

[54] METHOD OF MAKING AN ARCH

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[51] Int. Cl. E04b 1/32

[58] Field of Search.....52/741, 742, 747, 222, 227, 52/108, 64, 86; 135/1, 4; 29/429, 455

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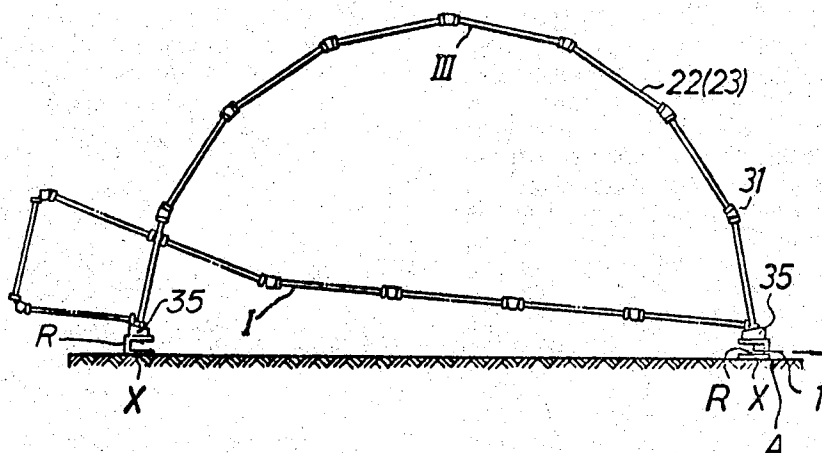
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[57] ABSTRACT

A stressed arch fabricated from a plurality of prefabricated structural frame members assembled over a flexible strand which is tensioned for causing the frame members to coact and assume an arch configuration and a method of making same are disclosed. Joint members may be added between each of the frame members. A plurality of connected or intersecting arch configurations may be covered by siding and roofing materials and erected simultaneously to provide a complete building suitable for permanent use or for easily disassembled portable use.

7 Claims, 24 Drawing Figures



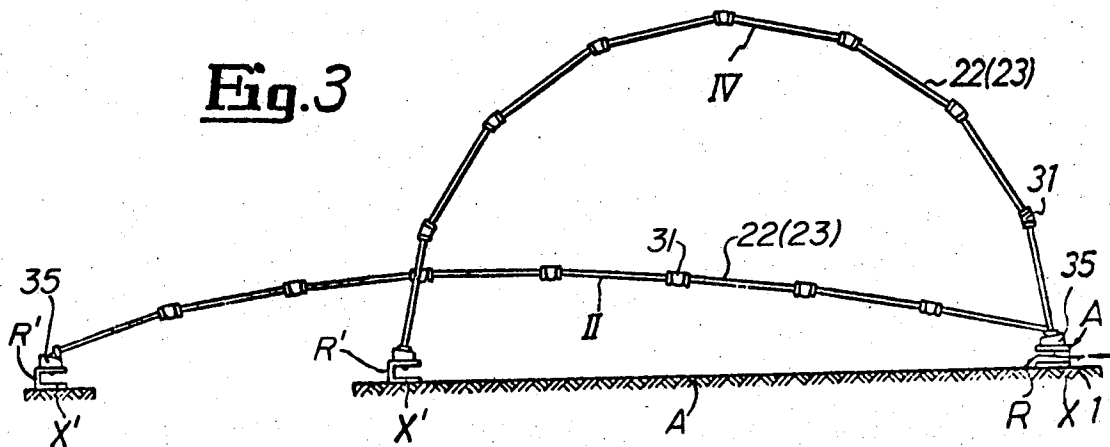
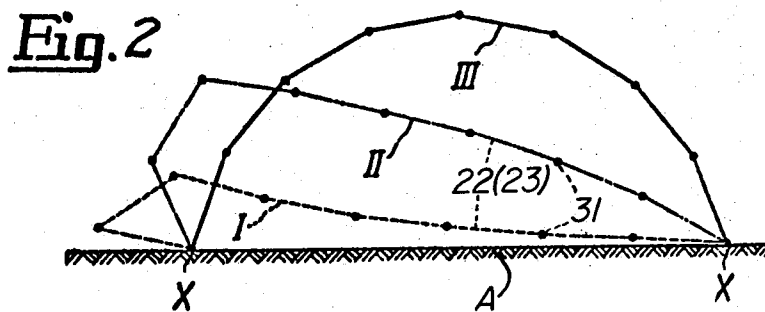
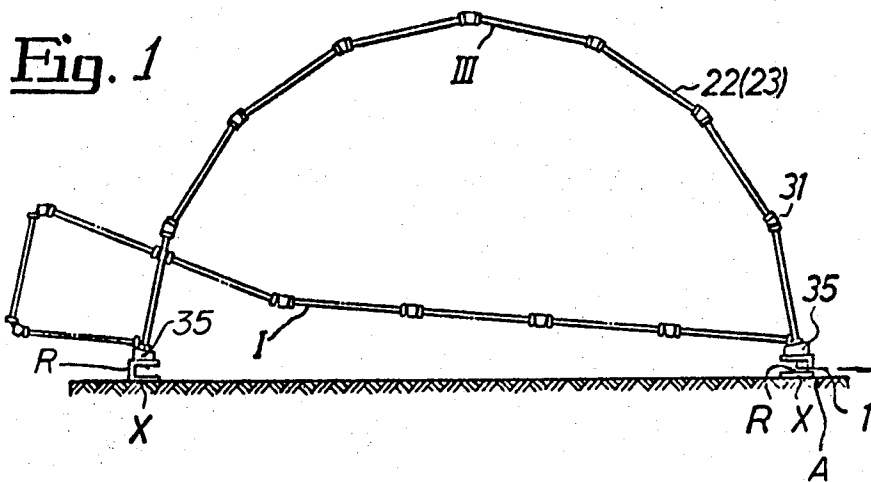


