

Dec. 10, 1968

R. L. HALL

3,415,260

EXTENSIBLE CANOPY STRUCTURE

Filed July 17, 1967

3 Sheets-Sheet 1

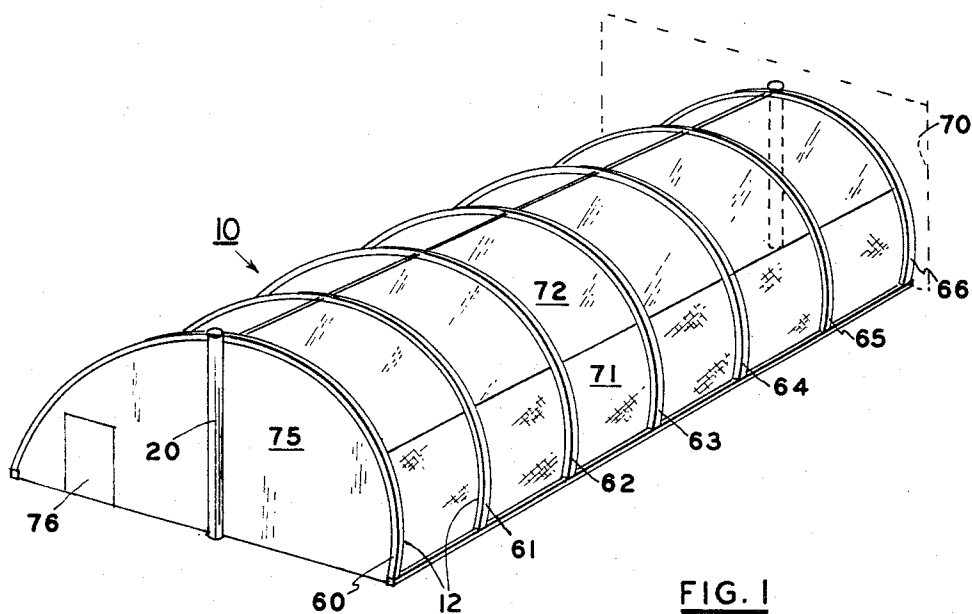


FIG. 1

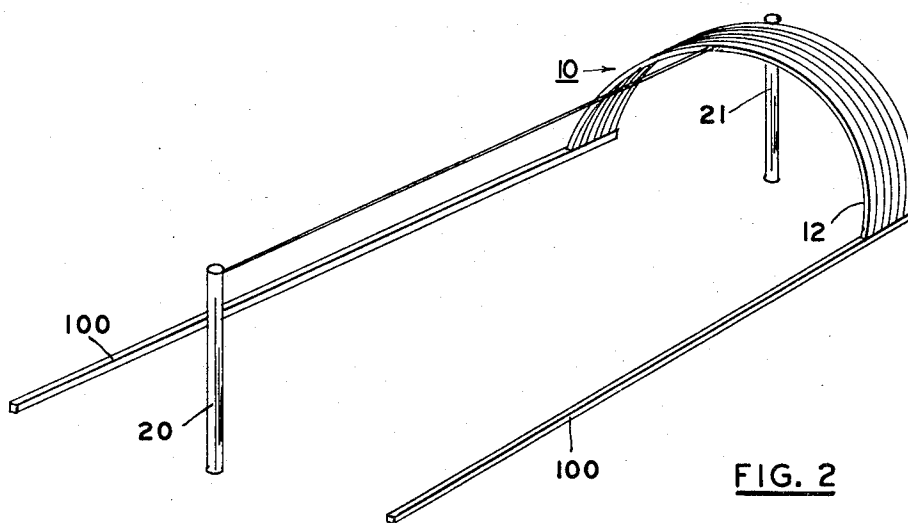


FIG. 2

INVENTOR

RAYMOND L. HALL

BY

Ralph R. Roberts
AGENT

Dec. 10, 1968

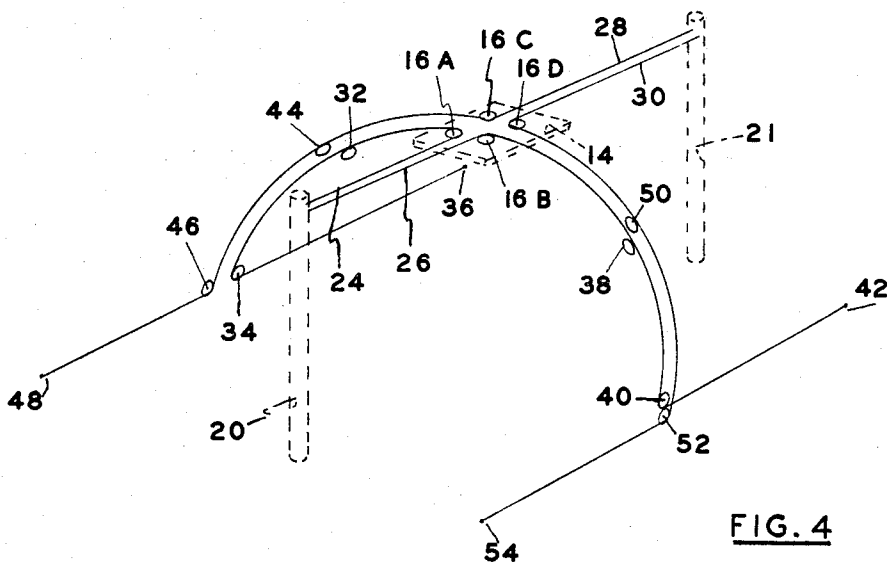
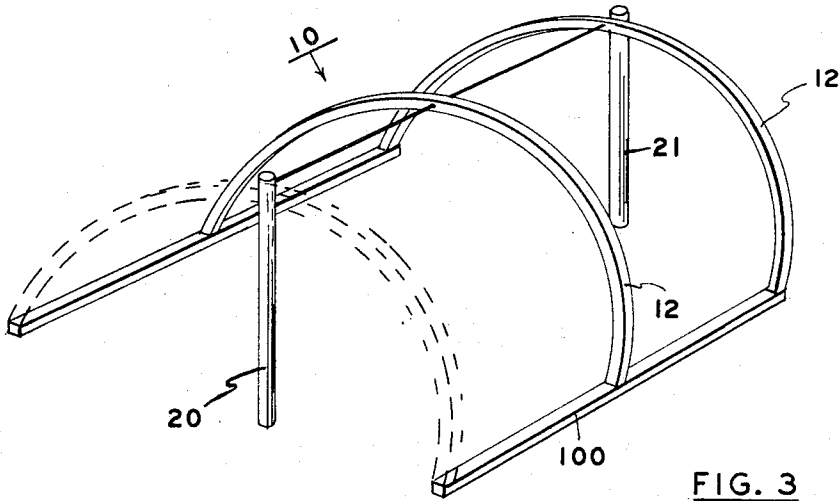
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3 Sheets-Sheet 2



