

STAIRWAY FOR USE ON BUILDING SITES

FIELD OF THE INVENTION

The present invention relates to stairs, in particular to stairways suitable for
5 temporary erection and use on a building site during construction of a building.

BACKGROUND OF THE INVENTION

Temporary stairways are often required on building sites during
construction of a multistorey building to allow construction workers to move from
10 one storey of the building to another.

Whilst permanent stairways are often formed at the same time as the floor
slabs of the storeys, making the rough (eg concrete cast) stairways safe for use
by workmen requires additional onsite construction, ie installation of security
items such as handrails, anti-slip stair tread surfaces, and similar. More
15 importantly, the stairwells of permanent stairways are often located within the
building or at one end thereof, such that during construction work, when workers
are working at different locations within the building, additional travel time is
required to access the stairways. This inconvenience is exacerbated if materials
are also required to be transported between building levels, as several trips from
20 distant locations might be required.

To speed up the process and have a more efficient environment for
building workers, temporary stairways can be erected at numerous locations
around the building under construction, and then removed either when
construction is complete, or when the permanent stairways are completed and
25 safe for use.

For multistorey buildings, temporary stairways are typically provided at or
within the scaffolding structure present on the outside faces of the building. For
example, US patent 3,684,057 discloses a portable stairway comprised of step-
ladder-like sections which are releasably lockably mounted onto outrigger
30 supports which in turn are releasably lockably secured to the scaffolding's upright
struts. Safety side guard rails are hingedly attached to supporting posts which in
turn are pivotedly mounted to the step-ladder side frame members.

Whilst portable stairway assemblies that are incorporated into scaffolding have found increasing use in the building sector, the disadvantage of such scaffolding stairway structures is that they require the presence of an external scaffold, and incorporation of numerous additional structural components, in particular to secure the modular step-ladder sections onto the scaffolding for example.

Another problem that exists with such types of modular/portable stairways is that they lack floor-height adjustability, ie they are designed for a discrete storey height between the floor levels of a lower and adjacent upper storey. The inclination angle of the stair run section, being that part of the stairway which incorporates the plurality of individual steps (each defined by a vertical rise and horizontal run) with regard to the horizontal is mostly confined to discrete values, given that building codes require minimum dimensional safety standards for each step in the stair run. For example, the rise and tread of each individual step may be fixed such that the rise shall not exceed 215mm, whereas the tread shall not have an extension of less than 215mm; industry practice is to use stair rise to tread ratio formulae in making the stair run sections.

In the construction and transport industry it is also known to utilise height-adjustable and self-height-adjustable stair constructions wherein a plurality of tread boards are disposed in parallel, stepped relationship and moveably fixed onto a pair of opposing longitudinal stringers with terminal end links traverse thereto. The stringers and links are pivotably joined such as to provide a parallelogram frame structure which supports the stair treads. As noted, the stair treads span between the longitudinal stringers, and the stairs can therefore be manipulated as a flexible assembly to meet a desired inclination or pitch angle of the stringers required to span any desired height, whereby the tread boards remain substantially horizontal, but the rise will vary in accordance with the change of inclination angle. Examples of such adjustable stairs may be found in US patent 3,626,438, US patent 3,593,821 and US patent 4,768,617. It is noted that whilst these documents all describe height adjustable stairway constructions, to the knowledge of the applicant, none of these constructions have been employed in temporary stairway units between levels of multistorey buildings.

It is an object of the present invention to provide a portable stairway unit suitable for use on building sites during construction of multistorey buildings, which can be deployed in an assembled state and adjusted for use on buildings with varying floor to ceiling heights. Preferably, such stairway units should be modular in layout and incorporate or use fastening or fixing structures that allow the stairway unit to be temporarily secured at one building location and be easily removed for deployment at a different location.

It would be also advantageous to provide a temporary stairway construction which can be secured in a detachable manner to the building without structural damage to building components, for example building storey floor slabs, walls and the like.

SUMMARY OF THE INVENTION

According to one aspect of the present invention, there is provided a portable, modular stairway unit for use on a building site during construction of a multistorey building, the stairway unit including:

a stair run section with a plurality of rise-separated stair treads, the stair run section having an upper and a lower end;

an upper landing connected to the stair run section at, or at a distance from, the upper end of the stair run section;

a lower landing connected to the stair run section at, or at a distance from, the lower end of the stair run section;

wherein each of the landings have portions that extend laterally beyond a width of the stair run section, the landings being devised to extend inwardly into respective upper and lower storey levels of the building when the stairway unit is situated adjacent to a face of the building; and

anchoring means arranged to removeably secure the landings, in use, at the upper and lower storey levels thereby to provide a double-cantilevered mounting of the stair run section extending between the two storey levels.