Fig. 4

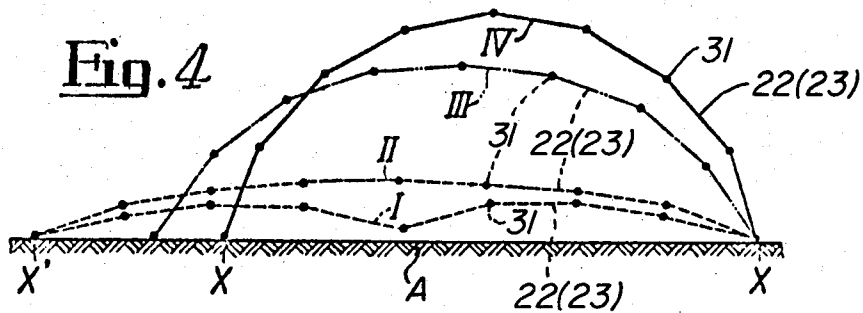


Fig. 5

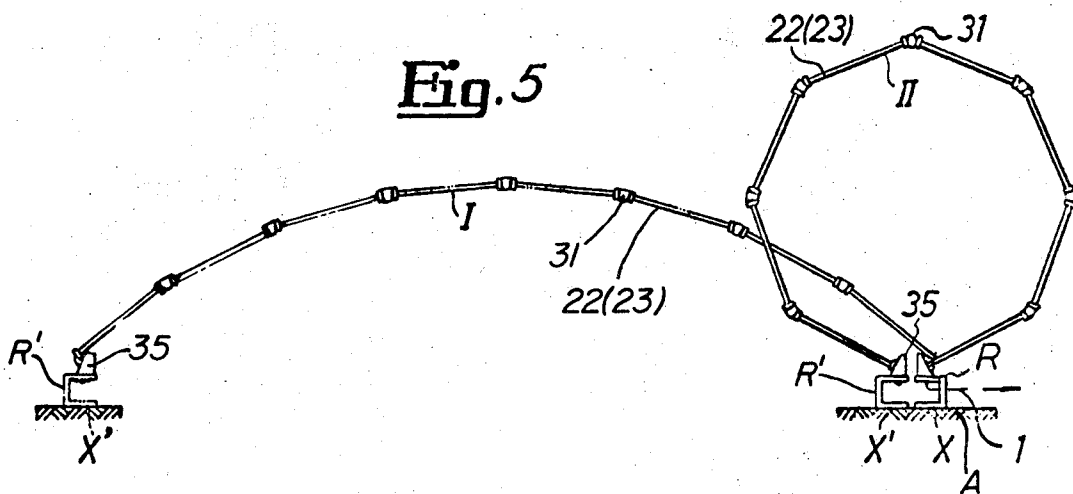


Fig. 12

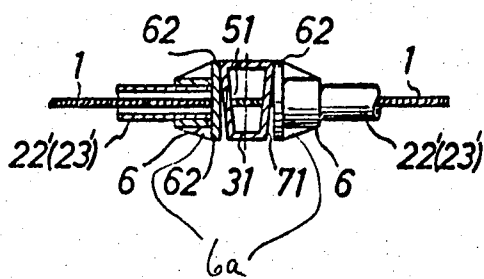
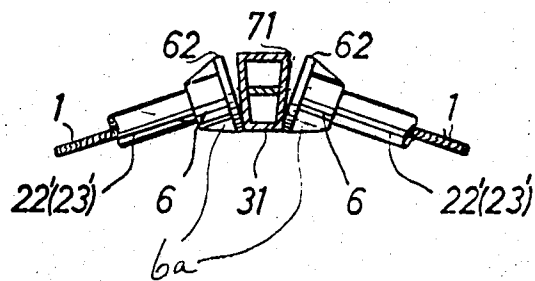


Fig. 13



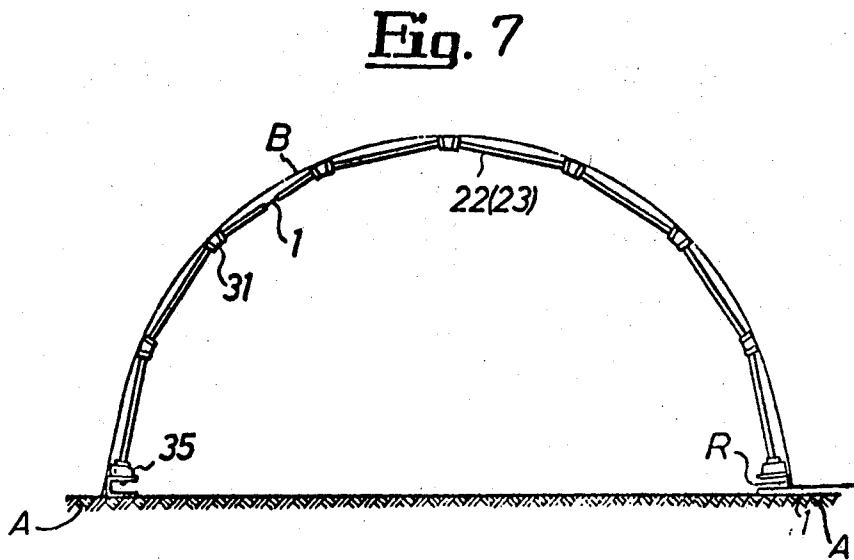
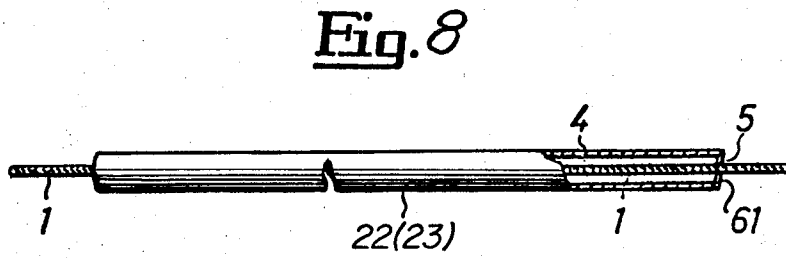
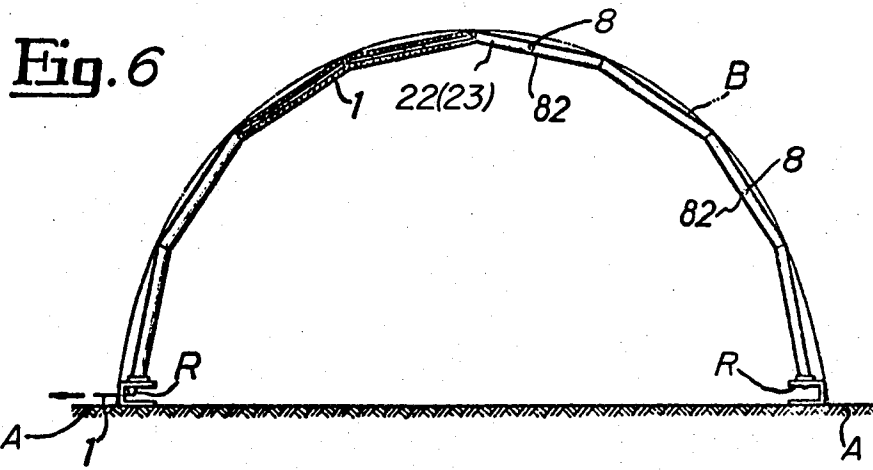