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BY

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AGENT

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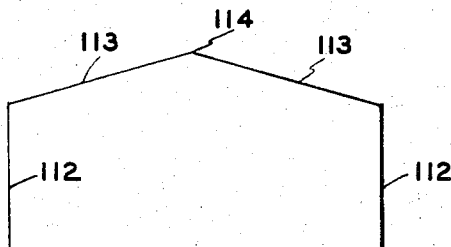
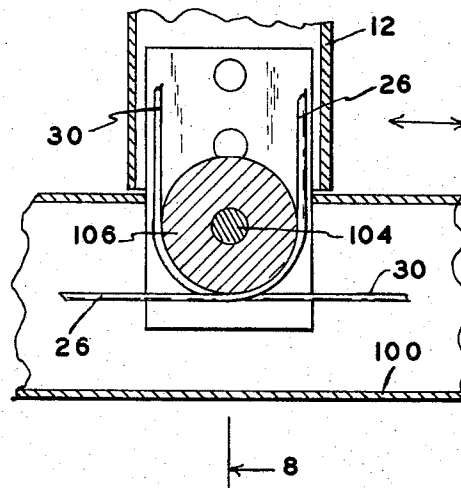
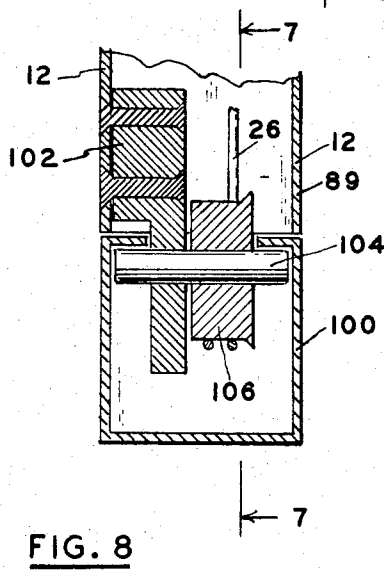
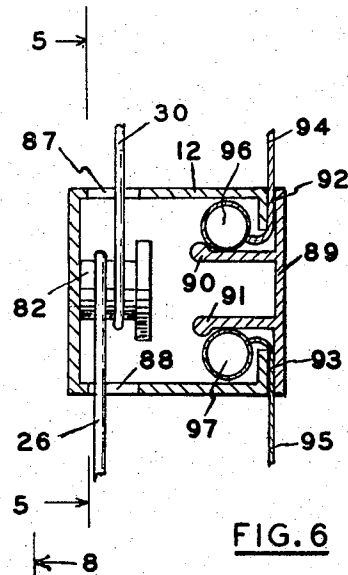
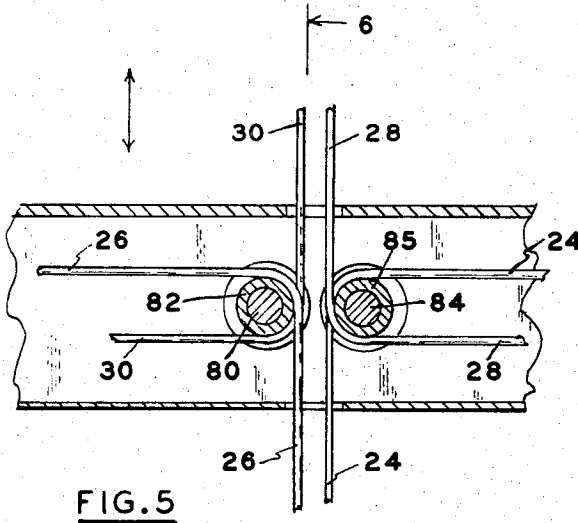
R. L. HALL