Modular stairways in accordance with the present invention achieve significant cost savings with regards to erection time given that the stairway can be positioned as a pre-assembled unit at an outside location adjacent to the

building face, whereupon suitable anchoring of the landings at the upper and lower storeys secure the stairway module in place.

Preferably, at least one of the landings is pivotably secured to the stair run section, to allow the incline of the stair run section, when in use, to be varied.

- 5 More preferably, each of the landings is hinged to the stair run section, as this will allow the landings to be folded back onto the step section for ease of transport, when the stairway module is not in use.

Stairway embodiments incorporating landings that are articulated or hinged at both an upper and lower end of the stair run section allow deployment and use
 10 of the same stairway unit at buildings having storey heights (ie distance between floor to floor of adjoining storeys of the building) that vary within a predefined narrow range. For example, some multilevel buildings incorporate floor levels with varying floor to ceiling heights, eg lower levels having a floor to ceiling height of 2,700mm, whereas upper floor levels might have an increased floor-ceiling
 15 height of eg 2,900mm.

In an alternative form, at least one of the landings is secured to the stair run section in such a manner as to allow linear movement along a longitudinal axis of the stair run section, and further including fixing means to secure the landing at a desired position along the stair run section, whereby a distance
 20 between the upper and lower landings at the stair run section can be varied and fixed in a desired position.

In particular, the lower landing is arranged to be held at a fixed angle of inclination with respect to the longitudinal axis of the stair run section, such that the tread and rise of each step are allowed to remain horizontal and vertical,
 25 respectively, as the stair run section is moved relative to the landing.

In a preferred and advantageous further embodiment, the stair run section is devised with a plurality of treads whose incline with respect to the longitudinal axis of the stair run section may be selectively varied and fixed in such a manner that the treads will remain substantially horizontal irrespective of the angle of
 30 incline which the stair run section has when extending between adjacent building storeys. The variation of step tread incline is preferentially achieved by providing a linkage mechanism articulating the individual treads to one another in such a manner that variation of the incline angle of the stair run section will resolve in

self-adjustment of the treads into a horizontal attitude. The present invention contemplates use of known adjustable stair run section construction principles as illustrated in the aforementioned US patents of Cornell, Lister, Mason and others.

Preferably, the anchoring means are provided by adjustable-height props
5 arranged for loading in compression when extending between the floor and ceiling of a respective storey where the respective landing is to be secured. Use of compression props rather than more conventional anchoring bolts, hooks and loops avoids damage to the building structure, as there is no need to drill into the building structure to provide a fixing point or attachment for the landings of the
10 modular stairway unit. Height adjustable props are known in the construction industry for securing form work prior to and subsequent to casting of building storey slabs. It should be noted, however, that conventional fasteners such as bolts can also be used, eg to temporarily secure the landings in deploying the modular stairway.

15 An illustrative embodiment of the present invention will now be described with reference to the accompanying figures. Further features and advantages of the invention will become apparent from the accompanying description provided in relation to the drawings.

20 **BRIEF DESCRIPTION OF THE DRAWINGS**

Figure 1 is a schematic side view of a modular stairway according to one embodiment of the present invention, installed against an exterior face of and between two storeys of a building;

Figure 2 is a top view along direction of arrow II of the stairway of Figure 1;

25 Figure 3 is an end view along direction of arrow III of the stairway of Figure 1;

Figure 4 is a side view of the stairway of Figure 1 when in a transport or non-deployed position;

Figure 5 is a schematic, partial side view, of a height adjustable, modular
30 stairway in accordance with another embodiment of the present invention.

DESCRIPTION OF PREFERRED EMBODIMENT

Figure 1 shows a modular stairway unit 10 in position at the external face and between an upper storey 12 and a lower storey 14 of a building. The modular stairway unit 10 consists of an upper landing 16, a lower landing 18, a
5 stair run section 20 extending between and connected to the landings 16, 18 and four anchoring members 22a to 22d per landing as described in more detail below.

The stair run section 20 essentially includes a plurality of individual treads 24 in the form of boards, with optional risers 26 extending therebetween. The
10 treads 24 are suitably secured and supported at their widthward ends at opposed, tread support bar panels (not shown) in a known manner, for example, that described in US patent 3,788,028. Alternatively, a tread-rise adjustable stair run assembly can be employed, such as that described in US patent 3, 593,821 or
15 US patent 4,768,617, allowing, of course, for the necessary modifications required for incorporation of such type of adjustable stair run assemblies into the concept of the present invention.

