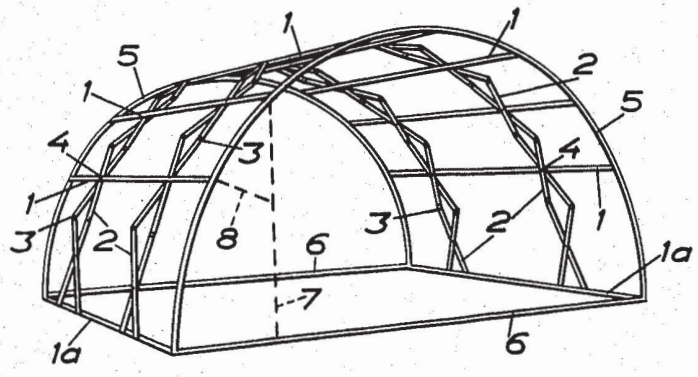
Feb. 2, 1971 G. C. PARTRIDGE 3,559,353

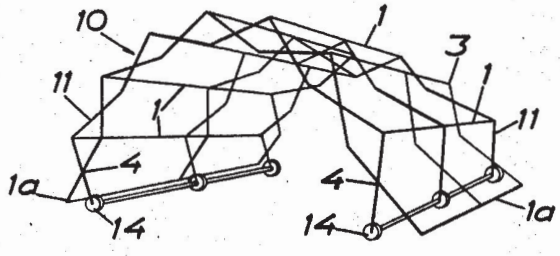
COLLAPSIBLE BUILDING STRUCTURES

Filed Nov. 5, 1968 3 Sheets-Sheet 1

-FIG. 1.-



-FIG. 4.-



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COLLAPSIBLE BUILDING STRUCTURES

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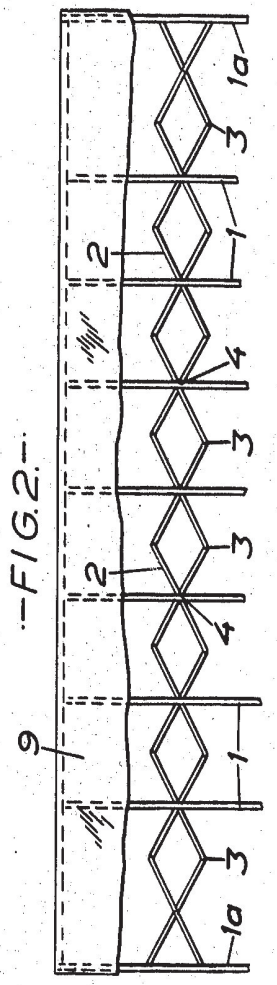

FIG. 2.

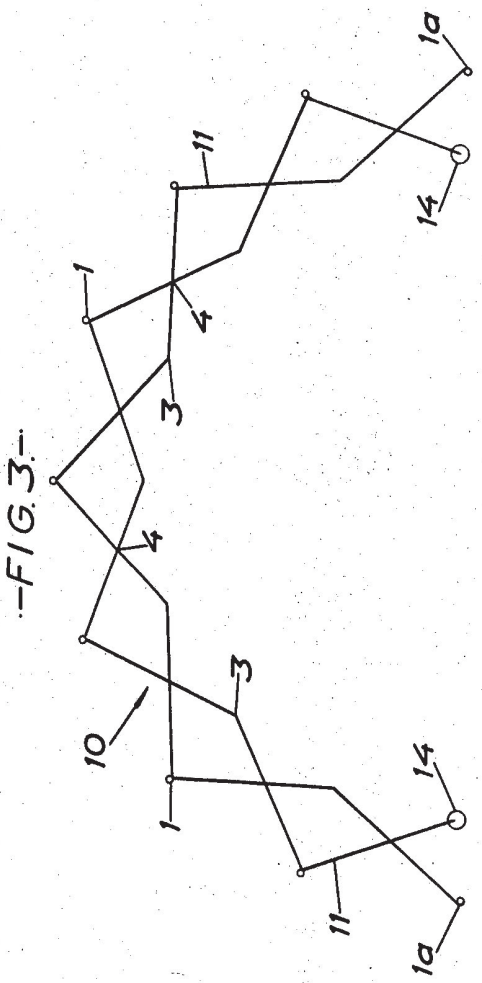

FIG. 3.