Fig. 9

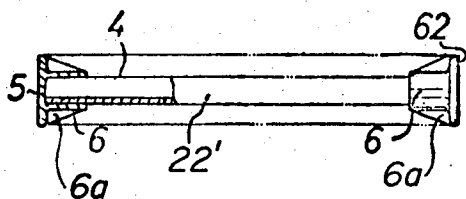


Fig. 10

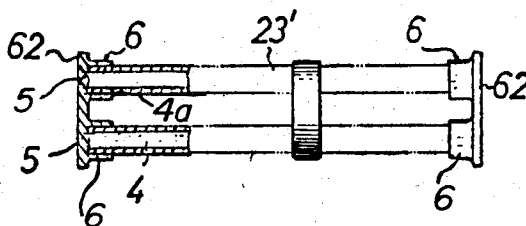


Fig. 11

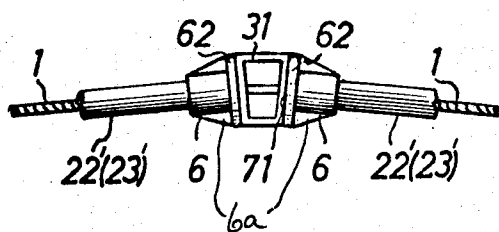


Fig. 14

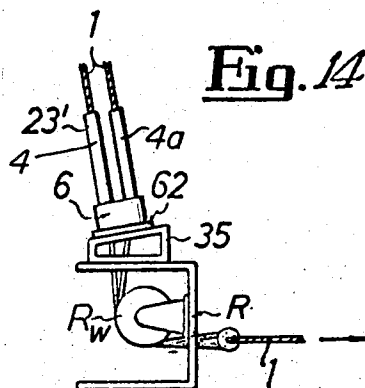
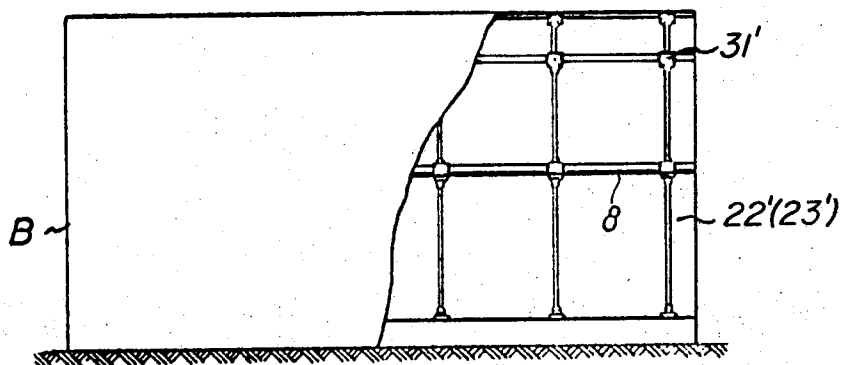


Fig. 15



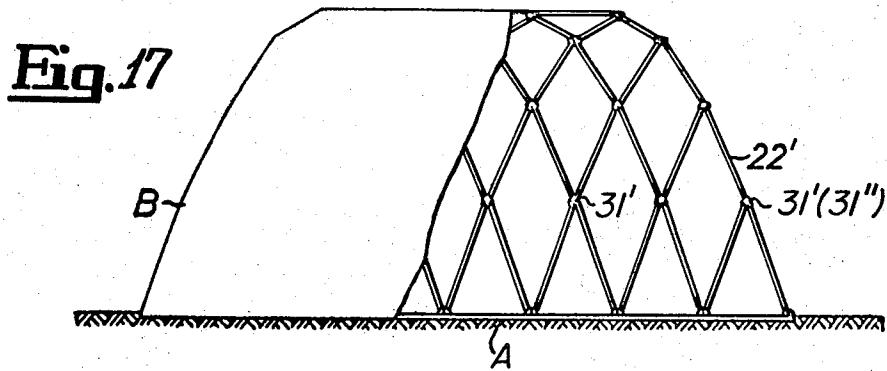
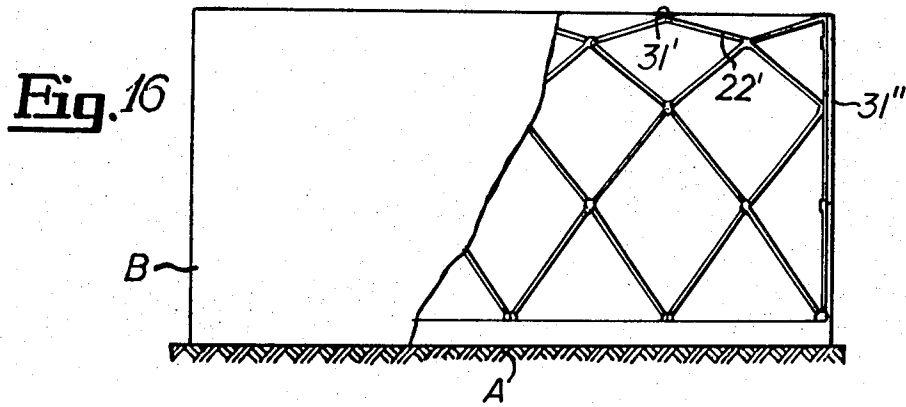