3,415,260

EXTENSIBLE CANOPY STRUCTURE

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3 Sheets-Sheet 3



INVENTOR.

RAYMOND L. HALL

BY

Raeph R Roberto
AGENT

1

3,415,260

EXTENSIBLE CANOPY STRUCTURE

Raymond L. Hall, 19 Hamilton Court,

Whippany, N.J. 07981

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15 Claims. (Cl. 135—1)

ABSTRACT OF THE DISCLOSURE

A plurality of frames or arch members are independently movable between two fixed posts or support members and each is maintained in aligned parallelism by four cables, each cable being disposed in a Z-pulley arrangement. Between each frame there may be provided a flexible cover or screen or a combination thereof so that when assembled the structure may be expanded to its maximum limit to provide an enclosure or canopy and may be moved to its minimum or closed limit for storage of the structure and cover.

Background of the invention

Field of the invention

The field of art to which this movable structure pertains is the general class of tents, canopies, umbrellas and canes and particularly to the subclass of tents and tent frames and folding frames as well as canopies with expansible frames. Another field of art to which this invention might pertain is the general class of land vehicles, bodies and tops and in particular to the general subclass of tops and more particularly to load covers and collapsible standing tops.

Description of the prior art

Collapsible or retractable covers or extensible canopies are generally represented as in U.S. Patent to Richard, No. 3,041,104 of June 26, 1962 and in the patent to Openshaw, No 3,298,732 of Jan. 17, 1967. A patent of similar nature was issued to Greenberg, No. 3,310,338 on Mar. 21, 1967 while U.S. Patent No. 3,240,217 to Bird of Mar. 15, 1966 also shows an erected structural assembly in which arches or frames are used to support a flexible covering.

Summary of the invention

This invention contemplates the use of a plurality of like sized arches or frames which are generally planer in construction and use. Each of these frames when erected is operatively maintained in a vertical alignment by means of a cable assembly. Each of these frames is maintained in a vertical relationship by separate cable assemblies and is adapted to be moved independently forwardly and back while being maintained in an aligned and vertical manner. It is generally contemplated that this structure may be used as an expansible cover for a swimming pool or provide an expansible covering for a patio and the like and that as such, this structure provides a support means for a flexible roof covering whereas the sides may also have a flexible screen or a flexible wall which would provide for the exclusion of insects or of moisture as well as heat or cold.

The present invention provides an assembly in which each frame is supported by four cables and is retained in a vertical manner by means of pulleys or guides. These cables are attached at their ends and are guided and retained by pulleys and the like which are attached to the frame so that as the frame is moved the cables limit the movement of all portions of the frame so that it may be moved only as guided by the cables. The covering between frames is contemplated to be of plastic film and the

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like which is preferably flexible and permits the frames to be brought into a near contiguous relationship to each other. The maximum extension of the structure is determined by the distance between two vertical support means which may be in the nature of posts which carry the upper and outer ends of the cables.