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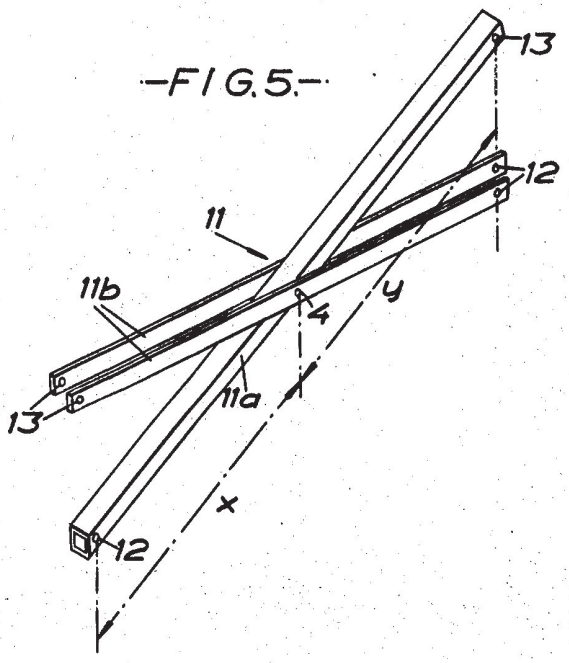
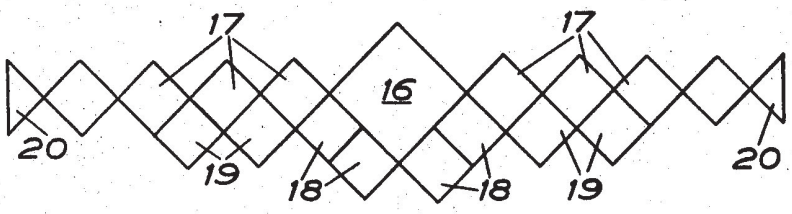
-FIG.5.-



-FIG.6.-



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COLLAPSIBLE BUILDING STRUCTURES

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Int. Cl. E04b *1/347, 7/16*

U.S. Cl. 52—63

7 Claims

ABSTRACT OF THE DISCLOSURE

The invention comprises a collapsible building structure incorporating latticework units of pivoted together crossed links to form parallel beams or trusses joined by purlins, and which units can be extended in arched formation. The links of the units may be arranged in a horizontal or vertical plane and a flexible covering is located over the framework.

This invention relates to collapsible buildings which can be erected easily and collapsed at will for movement to another site or for storage or transportation.

Various types of collapsible buildings are known of which many are made in sections to be assembled and secured together. It is also known to form inflatable tent-like structures.

According to the present invention there is provided a collapsible building or structure comprising a framework incorporating at least two latticework units in parallel relationship, said units having the links of the units pivotally connected in a manner that enables said units to be extended from a collapsed arrangement to an operative formation of a beam or truss.

The invention also includes a collapsible building or structure comprising a framework of straight parallel members joined at intervals by cross latticework units incorporating pivotal joints, the construction being such that said members can move from collapsed side-by-side relationship to spaced relationship and erection in arched operational form on a site, means for retaining said form and a covering for attachment to said framework.

The covering may be flexible waterproof sheeting, such as reinforced or other plastics material.

The covering may be laminated sheeting having a thermal insulating characteristic.

The arched structure may have upright and/or transverse stabilising means, or ground retention means.

The invention will now be more particularly described with reference to the accompanying drawings, in which:

FIG. 1 is a perspective view of one form of collapsible structure;

FIG. 2 is a part plan view of an extended latticework unit;

FIG. 3 is a diagrammatic elevation of a modified latticework unit;

FIG. 4 is a diagrammatic perspective view of the framework of an arched building incorporating units of the type shown in FIG. 3;

FIG. 5 is an enlarged perspective view of a pair of crossed links; and

FIG. 6 is a diagrammatic elevation of a further modified latticework unit.