Fig. 19

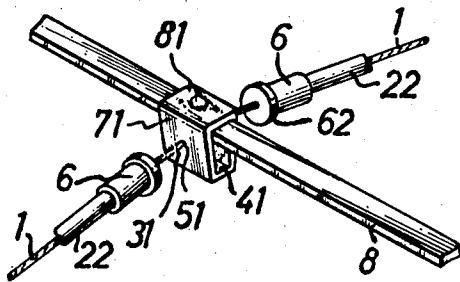
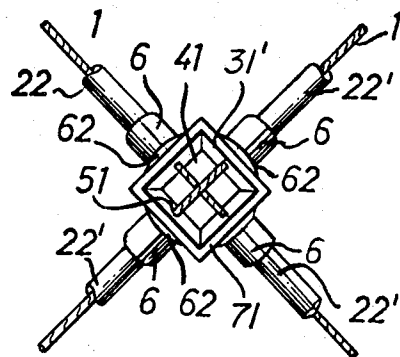


Fig. 20



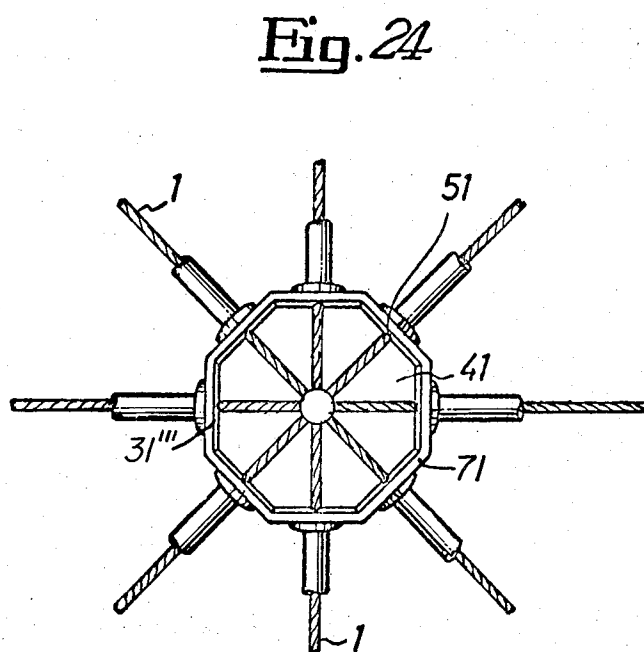
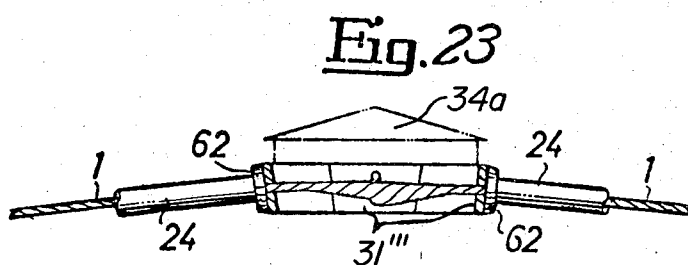
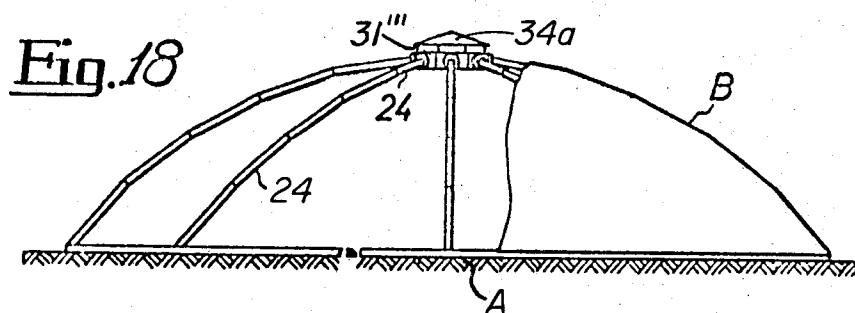


Fig. 21

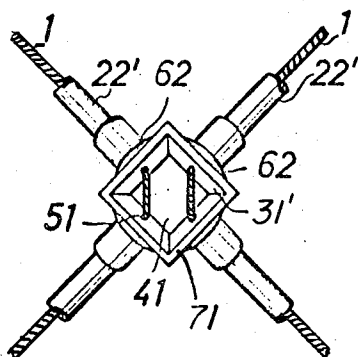
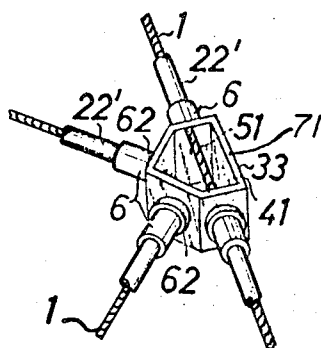


Fig. 22



METHOD OF MAKING AN ARCH

FIELD OF THE INVENTION

The present invention relates generally to permanent or temporary structural constructions and methods for assembly and erection of the same. More particularly, the present invention relates to prefabrication, assembly and erection of structural components comprising, when erected, a tension arch structure suitable for use as a temporary or permanent framing for supporting a dwelling or other suitable building. In practice, a plurality of substantially rigid hollow structural components are slidably, serially provided over a flexible wire, strand, cable or rope. Under application of a tension force to the rope, the structural components are forced into abutting relationship. The tension force on the rope causes the structural components to coact and exert mutual pressure and stress upon adjacent abutting structural components. Such coaction results in a stressed tension arch comprised of the coacting structural components. The resulting tension arch may then be erected in a single operation which is greatly simplified since the arch is prefabricated and assembled prior to erection.

