connectors, all male press fit connectors with separate short double female coupling elements (or vice verse), etc. External valves which are not used to couple two bags together or as feed valves must of course be closed off. This can be done by providing stop elements which can be attached to the valves, or by providing internal flaps in the bags which can be used to close off the valves similarly to the internal valves 25.

[0032] A row of fixing means 31 is provided around the top edge of the bag, for coupling bags together and/or fixing a cover sheet over the bag or bags. The fixing means may be of the spring hook type, so that they can be safely linked together but can easily be unlinked manually when desired.

[0033] Similar fixing means may be provided along the top and bottom of the bag opposite the internal walls 23 and 24, so that uninflated segments can be mechanically held collapsed and empty.

[0034] Fig. 3 shows a slightly modified form of bag 35, consisting of a single segment of generally rectangular shape. Male connectors 36 are provided along one long top edge and an adjacent short top edge and the corresponding bottom edges; and female connectors 37 along the remaining top and bottom edges, for attaching the bags together. The bag also has diagonal internal braces 38 to hold it in approximately rectangular shape when inflated.

Claims

1. Safety apparatus for use in building construction comprising pump means and bag means inflatable thereby to provide a substantially level surface to cushion a worker falling thereon.

2. Safety apparatus according to claim 1 wherein the bag means comprises a rectangular bag having internal dividers and valve means for controllably coupling the segments together.

3. Safety apparatus according to either previous claim wherein the bag, or the segments thereof, has internal bracing for shape control.

4. Safety apparatus according to any previous claim including means for coupling together a plurality of bags, such means comprising pneumatic coupling means and mechanical linking means.

5. Safety apparatus according to claim 4 including cover means for covering the coupled bags.

6. Safety apparatus according to any previous claim including alarm means for indicating over- and/or under-pressure.

7. Safety apparatus substantially as herein described.

8. A method of protecting workers on elevated portions of a building comprising providing inflated bag means in the interior of the building or parts thereof

and/or adjacent the outside of the building or parts thereof.

9. A method of protecting workers on elevated portions of a building substantially as herein described.

10. Any novel and inventive feature or combination of features specifically disclosed herein within the meaning of Article 4H of the International Convention (Paris Convention).