In a particular embodiment of this invention, FIGS. 1 and 2, straight elongated longitudinal members **1**, forming purlins, of wood or other material are joined together at intervals by latticework units **2**. The latter lie in the same horizontal plane in spaced parallel relationship. Each unit may be formed of metal or other material

laths or bars and/or tubes forming links with pivotal joints **3** and pivotally joined at **4** to the said members. The number of members **1** depends on the size of the structure and there may be only two spaced apart, or end, lattices, or an intermediate lattice or lattices may be incorporated depending on the length of structure desired. The said framework can be collapsed for storage or transportation with the longitudinal members lying side-by-side and when required said members are pulled apart to a desired extent, there may be means for limiting the extent, and then such framework is caused to assume an arched formation by flexion of the lattices **2**. This formation can be retained by arched end stays **5** and cross members **6** extending across the base of the arch and secured to the then lowest longitudinal members **1***a* of the framework. Intermediate stays may be attached to the members. Further stabilising means can be employed to hold up the arched framework and such means may comprise vertical members **7** with or without diagonal or other associated members **8**. Such stabilising means may be only at the ends of the structure and/or intermediate means may be employed. Moreover, if required, cross stabilising means may be used between longitudinal members **1** and/or between members and joints of the latticework to reinforce the arch formation.

When such skeleton structure has been assembled, it may be anchored to the ground, covering sheeting **9** is spread over the structure and attached to the framework in any convenient manner. This covering may be plastics material sheeting which may or may not incorporate reinforcement. The sheeting may or may not be transparent, the covering may at least incorporate one or more transparent areas, and rigid or other members may be provided at least at the ends of the sheeting for attachment to the lowest longitudinal members of the framework and also used for rolling up the sheeting. In one form the covering comprises a plastics material film or films bonded to textile or other material, say glass fibre, woven or non-woven threads. If thermal insulation is required the covering may be laminated sheeting including one or more layers having thermal insulating characteristics. The covering may be of air spaced double skin form.

If so desired a building may be formed of sections of the aforesaid framework which can be located end to end and joined together. For example, the ends of the longitudinal members **1** may be socketed together. The members **1** may be of solid or tubular formation and may comprise rectangular section metal tubing or substantially rigid plastics material tubing or rod.

In another embodiment of this invention, FIGS. 3 to 5, a collapsible latticework structure of units **10** is again formed comprising pairs of pivoted together links **11** in cross formations so that a given length of structure can be collapsed into a fore-shortened length with the links lying in butting or close relationship but which can be extended in lazy-tong fashion. The intermediate pivot **4** of each pair of crossed links can be arranged so that the distance X between the bottom pivotal axis **12** and the intermediate pivotal axis **4** can be different from the distance Y between the intermediate pivotal axis **4** and the top pivotal axis **13**. By this means each latticework structure unit on the ground can be in a collapsed straight construction and when extended will rise into an arch formation.

Two or more, three are shown, of such latticework units **10** can be arranged in the same horizontal plane in parallel relationship, with the pairs of links **11** in a vertical plane, and the latticework units can be connected to another by longitudinally extending purlins **1** at right angles to the latticework structures. These purlins may be tubular and of say, square section, and are attached to the upper ends of all or selected links. The purlins

may be made integral with the links by being welded thereto, or they may be detachably secured to the links. If desired the purlins may be hinged or pivoted to the links. Moreover, the purlins may be so mounted relative the links that they wholly or partly lie in a plane above the tops of the links. The purlins may have spigots projecting at right angles thereto and such spigots can be inserted into the open ends of selected links if the latter are also of tubular members or furnished with sockets. FIG. 5 shows one form of a pair of crossed links **11** in which one link **11***a* is of square tubular section form and the other link **11***b* comprises a pair of bars but may also be tubular members.

This collapsible skeleton formation of latticework units **10** and purlins **1** can be stored and/or transported in a collapsed condition and erected on a selected site by simply securing or restraining one end of each latticework structure and extending such structures manually or by the aid of mechanical means, such as by jacks or winding means, so that the structures will rise into arched formation. To facilitate erection wheels **14** are provided at the ends of the units. The ends of the latticework structures can be tied together by cross means or otherwise secured to retain the arched formation. A skeleton building framework structure may comprise a single arched formation embodying two or more latticework units, or two or more such structural formations may be butted or tied together in alignment to produce a given length of building. A covering **9** of flexible or other material, with or without windows or ventilation means, can be located over the arched structural formation and secured in any convenient manner. Moreover, the ends of the building may be left open, or one or both ends furnished with covering or closure means. A closable entrance may be provided at one or both ends.