BACKGROUND OF THE PRIOR ART

Conventional building structural components have been standardized to enable assembly and disassembly thereof with a saving of time and effort. Such components, however, must be precisely designed and manufactured to operate successfully when assembled. Additionally, workmen must be trained to recognize the interfitting and connection techniques employed for assembly of such components. Additionally, assembly of conventional structural components require erection of auxiliary equipment such as scaffolding and hoisting equipment. Furthermore, conventional structural components, when prefabricated, are bulky and relatively fragile causing difficulty in transportation thereof to the construction site and in precisely locating such components for erection at the site.

BRIEF DESCRIPTION OF THE INVENTION

The present invention includes structural components which may be standardized as to shape and dimensions, and which may be assembled together with conventional fastening techniques. Assembly and subsequent disassembly of the components may be accomplished quickly and on the ground at the construction site, thereby permitting adjustment or changes in the profile or height of the resultant structural configuration. Further, the arch may be subsequently erected without a need for laboriously assembling the same directly upon its final erection site. Such advantage eliminates the need for auxiliary equipment, such as scaffolds and hoisting apparatus for positioning each component as the construction is formed.

Transportation of the components to the construction site is simplified, since assembly is accomplished at the site. Additionally, adjustment and positioning of components for assembly are easily accomplished before erection to a final structural configuration.

The present invention provides a light, strong, economical structural construction which is readily adapted for meeting the structural static and dynamic

considerations required of permanent installations for general use, such as aircraft hangers, warehouses and factory buildings. Such a construction according to the invention departs from the past concept of immovable structures, since the invention is suitable for disassembly into easily transportable structural components while satisfying commercial requirements of permanent general use type buildings when erected.

In practice, a plurality of prefabricated, elongated hollow frame members of standardized construction are serially and slidably assembled over a strand of flexible wire, cable or rope with intervening joint forming members between adjacent frame members being also provided slidably over the strand.

Spaced anchors are provided at the construction site. One end of the strand is secured fixedly to one anchor, and the strand of the other end is passed through an apertured portion of another anchor. A suitable force applying machine, such as a winch, applies tension forces to the strand forcing the frame members to assume a stressed arch configuration, hereafter also referred to as a unit member, which configuration is especially determined by properly positioning frame members of selected shapes and dimensions in the assembly. The frame members if desired may be joined to the joint members by conventional fastening techniques subsequent to erection of the stressed arch configuration resulting in a permanent installation. If joining is not desired for ease in disassembly, tension may be maintained on the strand after erection of the resulting arch. To construct a complete frame suitable for supporting building panels or other siding and roofing materials suitable for a building, a plurality of arches must be provided. Such arches, or unit members, may be secured together by rigid spanning frame members supported between joint members provided on adjacent unit members. If desired, the joint members may be dispensed with, in which case, the frame members and spanning members may be connected directly to one another, again by suitable conventional fastening techniques. Additionally, the adjacent arch configurations may be intersected without a need for the spanning members.

OBJECTS OF THE INVENTION

An object of the present invention is to provide a simplified erectable structural construction fabricated from a plurality of standardized components adapted for assembly prior to erection of the resultant structural construction and a method of making the same.

Another object of the present invention is to provide a simplified construction of readily assembled and disassembled structural components resulting in a permanent or temporary structural construction.

Still another object of the present invention is to provide a plurality of structural components serially over a flexible strand such that upon application of tension forces to the strand, the components coact to form a tension arch.

A further object of the invention is to provide a plurality of structural components which are light, strong, easily transported, adapted for assembly and disassembly with conventional fastening techniques and which result in an erectable stressed arch configuration subsequent to assembly.

Other objects and attendant advantages of the present invention will become apparent from the following detailed description of the preferred embodiments taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of a preferred embodiment of the invention illustrating a plurality of structural components in an initially assembled condition and also in an erected unit member or stressed arch configuration subsequent to assembly;

FIG. 2 is a schematic view showing exemplary intermediate positions attained by the embodiment shown in FIG. 1 during erection thereof;

FIG. 3 is a side elevation similar to FIG. 1 of another preferred embodiment of the present invention utilizing a movable anchor and shown illustrated in an assembled condition and in an erected condition;

FIG. 4 is a schematic illustration, similar to FIG. 2, of exemplary intermediate positions assumed by the embodiment shown in FIG. 3 during erection thereof;

FIG. 5 is a side elevation illustrating another preferred embodiment of the present invention shown in two of any number of erected configurations;

FIG. 6 is a side elevation of a unit member, formed with a plurality of frame members without any joint members, and with parts shown partially in section to illustrate particular details of construction and further showing a mode of operation in the practice of the invention;

FIG. 7 is a side elevation of a unit member fabricated from frame members and intervening joint members illustrating a mode of operation in the practice of the invention;

FIG. 8 is an enlarged fragmentary view illustrating in detail, and with parts shown partially broken away and in section, exemplary frame members utilized on the embodiment shown in FIG. 6;

FIG. 9 is an enlarged fragmentary elevation with parts partially in section to illustrate in detail an exemplary frame member of the embodiments illustrated in FIGS. 1-5 and 7;

FIG. 10 is an enlarged fragmentary elevation with parts partially in section to illustrate in detail another exemplary frame member;

FIG. 11 is an enlarged fragmentary elevation of an exemplary joint member utilized, for example, in the preferred embodiments shown in FIGS. 1-5 and 7;

FIGS. 12 and 13 are enlarged fragmentary elevations of modified exemplary joint members of the one shown in FIG. 11;

FIG. 14 is an enlarged fragmentary elevation of an anchor showing the particular details and operation thereof;

FIG. 15 is a side elevation, with parts partially broken away, to illustrate a completed structural installation fabricated from a plurality of joined unit members such as those shown in FIGS. 1-4, 6 and 7;

FIGS. 16, 17 and 18 are side elevations with parts partially broken away to illustrate modifications of the completed structural installation shown in FIG. 15; and