It is contemplated that the frames of the assembly will be made of light weight extrusions and of relatively inexpensive cost. The extent of flexible material between frames also is of low cost and weight so that for the assembly and operation of the extensible structure there is no need of extensive erecting facilities. Operation for the opening or closing of the structure requires little force and may be moved according to the weather as to sunshine, rain, heat or cold. As a pool cover it extends the useful season length of pool use. If desired the sides and roof portions may be rigid panels that telescope onto one another.

It is an object of this invention to provide a structural assembly adapted for extension to a maximum condition and at the other limit movable to a condensed condition, and between these limits the structure may be moved as desired to any open, partially open or closed position and in the position the structure will support the desired covering.

It is a further object of this invention to provide an extensible canopy structure having at least one movable arch member maintained in its erected and substantially vertical manner by means of cables extending from a first fixed support position to a plurality of cable guide means in the arch member and thence to another fixed support position.

It is a still further object of this invention to provide an extensible canopy structure in which a movable arch member is maintained in a substantially vertical relationship to a ground or support surface, the arch member being movably supported by at least four cables and the like, each cable extending from a fixed support and in a line normal to the plane of the frame to a cable pulley or guide near or at the apex of the frame, said cable carried and guided around this pulley and continuing parallel to the frame to yet a second pulley or guide near or at the outer lower end of the frame, said cable thence being carried or guided around this second pulley and then in a line normal to the plane of the frame, the cable is continued to and attached to another fixed support.

Intent of the disclosure

Although the following disclosure offered for public dissemination is detailed to ensure adequacy and aid in understanding of the invention, this is not intended to prejudice that purpose of a patent which is to cover each new inventive concept therein no matter how it may later be disguised by variations in form or additions of further improvements. The claims at the end hereof are intended as the chief aid toward this purpose, as it is these that meet the requirement of pointing out the improvements, combinations and methods in which the inventive concepts are found.

There has been chosen a specific embodiment of the canopy structure and a preferred and alternate means for guiding the cables to and through a movable arch of the structure, the embodiments chosen for the purposes of illustration and description of the structure and method supporting these arches are shown in the accompanying drawings forming a part of the specification wherein:

Brief description of the drawings

FIG. 1 represents an isometric view of the extensible canopy structural assembly of this invention and in an expanded and/or fully open position;

FIG. 2 represents an isometric view of the extensible canopy structure of FIG. 1 but with the movable arches moved to the closed position;

FIG. 3 represents an isometric view of the structural assembly and showing one movable arch frame and the arrangement of cables therefore with said movable frame midway between two fixed support ends;

FIG. 4 represents an isometric and somewhat schematic view of a four cable arrangement for one arch frame;

FIG. 5 represents an enlarged fragmentary sectional plan view of a pulley arrangement for supporting the apex of the arch, the view generally taken on the line 5—5 of FIG. 6;

FIG. 6 represents a sectional view of the pulley arrangement of FIG. 5 with the view taken on the line 6—6 of FIG. 5;

FIG. 7 represents an enlarged fragmentary sectional side view of a pulley arrangement for guiding and supporting the bottom outward end of a movable arch member, the view taken on the line 7—7 of FIG. 8;

FIG. 8 represents a sectional view of the pulley arrangement of FIG. 7 but with the flexible material retaining means omitted, the view taken on the line 8—8 of FIG. 7, and

FIG. 9 represents a somewhat diagrammatic view of an alternate form of arch or frame.

Referring now to the drawings in detail in which like numbers refer to like members throughout the several figures and in particular to the FIGS. 1, 2, 3 and 4, it is to be noted that an arch frame as in this preferred embodiment is generally indicated as 10 in which a curved or arcuate member 12 is retained at its ends and at an apex or peak. At the apex there may be provided a plate 14 upon which there are carried pulleys or cable guides 16 each adapted to receive and redirect a cable to other guides. To support the ends of the cables there are provided front and rear posts 20 and 21 which are about the same height as the peak of the arch frames and carry the upper outer ends of the cables.

As diagrammatically shown particularly in FIG. 4, it is to be noted that cables 24 and 26 are attached to and are supported by the post 20 and in like manner cables 28 and 30 are attached to and are carried by the post 21. This post 21 is not needed if the ends of these cables are attached to a wall or some other structure against which this extensible framework is adapted for storage.