Figure 1 also illustrates schematically at 28 safety fence structures which are secured to each widthward side of the stair run section 20, thereby providing added security to users of the modular stairway unit; a conventional hand rail can
20 be replaced.

The stair run section 20 is manufactured and assembled from materials and components commonly used in portable stairway manufacture. Preferably, the components are made from sheet and section steel, allowing the stairway 10 to be weatherproof and strong enough to withstand significant loads as
25 experienced during building construction.

As best seen in Figure 2, the two landings 16, 18, essentially rectangular steel plates, each have a portion, identified at 16a, 18a, respectively, that protrudes to one side in widthward extension beyond the width of the stair run section 20, ie the landings have outrigger portions that serve to secure the
30 stairway 10 to a building. In deployment of the modular unit 10, as illustrated in Figures 1 and 2, the landing portions 16a, 18a extend into the building in substantially coplanar horizontal relation with the floor 12a, 14a of the respective floor levels 12 and 14. Both the upper and lower landings 16, 18, are secured in

articulated manner (eg using axle hinges) to the upper and lower ends of the stair run section 20, respectively, thereby allowing the entire modular unit to be deployed between building storeys having varying floor 14a to ceiling 14b heights, whilst maintaining horizontal orientation of the lower and upper landings, 18, 16, respectively. It will be appreciated that, depending on the height between ceiling and floor, the inclination angle (i) of the stair run section 20 varies.

The entire modular stairway 10 is removably secured such as to be cantilevered at two locations, namely the upper and lower floors 12, 14 by means of a total of eight longitudinally adjustable compression props 22a to 22d of such type as commonly employed in the building trade, for example screw props. The props 22a to 22c consist essentially of a tubular strut with plate footings at the lower terminal end, the opposite upper hollow end of the prop tubes having an internal tread into which externally threaded stems of prop headers are inserted. It is preferred to have the mechanism which allows height adjustment (and tensioning/wedging) of the props to be located at the upper end (header) of the units, to prevent accidental de-tensioning of the props during use of the stairway.

As seen from Figures 1 to 4, a total of four props 22a to 22d is provided per landing 16,18, thereby providing a stable anchoring arrangement at the bottom and top of the stairway unit at the building levels, whereby one prop each is situated close to the corners of the landing platform sections 16a, 18a, thereby to ensure potential bending and deformation of the landings due to the weight of the stairway or the load on the stairway being minimised. The entire arrangement creates a double-cantilever mount of the stair run section 20 at the building.

The individual props can be secured to the landings 16, 18 in a known manner, for example by passing the props through suitably dimensioned through holes in the platforms, and then securing the relative position of the platforms 16, 18 with respect to the tubular prop struts. It is preferred that the props will be welded to the landings during manufacture of the system, to provide a wholly pre-fabricated unit to minimise erection times. It will be immediately appreciated that using props to secure and fix/anchor the modular stairway unit 10 between building storeys makes installation of the entire unit location independent, since there is no need to provide for fixed anchoring/fixing locations in the building structure, for example in the floor slabs.

It is also possible to dispense with receptacle holes for the props and instead weld (or otherwise secure) the prop footings on the upper face of the landing platform sections 16a, 18a; the headers of all four props 22a to 22d can be extended to engage on the ceiling surface, whereby further tensioning presses
 5 the elastically deformable steel platform sections securely onto the storey floor surface thereby to achieve a secure friction-tight engagement of the landing at the storey floor. If desired, friction increasing finishings can be present on the surfaces of the platforms 16, 18.

As best seen in Figure 1 but also illustrated in Figures 2 and 3
 10 schematically, each landing is provided with a L-shaped fence structure 30, 32 on the sides facing away from the building, thereby to ensure safety of the users of the stairway unit, whereby it is noted that the fence 30, 32 extends into the building storeys once the unit is mounted and secured in place.

Figure 4 shows the modular stairway in a transport position, where the
 15 stair run section 20 extends parallel and horizontal with the landings 16 and 18, thereby facilitating transport of the modular stairway unit on a flatbed truck. The modular, articulated construction of the stairway unit 10 enables the unit to be transported in pre-assembled manner to the building site, where a crane lift may be used to hoist the unit into place at the exterior face of the building.