FIGS. 19-24 illustrate various embodiments of joint members as applied in the embodiments shown in FIGS. 15-18.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to FIG. 1 of the drawings, the basic operation principles of the present invention are illustrated. A pair of spaced, anchors or base members R (having a pedestal 35 thereon) are fixedly secured at points X to the ground or to any suitable planar base surface A, at a construction site. A plurality of straight elongated hollow prefabricated frame members 22 or 23 are serially assembled over a flexible strand 1 (FIGS. 1, 5-8) with joint members 31 interposed between adjacent frame members. With the strand 1 initially secured to the anchors R and under no tension forces, the assembled frame members 22 (23) and joint members 31 comprise structural elements which assume a random relaxed configuration, such as the one particularly shown at I (FIGS. 1, 2). However, when tension forces are applied on the strand 1 by utilizing a machine (not shown in FIG. 1, but shown as R_m in FIG. 14), such as a winch, the assembled components coact to form a stressed arch, as shown at III (FIGS. 1, 2). The particular arch configuration arises from a proper selection of the lengths of frame members 22 (23) and joint members 31 utilized and the spacing chosen for the fixed anchors R.

FIG. 2 shows in schematic the exemplary progressive positions of the frame members 22 (23) and joint members 31 as tension forces are progressively applied to the strand 1. Thus, when relatively little tension is on the strand 1, the assembled components may assume the initial position I (FIGS. 1 or 2). As additional tension forces are applied on the strand 1 by a winch (not shown), for example, the frame members 22 (23) and joint members 31 will be forced into abutting contact with one another, coacting and exerting mutual pressure and stress upon adjacent abutting structural components 22 (23) and 31. Accordingly, the effective length of strand 1 over which the components 22 (23) and 31 are assembled progressively decreases, forcing the components 22 (23) and 31 to arrange themselves in an intermediate, partially erected arch configuration as shown at II (FIG. 2). Tension is further progressively applied to the strand 1 until the assembled components 22 (23) and 31 assume a fully erected arch configuration as shown schematically at III (FIG. 2).

FIG. 3 illustrates a modification of the preferred embodiment of FIG. 1, wherein one of the anchors R is movably mounted, for varying the shape of the finally erected arch configuration, or for a modified technique in erecting the arch configuration.

Accordingly, the Figure shows a fixed base member or anchor A provided with a force applying machine such as a winch (not shown), and fixed at point X. Another base member R is movably mounted at point X'. A strand 1 secured to the anchor at X' extends to the fixed anchor R at point X and is operatively connected to the winch (not shown). Structural components, including frame elements 22 or 23 and joint elements 31, are shown serially assembled over the strand 1. In operation, the winch (not shown) applies a desired degree of tension to the strand 1 causing the assembled components 22 (23) and 31 to coact, as heretofore explained, and assume a relatively flat arch configuration as indicated at II in FIG. 3. With the tension maintained on the strand 1, the movably mounted anchor R is moved from right hand point X' to the left

hand point X' causing increased tension in the strand 1 and forcing the coacting components 22 (23) and 31 to assume an arch configuration, shown at IV (FIG. 3), which totally differs from that shown at II in FIG. 3. Accordingly, the movable base member R' may be utilized to select the shape of the finally erected arch configuration or as an alternate technique for erecting the structural components 22 (23) and 31 to a desired arch configuration.

To more particularly illustrate the erection technique, reference will be made to FIG. 4, wherein the movable anchor at X' is provided with unstressed structural components 22 (23) and 31 which assume a random configuration such as the one indicated at I. Tension forces are applied to the strand 1 until a desired level of tension is attained, causing the structural components 22 (23) and 31 to coact, as described hereinbefore, and form a relatively flat arch configuration indicated at II (FIG. 4). As the movable anchor X' is moved progressively toward an adjacent relationship to the fixed anchor X, the arch configuration changes height and shape, as indicated at III and IV (FIG. 4). Thus, the movable anchor technique is used advantageously to erect or to adjust the final shape of the desired arch configuration.

FIG. 5 further emphasizes the change in shape of the arch configuration upon moving the movable anchor R'. In the Figure, left hand X' indicates the initial position of the movable anchor R' with the initially stressed structural components assuming an arch configuration shown at I (FIG. 5). Upon moving the anchor R' to a position right hand in adjacent relationship to the other fixed anchor R', the arch configuration may be caused to vary from relatively flat to circular.

With reference now being made to FIG. 6, there is shown in detail section a strand 1 denoting a rope, wire or cable made of a strong, flexible and durable material such as synthetic fiber, iron steel or other high-strength material. The particular material selected may vary with the considerations of planned arch configuration use and environment, structural strength requirements or conditions under which the configuration is used. The strand 1 is particularly utilized in the embodiments of the invention heretofore described in regard to FIGS. 1-5.

An important structural component utilized in practice of the preferred embodiments include elongated hollow frame members 22 (23) adapted to be serially slidably assembled over the strand 1 as shown in FIG. 6. The frame members 22 (23) are preferably of metal, synthetic resin, bamboo or similar materials which are rigid, resistant to crushing under pressure and or relatively high strength. Although a tubular cross-section is most commonly used in practice, it should be understood that other hollow cross-sectional shapes may be utilized. The particular material selected for the frame member 22 (23) is based upon considerations of structural strength and conditions under which the members 22 (23) are subjected during use.

The frame member 22 (23) is more particularly shown in FIG. 8 with certain prefabricated features. Each frame member 22 (23) is provided at each end with a beveled end surface 61, such that, when assembled frame members 22 (23) coact as described to form an arch configuration, the ends 61 of adjacent

frame members 61 will abut, as shown in FIG. 6, in complementary engaging relationship without stress concentrations due to irregular engaging surfaces. Such a construction is further advantageous, since no intervening coupling members 31 between adjacent frame members 22 (23) is required. A roof B is shown applied to the arch in FIGS. 6, 8.