The cable 24 extends from post 20 to and around the leftward pulley 16A thence down or inside member 12. When carried outside the member the cable is movable in and through a guideway 32 and then down to a pulley or cable guide 34 near the bottom portion of the member 12. The cable 24 is guided around this pulley and normal to the plane of the member 12 continues back to a wall mount or attachment 36. Cable 26 extends from post 20 to and around pulley 16B and down or inside the right portion of member 12. If necessary it is carried through a cable guide 38 and thence down to a lower pulley 40 and guided around this pulley continues rearwardly to a wall mount 42.

In like manner cable 28 is attached to the post 21 or to a wall and extends forwardly therefrom to a pulley or cable guide 16C thence down or inside the left upper portion of member 12 to a cable guide 44 and thence down to and around a lower pulley 46 and forwardly to an attaching point 48. Similarly, cable 30 extends forwardly from the post 21 to a pulley 16D and parallel to the frame 12 leads outwardly and downwardly to a cable guide 50 and thence down to a lower pulley 52 and around this pulley forwardly to an attaching point 54.

Although the cable arrangement shown in FIG. 4 is shown as for only one frame many frames may be used with four such cables used for each movable frame so that each frame is independently retained and as it is moved is maintained in the erected position. It is, of course, readily apparent that the pulleys 34 and 46 may

be freely rotatable on a common shaft as also can the pulleys 40 and 52, this arrangement being described below. The attaching of the ends of the cable at points 42, 54, 48 and 36 can be either to the ground or to fixed wall structures. The cables are attached with no slack and so that the desired tension in the cable is maintained and remains the same as the frame is moved back and forth.

Referring now to FIG. 1, it is to be noted that the structure embodies a plurality of frames, as for example, a first or forward frame 60 and a first rightwardly adjacent frame 61. Other adjacent frames 62, 63, 64 and 65 are spaced rearwardly toward a rear frame 66, which frame may be attached to a wall 70 indicated in phantom outline. On these various frames are indicated side portions 71 which may be a flexible screen, either plastic or metal, or may be a thin flexible plastic film either clear or colored which may be attached to the side member portions of the frame so that as the frame is moved back and forth the side portion is expanded or folded in accordance to the relative position of adjacent frames. The side 71 may be continued upwardly or a different top covering 72 may be supplied so as to extend from the outermost frame to the wall. In FIG. 1 the cover extends from the rightward frame 66 to the leftward frame 60 when the framework is expanded to its maximum position. The ends of the structure as provided by the frame 60 may be covered by a screen or plastic wall 75 with selected supports and also a framework which may include a door 76.

Referring particularly to FIGS. 3 and 4, it is to be noted that as the frame is moved leftwardly the portions of the four cables to the left of the frame, of course, becomes shorter as the frame moves on those cables and those portions of cables to the right of the frame become longer as the frame moves leftwardly. However, as the distance from the pulleys 16 down to the lower pulleys 34, 40, 46 and 52 are fixed and always the same, it is apparent that as the frame is moved the cables maintain the frame in the position in which it was originally erected. As each frame is pushed forwardly or backwardly it maintains its erected alignment without restraint as it is moved to the desired position or until the outer sides 71 and top or roof 72 which are attached to the frames limits and determines the extent of the movement of the several frames.

Use and operation of the preferred embodiment

The structure above-described may be an independent canopy or may be used in conjunction with a permanent structure such as a house and the like. When used with a house it is only necessary that the position and extent of the enclosure be determined and against the house the frame 66 is attached. The forward or outward extent of the structure is determined, at which point the post 20 is erected. When it is desired that the structure be self-supporting and independent of any other structure, as for example, as a swimming pool cover and the like, then the post 21 is also erected which provides the other determined extent of the structure. Normal to the axis between the two posts is the determined positions for the attaching of the ends of the cables as indicated by points 48, 54, 42 and 36. Having located these points the cables 24, 26, 28 and 30 are attached to the top of the posts and from these posts are fed to and threaded through the frame. The frame is placed in a desired established position, preferably vertical, and the other ends of the cables are attached so that the cables are brought into and maintained with a predetermined amount of tension.

It is to be noted, of course, that the plate 14 need not be exactly at the apex of the frame but may be slightly below that so that the cables are disposed on the underside of the frame without interference or engagement of the structure of other frames.