FIG.2

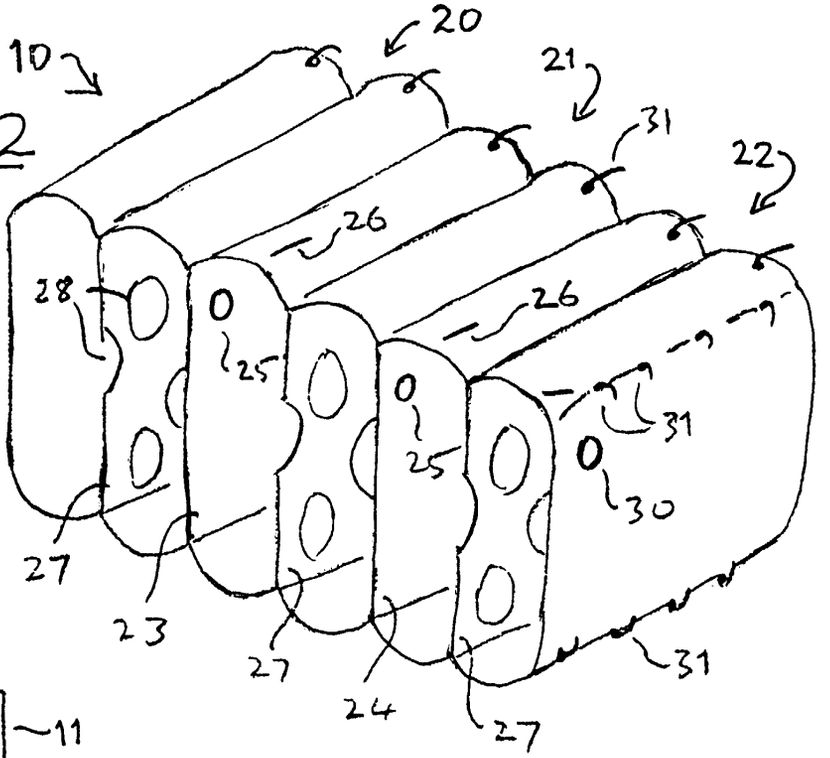


FIG.1

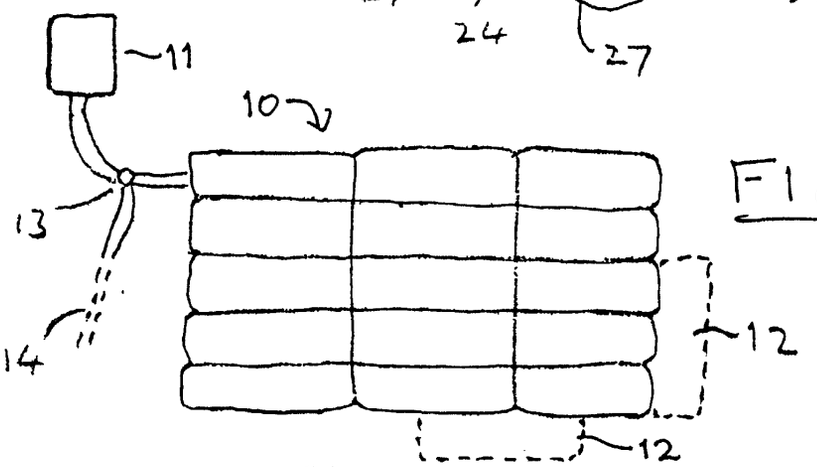
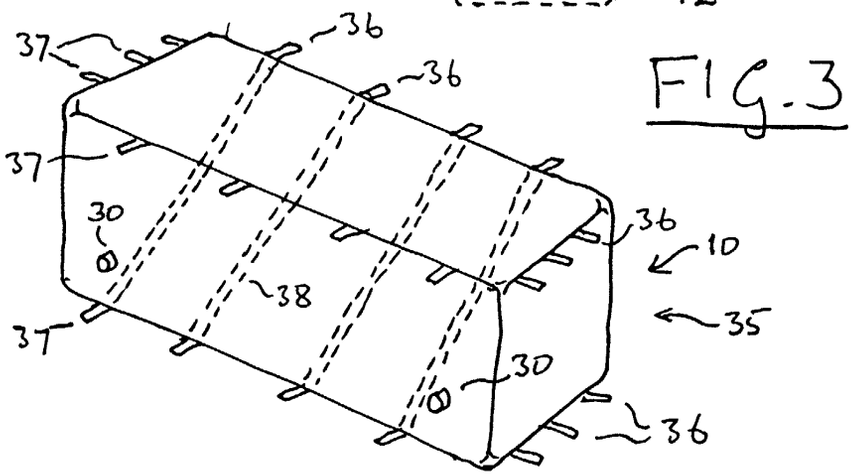


FIG.3



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EUROPEAN SEARCH REPORT

Application Number
EP 99 30 6988

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	FR 2 277 600 A (DUPEYROUX ROGER) 6 February 1976 (1976-02-06) * the whole document *	1-3,7-10	A62B1/22 E04G21/32
A		4	
X	DE 93 15 692 U (FRANK HANS ALBRECHT) 23 December 1993 (1993-12-23) * page 4, line 15 - page 5, line 35 * * figure *	1-3,7-10	
A		4	
X	DE 23 02 248 A (KUTSCHERA WOLFGANG) 25 July 1974 (1974-07-25) * the whole document *	1-3,7-10	
A		5	
X	US 3 851 730 A (SCURLOCK JOHN T) 3 December 1974 (1974-12-03) * column 11, line 44 - column 16, line 42 * * figures *	1-3,7-10	
A		5	
X	FR 2 691 634 A (HENRY JEROME) 3 December 1993 (1993-12-03) * the whole document *	1-3,7-10	
X	DE 31 46 771 A (KARL MARX STADT TECH TEXTIL) 8 July 1982 (1982-07-08) * page 4, line 27 - page 5, line 17 * * figures *	1-3,7-10	
X	US 2 390 955 A (ARTHUR E. MCDONNEL) 11 December 1945 (1945-12-11) * the whole document *	1,3,7-10	
A		2	
	-/--		

TECHNICAL FIELDS SEARCHED (Int.Cl.7)
A62B
E04G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	9 December 1999	Andlauer, D

CATEGORY OF CITED DOCUMENTS

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EUROPEAN SEARCH REPORT

Application Number
EP 99 30 6988

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 5 150 767 A (MILLER RALPH A) 29 September 1992 (1992-09-29) * column 3, line 24 - column 4, line 50 * * figures *	1,7-10	
A		2	
X	US 2 906 366 A (DANIEL MAPES) 29 September 1959 (1959-09-29) * the whole document *	1,7-10	
A		4	
A	DE 450 584 C (OTTO LÖRTSCHER) 22 September 1927 (1927-09-22) * the whole document *	1,4,5, 7-10	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	9 December 1999	Andlauer, D

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09-12-1999

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2277600 A	06-02-1976	NONE	
DE 9315692 U	23-12-1993	NONE	
DE 2302248 A	25-07-1974	NONE	
US 3851730 A	03-12-1974	NONE	
FR 2691634 A	03-12-1993	NONE	
DE 3146771 A	08-07-1982	DD 155805 A	07-07-1982
US 2390955 A	11-12-1945	NONE	
US 5150767 A	29-09-1992	NONE	
US 2906366 A	29-09-1959	NONE	
DE 450584 C		NONE	

EPO FORM P0459

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