As shown in FIGS. 9-14 and 19-24, additional frame members, modifications of the frame members 21, are illustrated at 22' (FIGS. 9, 11-13, 15-17, 19-22), 23' and 24 (FIGS. 10, 11-13), respectively. Each end of each frame member 22', 23' or 24 is provided with flanges 62. Each flange 62 may be formed integrally with the respective frame member 22', 23', 24 or, as more particularly shown in the drawings, provided on one end of a separate relatively short tube 6 matingly engaging the respective frame member 22', 23' or 24. Each flange 62 is preferably perpendicular to the longitudinal axis of its respective frame member 22', 23', 24, although other orientations of each flange 62 may vary as desired. Each flange 62 may be provided with reinforcing ribs 6a (FIG. 9) and a central opening 5 (FIG. 9, 10) aligned with the hollow cross-section of its respective frame member 22' or 23' to permit passage of the strand 1 entirely through the flanged frame member.

A modified prefabricated frame member is shown in FIGS. 10 and 14 and includes a pair of parallel, elongated, spaced, hollow cross-section tubes 4, 4a provided at each end with a common flange 62, each flange 62 being fixedly secured to either a single or, alternatively, a pair of parallel short length tubes 6. The tubes 6 matingly engage respective frame members 4 and 4a (FIGS. 10, 14). Each flange 62 is provided with apertures 5 which communicate with the hollow interiors of the tubes 4, 4a to permit passage of a strand 1 therethrough. In operation, as shown in FIG. 14, each tube 4, 4a is provided with a separate strand 1 therethrough. The embodiment frame member 23' particularly shown in FIG. 14 includes a flange 62 provided with a single rather than a pair of tubes 6. The flange 62 seats on an inclined surface of a generally trapezoidal interposer or adapter pedestal 35 of hollow interior construction. The interposer 35 (FIG. 14) rests on one leg of a generally U-shaped base or anchor R, the other leg of which is fixed to the construction site ground A or other suitable surface. On the base of and between the legs of the U-shaped member R is mounted a tension applying machine such as a pulley or winch R_W. The two strands 1 extend through the adapter pedestal 35 (FIG. 14) and through one leg and base of the U-shaped member to operatively engage the winch R_W. Upon operation of the winch R_W the strands 1 are placed in tension so that a plurality of frame members, similar to the double frame member 23' and shown in FIG. 14, coact to produce a stressed arch configuration as heretofore described.

The particular frame member embodiments utilized are prefabricated and are thus able to be selected upon a consideration of the planned mode of construction, structural strength requirements and conditions subjected to during use. Any of the frame member embodiments are compatible for use with the pedestal 35 shown in FIG. 14.

With reference to FIGS. 11 through 13, one embodiment of a prefabricated joint member 31 is shown. As heretofore explained, a joint member 31 is selectively interposed between adjacent frame members 22, 23, 22', 23', or 24 in the stressed arch configuration. With reference to FIGS. 11-13, a joint member 31 is shown interposed between adjacent frame members 22' or 23'. Each joint member 31 may or may not be selected of the same material as the frame members 22, 23, 22', 23', 24 and are conveniently utilized for attaching the spanning frame members 8, (FIGS. 15, 19), between adjacent arch configurations. Each joint member is generally of hollow interior trapezoidal configuration with vertically inclined side wall surfaces 71 (FIGS. 11-13), each of which wall surfaces 31 is appropriately apertured as shown at 51 (FIG. 12) to permit passage therethrough of a strand 1 for a purpose heretofore described. The pitch of the inclined wall surfaces 71 may be selected for controlling the radius of curvature desired in the final arch configuration formed when the frame members 22' or 23' and the interposed joint members 31 coact in abutting relationship. Thus, the wall surfaces 71 provide bearing surfaces of adjustable pitches for the abutting frame members 22', 23', as shown in FIG. 11, thereby controlling the inclination of the frame members 22', 23' in the arch configuration and thus the radius of curvature of the arch configuration.

Further details of the joint member 31 are shown in FIG. 19. With reference thereto, the hollow interior of the joint member 31 is shown at 41 provided for accommodating a spanning frame member 8 in the form of a rigid bar of rectangular cross-section. The spanning frame member 8 may be secured to the joint member 31 by a threadably driven fastener 81 engaged in the spanning member 8 to securely lock the spanning member 8 and the joint member 31 together.

As heretofore described, the invention may be practiced without using interposing joint members 31. Accordingly, with reference to FIG. 6, a plurality of spanning members 8 may be secured by conventional fastening techniques directly to the frame members 22 (23), either at the midpoints 82 of member 22 (23), as shown, or to other portions as desired.

With reference to FIGS. 20 and 21, a modified prefabricated joint member 31' is shown with four inclined wall surfaces 71 arranged in a generally rectangular configuration about a hollow interior portion 41. The joint member 31' is thus used for connecting four frame members 22' or 23' covering from different directions and included in arch configurations which intersect at the joint member 31'.

As shown in FIG. 20, the strand 1 is passed through holes 51 in opposite sidewalls 71, whereas in FIG. 21, the strands 1 are passed through adjacent holes 51 in sidewalls 71 to result in an arch configuration which is not planar, but segmented and multiplanar with the different segment planes thereof intersecting at the frame member 31'.

FIGS. 16 and 17 particularly illustrate practical applications for the joint member 21' (FIGS. 20, 21) wherein building panels or similar building structural wall and roof surfaces B are supported by a plurality of arch configurations which intersect, with joint members 21' (FIGS. 20, 21) being provided at the intersections thereof.

FIG. 22 illustrates another modified prefabricated joint member, indicated at 31' and including a plurality of flat bearing sidewalls 71 mutually arranged in a hollow interior 41 polygonal configuration. Each sidewall 71 is abutted by a frame member 22' and is provided with an aperture 51 to permit passage therethrough of a strand 1, for a purpose heretofore described. It is noted that two of the shown abutting frame members 22' are not directly opposite other frame members 22'. Such frame members 22 are thus included in segmented stressed arch configurations which terminate at the joint member 31'. Accordingly, in the formation of such segmented configurations, the strands 1 associated therewith is secured, by any well-known technique, to the joint member 31', rather than to an anchor R, as heretofore described with regard to non-segmented configurations. The remaining end (not shown) of the segmented configuration is associated with an anchor R and a tension applying means R_w (FIG. 14), as described, to result in the arch configuration, segmented because of its attachment to the joint member 31'. Alternatively, the segmented configuration may be fabricated with a single strand 1 as described for the segmented arch shown in FIG. 21.