In yet another embodiment of this invention a collapsible roof beam or truss is formed of pivoted together link members in the form of a latticework unit **10** which can be opened out from a closed position for operational use. Such latticework unit may be arranged in an arched form or in a substantially horizontal plane between walls or wall frameworks and with the transverse plane of the latticework lying in a vertical plane as aforesaid. Such latticework may form a single roof beam or truss joined with at least one other similar beam or truss by purlins **1** or other members. Alternatively, a beam or truss may comprise two or more such latticework units joined closely together by tie means at some or all of the pivotal axes of the latticework formation.

In yet another arrangement, FIG. 6, each latticework formation **15** is constructed to be deeper in the centre than at its two ends, to improve its strength in a vertical plane. This arrangement is achieved by forming the centre lattice unit part larger than the other unit parts which diminish in size towards the ends of the beam or truss. For example, assuming each unit to be rectangular (it may be of diamond shape) when the beam or truss is opened out, then there is a large central rectangle **16** joined with a row of other smaller rectangles **17** on each side. Said smaller units extending from the two side pivotal axes of the main centre rectangular unit, whilst each bottom member of the central rectangle has a pair of side-by-side rectangular units **18**. Additional integral bottom rectangular units **19** are formed between one or more of the laterally extending rectangles **17** of the latticework. Each end of the beam or truss terminates in a triangular lattice unit **20**. Such a beam or truss may be used singly in conjunction with other similar formations or two or more such latticework formations may be joined together as aforesaid at some or all of the pivotal axes by tie means. Here again, latticework beams or trusses can be joined by purlins **1** or other members, at least in their upper planes. The arrangement can be such that the beams or trusses are self-locking when opened out.

Although a completely collapsible building may be formed incorporating the aforesaid latticework arrangement, beams or trusses may be combined with collapsible or rigid wall structures which may be erected or built in situ.

What I claim is:

1. A collapsible building structure comprising a framework incorporating at least two latticework units in parallel relationship, said units each having pairs of crossed links pivotally connected together in a manner that enables them to be in closed relationship and then extended at will in lazy-tong fashion into operational beam form, each pair of crossed links being of multi-link formation and comprising a center link of tubular section and a pair of side links of bar section, purlins joining the units and movable therewith, and a covering for attachment to the framework.

2. A collapsible building structure according to claim **1**, wherein the latticework units lie with their own transverse planes in the same horizontal plane, said units being in arched formation.

3. A collapsible building structure according to claim **1**, wherein the latticework units lie with their transverse planes in vertical parallel planes, said units being in a common horizontal plane in arched formation.

4. A collapsible building structure according to claim **3**, wherein the links of the latticework units are so pivotally joined intermediate their upper and lower pivots that said units assume an arched formation as they are extended.

5. A collapsible building structure according to claim **4**, wherein at least some of the links in each latticework unit have the pitch between their intermediate pivotal axis and their upper and lower axes of different lengths to create a required curvature of the extended unit.

6. A collapsible building structure according to claim **1**, wherein each latticework unit comprises crossed links in a vertical plane, said links forming a large central angular formation of four links, a series of smaller four links formations extending on each side of the central formation in treble and double relationship to single end formations, to form a double tapering beam.

7. A collapsible building structure comprising a framework incorporating at least two spaced latticework units in parallel relationship, each unit being formed of pairs of vertically disposed crossed links pivotally connected together in a manner that allows them to be closed and opened into arched beam formation at will, each pair of crossed links being of multi-link formation and comprising a center link of tubular section and a pair of side links of bar section; parallel purlins attached to the upper ends of the crossed links to move therewith; ground tie members joining the two lower pairs of links of the spaced units; and a removable flexible covering for the erected framework.

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PRICE C. FAW, JR., Primary Examiner

U.S. Cl. X.R.

52—86, 109; 135—1; 160—136