It is also, of course, to be noted that the pulleys 16 may all be mounted upon a common shaft or axle with a cable

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being brought directly to and around each pulley. The pulleys 16 may be mounted upon two shafts with the shafts lying in a plane at right angles to the plane of the posts. This arrangement is described as an alternate embodiment below.

When the structure is rather extensive, the tension in the cables may be maintained by means of a spring and the like; also, the cable may be tensioned by means of a turnbuckle or other means. The tensioning of the cable although important is not considered a novel feature of this structure as cable tensioning devices are quite common.

Alternate embodiment of cable and frame

In FIGS. 5 through 8 there is shown an alternate means of assembly and construction of the frame and cables contemplated for use in this invention.

Referring now in particular to FIGS. 5 and 6, it is to be noted that the frame member 12 is a U-shaped or box extrusion and, at its apex, instead of a plate 14 there is provided a headed pin 80 carrying on an intermediate portion thereof a roller 82. This roller is adapted to retain and to receive the cables and rotate with the movement of the frame. FIG. 6 shows the roller as seen carrying cables 26 and 30 with the roller 82 rotating as the member 12 is moved back and forth. The cables are carried by and are redirected over the roller 82 and since both cables are moved in the same direction, the roller 82 carries both of them for movement of the cables at the same speed. In like manner a similar roller and pin is mounted adjacent to the roller assembly shown in FIG. 6 and, as seen in FIG. 5, carries the cables 24 and 28 and when of the same size and is rotated at the same speed as the roller 82. In FIG. 6 and for purposes of identification, the rightwardly illustrated pin is 84 and the roller is 85.

Referring particularly to FIG. 6, it is to be noted that the U-shaped structure 12 has passageways 87 and 88 formed therein for the passage therethrough of the cables. The inner or bottom side of the U-shaped frame 12 is provided with a closing or covering plate 89 having upright portions 90 and 91 attached so as to provide slots 92 and 93 for the insertion therethrough of film or flexible screen members 94 and 95. These members have the ends thereof fastened to or formed into tubular portions 96 and 97 so that when mounted in the slots 92 and 93, the film or flexible screens 94 and 95 is firmly retained therein. As thus arranged with the members 94 and 95 on the inner portion of the frame the cables pass above or outside the members 94 and 95 without engagement or damage to them.

It is also to be noted, of course, that the outwardly extending cable portions may be carried and guided in the interior portions of the structure 12 and between the portions 90 and 91 and as guided thereby they move downwardly to the outward and bottom portion of the frame more fully shown and described in conjunction with FIGS. 7 and 8.

Referring now in particular to FIGS. 7 and 8, wherein the cables, as for example, 26 and 30 are brought downwardly to the end of the frame 12 at which point a channel member 100 which is similar to frame 12 is laid upon or in the ground, this channel 100 provides a trackway for lateral retention of the frame during the movement of the frame 12. This frame has attached to its inner lower portion a block 102 carrying a shaft 104. This shaft rotatably carries thereon a roller 106 around which is guided and carried the cables 26 and 30.

Referring now in particular to FIG. 7, it is to be noted that as the frame 12 is moved to and fro as indicated by the arrows, the cables 26 and 30 are redirected by means of roller 106 moves around the roller to maintain the ends of and the channel 12 itself in an erected and substantially vertically predetermined position. Of course, the closing plate member 89 may be continued all the way to

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the ends of the member 12 and the flexible members 94 and 95 also may be continued down member 12 to the bottom end adjacent the channel member 100. The members 94, 95, 90, 91, 96 and 97 which would therefore be seen in FIG. 8 has been omitted in this figure for clarity of illustration. In this manner as the frames are moved to the expanded or closed position the flexible members 94 and 95 retain their position in respect to the ground and to the movable frames.

Referring finally to FIG. 9, there is shown a line outline of an arch or support frame of an alternate shape in which two upright side portion members 112 are substantially parallel to each other and from their upper ends the side members are bent to form or are attached to sloped rafter portion members 113 which terminate or join at an apex 114. The cross-section of this alternate frame may be like the assembly of FIG. 6 with aluminum extrusions providing the structural components of the frame. Other shapes of frames, of course, may be provided, it being only necessary that they be provided with cable and pulley arrangements providing a Z-cable arrangement for four cables as shown in FIG. 4. When desired for stability and/or because the arch is of a large size additional cables arranged in a Z-pattern may be provided. A pair of additional cables, for example, might be provided at the juncture of sides 112 and rafters 113 in FIG. 9.