FIG. 16 shows a practical application of the joint member 31', wherein a plurality of arch configuration intersect in a lattice building structure including a plurality of segmented arch configurations intersecting and terminating at a joint member 31'.

FIGS. 18, 23 and 24 illustrates a modified prefabricated joint member 31'', interposed between adjacent frame members 24 and provided with a plurality of bearing sidewalls 71 (FIG. 24) arranged mutually in a hollow interior polygonal configuration. In a manner similarly described, the sidewalls 71 are abutted by frame members 24 for a heretofore explained purpose. The hollow interior of the joint member 31'' encloses and carries a building roof accessory, as shown, such as a peak enclosure cap or a cowl vent 34a (FIGS. 18, 23). FIG. 18 further illustrates the joint member 31'' in a completed building structural installation.

The featured advantages of the present invention include the base on anchor R, which requires less foundation preparation required for prior art structural configurations. Merely selecting the distances between fixed bases A, or the arch terminating frame member 33, to be less than the total effective length of the assembled frame members 22, 23, 22', 23', 24 and joint members 31, 31', 31'', 31'', if any are used, will result in an arch configuration upon applying and maintaining tension forces to a strand 1 over which the members 22, 23, 22', 23', 24 and 31, 31', 31'', 31'' are assembled. The distance between intersections and the shape and height of the configuration may be adjusted as desired by selection of the anchor spacing effective length of the strand 1, effective lengths of each and the total effective combined frame members 22, 23, 22', 23', 24 and joint members 31, 31', 31'', 31'' used. Further adjustments are provided by the type of joint member 31, 31', 31'' used, the pitch selected in the joint member sidewalls and the inclination of the end walls of abutting frame members 21.

Tension forces applied to the strand 1 are evenly distributed and transferred to all of the frame members 22, 23, 22', 23', 24 and joint members 31, 31', 31'',

31''' throughout the progressive arch erection as shown in FIGS. 1-5. Since the members 22, 23, 22', 23', 24 are rigid and are immovably seated at the arch termination points X, the effective length of the arch configuration becomes a minimum upon reaching a corresponding tension level in the associated strand 1. Accordingly, any increase in tension forces applied to the strand 1, such as by wind loads, will not change the effective length or shape of the arch configuration.

All embodiments of the frame members 22, 23, 22', 23', 24, the joint members 31, 31', 31'', 31''' and the spanning members 8 are prefabricated with the structural features and standardized dimensions as described. Accordingly, the required structural component may easily be selected for incorporation in a specific arch configuration desired.

All of the intersecting or spanning member 8 (FIG. 15) connected arch configurations which are combined to form a building structural installation may be assembled as described, covered with suitable building sheeting or other siding and roofing material B (FIGS. 7, 16-18, 15) and subsequently simultaneously erected according to the techniques described, to result in a completed building, such as those shown in FIGS. 15-18. Other techniques may be employed during erection. For example, the arch configuration mid-points may be temporarily supported by removable upright support poles which are subsequently discarded upon erection of the configuration to a final position.

Other embodiments and modifications of the present invention are within the spirit and scope of the present invention as defined in the appended claims, wherein, what is claimed is:

1. A method of erecting a structural configuration comprising the steps of:

- a. serially slidably disposing a plurality of frame members provided with planar surfaces on each end thereof on a flexible strand,
- b. disposing joint members on said flexible strand between adjacent frame members so that a joint planar surface on each joint member is disposed adjacent to a planar surface on an adjacent frame member,
- c. extending a spanning frame member through said joint member,
- d. anchoring one end of said flexible strand on a foundation,
- e. passing the other end of said flexible strand through an anchor on said foundation in a spaced relationship to said one end of said flexible strand,
- f. applying tension forces upon said strand to cause said frame members to assume an erected arch configuration with said joint planar surfaces in contacting engagement with said adjacent planar surfaces,
- g. maintaining the tension forces upon said strand at a minimum level sufficient to maintain the arch configuration, and

h. while one of said contacting planar surfaces is substantially perpendicular to said frame member and the other planar surface is at an angle less than about 90° with respect to said other frame member.

2. The method recited in claim 1 including the step of:

- a. moving one end of said flexible strand with respect to the other end of said flexible strand prior to applying said tension forces.

3. The method recited in claim 1 including the step of:

- a. fastening said spanning frame member to said joint member.

4. The method recited in claim 1 including the step of:

- a. passing said flexible strand through opposed joint planar surfaces.

5. The method recited in claim 1 including the step of:

- a. passing said flexible strand through a first joint planar surface on said joint member, and
- b. then passing said flexible strand through a second joint planar surface on said joint member, which second joint planar surface is disposed at an angle less than about 180° with respect to said first joint planar surface.

6. The method recited in claim 1 including the step of:

- a. providing venting means for said structural configuration in one of said joint members.

7. A method for erecting a structural configuration comprising the steps of:

- a. serially slidably disposing a plurality of frame members on a flexible strand, each member being provided with planar surfaces on each end thereof,
- b. disposing joint members of said flexible strand between adjacent frame members so that a joint planar surface on each joint member is disposed adjacent to a planar surface on an adjacent frame member,
- c. extending a spanning frame member through said joint member,
- d. anchoring one end of said flexible strand on a foundation,
- e. passing the other end of said flexible strand through an anchor on said foundation in a spaced relation to said one end of said flexible strand,
- f. applying tension forces upon said strand to cause said frame members to assume an erected arch configuration with said joint planar surfaces in contacting engagement with said adjacent planar surfaces and lies substantially on a radius of said arch configuration, and
- g. maintaining the tension forces upon said strand at a minimum level sufficient to maintain the arch configuration.

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