20 As referred to above, in one preferred form, the stair run section 20 is of such type having height adjustable treads to allow use of the same modular unit 10 for varying floor level heights. However, the hinged arrangement of the top and bottom landings 16, 18 at either end of the stair run section 20 itself is capable of providing a certain degree of adjustability to different floor level heights
 25 (within construction tolerances) given that a change in the angle of inclination (i) of the stair run's incline position, where the treads are essentially horizontal, can be varied by a certain amount without making the entire stairway unit unsafe.

The widths and angles of the treads and the distances between the treads should preferably abide by relevant building code or standards. For example, the
 30 Australian Standard AS 1657-1992 states that stairways shall not be less than 600mm wide, and the angle of slope of the stairway should not be less than 26.5 degrees and not greater than 45 degrees, height of each rise shall be between 150mm-215mm, and length of each tread shall be between 215mm-305mm.

Figure 5 illustrates a modified embodiment of that illustrated in Figures 1 to 4. Similar reference numerals are used in Figure 5 to refer to similar components, which will thus not be described in further detail here. As with the previous embodiment, the upper landing 16 is hinged to the upper end of stair run section 20, thereby allowing variation of the angle (ii) between the platform 16 and the notional longitudinal plane (or axis) of section 20. In contrast to the previous embodiment, however, the lower landing 18 is secured to the stair run section 20 in such a manner as to allow displacement along the longitudinal axis of section 20 whilst maintaining a generally horizontal attitude of the landing platform 18. To this end, the landing platform 18 is provided with a support section 32 defining a sleeve in which the lower terminal end of the stair run section 20 is received for sliding engagement therewith, thereby allowing the entire platform structure 18 to be moved up and down along arrows (iii) along the length of unit 20. Sleeve member 32 is suitably attached to the side plates or bars 34 of stair run section 20, wherein a roller connected to the landing 18 is positioned to allow the landing 18 to move relative to and along bar members 34. When the landing 18 is at a desired position, it is immobilised with respect and fixed to the stair run section 20, for example using nut and bolt clamps, locating pins or bolts, etc. Preferably, a series of holes 36 are present in the side bars of 34 stair run section 20 at different positions, wherein a bolt is inserted through the support section 32 and into at least one hole 36, thereby securing the landing 18 in the desired position.

It will be appreciated by persons skilled in the art that the invention can be implemented in different ways, without departing from the spirit and scope of the invention.

Any discussion of documents, devices, acts or knowledge in this specification is included to explain the context of the invention. It should not be taken as an admission that any of the material forms part of the prior art base or the common general knowledge in the relevant art in Australia on or before the filing date of the patent application to which the present specification pertains.

CLAIMS:

1. A portable, modular stairway unit for use on a building site during construction of a multistorey building, the stairway unit including:
 - a stair run section with a plurality of rise-separated stair treads, the stair
 - 5 run section having an upper and a lower end;
 - an upper landing connected to the stair run section at, or at a distance from, the upper end of the stair run section;
 - a lower landing connected to the stair run section at, or at a distance from,
 - 10 the lower end of the stair run section;
 - wherein each of the landings have portions that extend laterally beyond a width of the stair run section, the landings being devised to extend inwardly into respective upper and lower storey levels of the building when the stairway unit is situated adjacent to a face of the building; and
 - anchoring means arranged to removeably secure the landings, in use, at
 - 15 the upper and lower storey levels thereby to provide a double-cantilevered mounting of the stair run section extending between the two building storey levels.
2. The stairway unit according to claim 1, wherein at least one of the landings is pivotably secured to the stair run section in such a manner as to allow the
- 20 incline of the stair run section to be varied with respect to the at least one landing.
3. The stairway unit according to claim 2, wherein each of the landings is hinged to the respective ends of the stair run section.
4. The stairway unit according to claim 1, wherein at least one of the landings is secured to the stair run section in such a manner as to allow linear movement
- 25 along a longitudinal axis of the stair run section, and further including fixing means to secure the landing at a desired position along the stair run section, whereby a distance between the upper and lower landings of the stair run section can be varied and fixed at desired positions.

5. The stairway unit according to claim 4, wherein the lower landing is arranged to be held at a fixed angle of inclination with respect to the longitudinal axis of the stair run section.
6. The stairway unit according to claim 4 or 5, wherein the stair run section
5 includes discrete fastening points spaced apart along the longitudinal extension of the stair run section.
7. The stairway unit according to any one of the above claims, further including means to secure the upper landing at a predetermined angle with respect to the stair run section.
- 10 8. The stairway unit according to claim 7, wherein the predetermined angle is from about 26.5° to 45° from the horizontal.