It is readily seen that the structure constructions as above-described are economically practical and high production can be made and maintained, that the parts can be prefabricated for ready assembly and that replacement and repair is easily provided for. The cables as contemplated for use in this structure are of the aircraft flexible metal type such as stainless steel. These cables are approximately one-eighth inches in diameter and when of stainless steel have sufficient tensile strength to retain the movable members in the preselected erected arrangement and that these members are maintained in parallelism as they are pushed to and fro at the selection or discretion of the owner or user.

Although each member requires four cables to maintain its alignment, the cost of the cables and the space required for the cables moving within a frame which may, for example, be two inches square and is preferably made of extruded aluminum provides a strong yet light weight member which may be used as a support for a swimming pool cover, as a canopy or enclosure for a patio or in an abbreviated vertical height may be used as a truck cover which may be moved to the cab or towards the end of the truck as desired.

It is, of course, to be noted that as described there is provided a structure adapted for covering patios or swimming pools, which structure, of course, permits the pushing of all of the frames to one end so that the patio or swimming pool may be exposed to the natural elements. Of course, it is quite relevant that the structure be movable into an open or closed position any time that it is desired and that the material forming the walls and roof of the enclosure be a type of material which is highly flexible. However it is contemplated that removable panels may be attached to these frames if desired. These frames may also have substantially rigid panels which are arranged to telescope within one another when closed and which join with adjacent panels to provide a substantially rigid wall when expanded.

It is, of course, realized that this type of structure may be used to provide an expandable cover for trucks, in which case instead of the ground as indicated in FIG. 1, the platform or sides of the truck body may be determined as being the ground level and the vertical side extents of the frame members 12 may be made whatever length is desired and also, of course, the roof may be an arc or sloped and may be any pitch from a substantially flat roof to a slope of any desired pitch, this being merely a matter of selection.

It is to be further noted that posts 20 and 21 need not be fixedly erected in the ground and the like but instead may be erected in the manner of a tent pole. When so erected the posts have their bottom ends resting in either temporary or permanent sockets. The upper ends of the posts are maintained in the desired erected position by means of ropes or cables attached to the posts so as to accommodate the overturning forces on the posts and retain the posts upright. Other obvious equivalents may be used to support or replace the posts and it is to be pointed out that the posts are intended only to support and retain the upper ends of the cables with no novelty ascribed to the method of erecting and supporting the posts.

Method of arranging the cables

The structure of this invention provides for a method of arranging the plurality of cables used with each frame so that each cable is disposed in a generally X-form and so that the apex and outer ends of each frame is supported and retained as erected and the frame is movable in a path normal to the plane of the member, the method of arranging the cables including retaining one end of a cable to a fixed support such as a post or building, the attached end of the cable disposed in a fixed position in a plane substantially midway of the ends of the frame and at a height generally the same as the midportion of the erected frame; feeding or extending a first length of cable downstream of the retained end and toward the other limit of the structure, the first length of cable extending to a first pulley or guide mounted midway of the ends of the frame and with the general axis of the first length of cable being generally normal to the plane of the frame; leading or guiding a second length of cable from the first pulley or guide to a second pulley or guide mounted on the frame and near the outer bottom end of the the frame; guiding the cable around the second pulley and feeding a third length portion of cable from the second pulley to a fixed position further downstream of the erected frame, the third length of cable being generally parallel to the first length of cable, and attaching and tensioning the other end of the cable to a fixed post or position on a building, the attached end being at the same height generally as the end of the erected frame. In addition there is provided the step of guiding and retaining the ends of the frame so as to limit the lateral movement of the frame from the axis of the adjusting movement.

Terms such as "in", "out", "downstream", "normal" and the like are applied to the extensible canopy structure as shown and described in conjunction with the drawings. These terms are used merely for the purposes of description and do not necessarily apply to a particular position in which the structure may be constructed or used.

The conception of the extensible canopy structure and the method of arranging the cables and its many applications is not limited to the examples above-described but departures therefrom may be made within the scope of the accompanying claims and protection is sought to the broadest extent the prior art allows.

What is claimed is:

1. An extensible canopy structure for the movable covering and uncovering of patios, swimming pools and the like, the structure having at least one frame independently movable between two fixed support positions, the canopy structure comprising: (a) at least one frame of generally planer construction and providing outer end portions adapted to support the frame; (b) a cable guide and the like midway between the ends of the frame and adapted to receive and redirect at least four cables; (c) a cable guide and the like near the end of the frame and adapted to receive and redirect at least two cables; (d) four cable lengths adapted to engage the cable guides of the frame and support the frame in an erected position while permitting the frame to be moved in a direction normal to the frame in said erected position, and (e)

fixed support positions for attaching the ends of the cable, said positions determining the longitudinal extent of the expanded structure, each of said cables being attached at one first end to a first fixed support position and extending upstream from this position and normal to the plane of the frame, the cable continuing to the frame and to and around one of the midway cable guides thence to and around one of the cable guides near the end of the frame thence extending further upstream and normal to the plane of the frame to a second fixed support position where the second end of the cable is attached.

2. An extensible canopy structure as in claim 1 in which the cable guides are pulleys, rollers and the like and are freely rotatable on shafts and the like.

3. An extensive canopy structure as in claim 2 in which the pulleys midway between the ends of the frame are mounted on two shafts arranged to lie in the plane of the frame.

4. An extensible canopy structure as in claim 2 in which the pulleys midway between the ends of the frame are each carried on a pin mounted in a plate.

5. An extensible canopy structure as in claim 2 in which a single shaft is provided near each end of the frame so as to support a pulley for guiding the cables extending from the end of the frame.

6. An extensible canopy structure as in claim 1 in which the movable frame is a U-channel in cross-section and with a cover plate adapted for attaching to and closing the open side of the U-channel.

7. An extensible canopy structure as in claim 6 in which the cover plate is provided with a retaining means for receiving the edge of and retaining a sheet of film, cloth, screening and the like.

8. An extensible canopy structure as in claim 1 in which there is a multiplicity of frames each independently movable and each supported and maintained in its erected alignment by at least four cable portions each arranged in a Z-pattern.

9. An extensible canopy structure as in claim 8 in which the frame is formed with side portions substantially parallel to each other and with a rafter portion attached to and extending inwardly and upwardly from the upper ends of the side portions, the rafter portions joining at an apex.

10. An extensible canopy structure as in claim 1 in which the frame is a U-channel in cross-section and with a pair of pins attached to the channel frame at its apex, each pin carrying a roller adapted to receive and redirect two of the cables, each approaching the frame from opposite fixed support positions, and with a shaft carried near the bottom end of the frame and carrying a roller adapted to receive the cables redirected from the apex roller and to redirect these cables to opposite fixed support positions.

11. An extensible canopy structure as in claim 10 in which the U-channel is disposed with its open side toward the inside of the frame, the channel provided with a cover plate adapted to close the open inner side of the U-channel while providing receiving and retaining means for the edge of a sheet of film, cloth, screening and the like.

12. An extensible canopy structure as in claim 11 in which there is provided a U-channel adapted to lie on a support surface which may be the ground level, the channel adapted to engage a guide means on the frame and support the end of the frame to prevent transverse movement of the frame as it moved longitudinally along the U-channel.

13. In an extensible canopy structure the method of supporting a frame member of generally planer construction, the frame member movable in a position as erected and generally in a path normal to the plane of the member, the method of arranging each cable portion of four cables for supporting the frame, the steps including: (a) retaining one end of a cable to a fixed position and in a

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plane substantially midway of the ends of the frame and at a height generally the same as the midportion of the erected frame; (b) feeding a first length of cable downstream of the retained end of the cable and to a first pulley mounted midway of the ends of the frame, said first length of cable being disposed generally normal to the plane of the frame; (c) leading a second length of cable from the first pulley to a second pulley mounted near one end of the frame; (d) feeding a third length of cable from the second pulley to a fixed position and further downstream of the erected frame, the third length being generally parallel to the first length of cable, and (e) attaching and tensioning the other end of the cable to a fixed position, the attached end being at the same height generally as the end of the erected frame.

14. In an extensible canopy structure the method of claim 13 in which there is additionally provided a plurality of frames each independently movable and including the step of connecting each frame to an adjacent frame by means of a film, screen and the like.

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15. In an extensible canopy structure the method of claim 14 in which there is additionally provided a pair of U-channels adapted to lie on a support surface, the channels sized and spaced from engaging and guiding the ends of the frame to prevent transverse movement of the frame during the longitudinal manipulation and movement of the frame.

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15 KENNETH DOWNEY, *Primary Examiner*.

U.S. Cl. X.R.

135—3, 5, 7.1; 52—63, 64, 66; 4—172