July 2, 1957 C. B. FRITSCHE 2,797,696

COLLAPSIBLE SHELTERS AND TENTS

Filed June 16, 1952 3 Sheets-Sheet 1

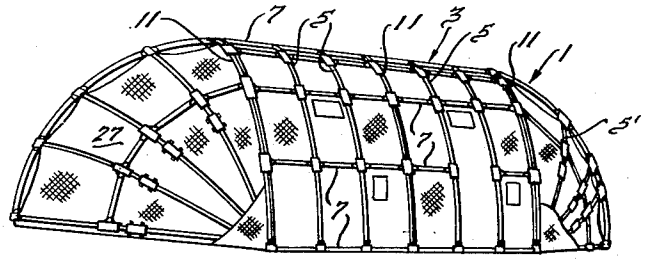

Fig. 1.

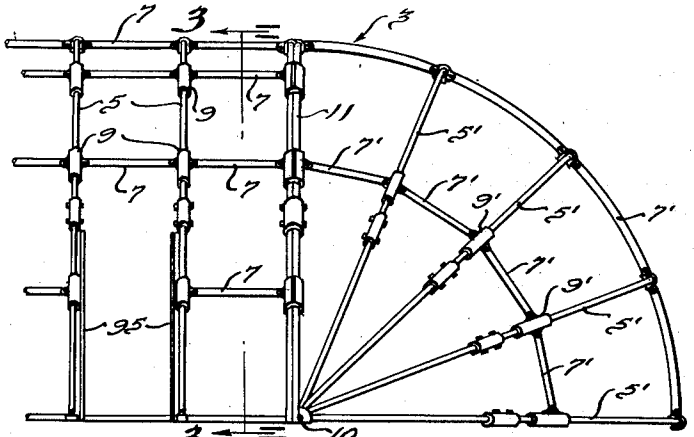

Fig. 2.

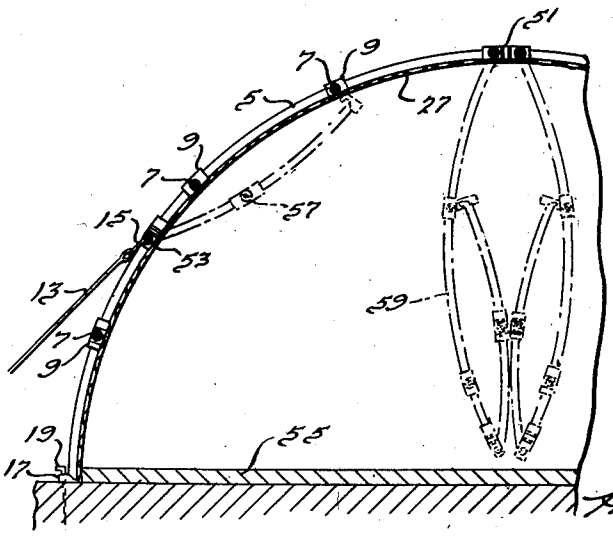

Fig. 3.

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Fig. 4.

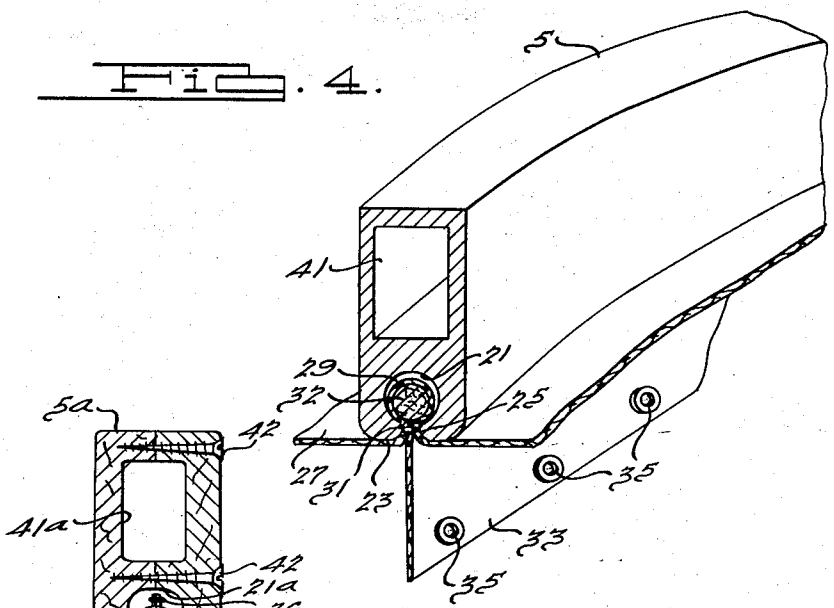

Fig. 4A.

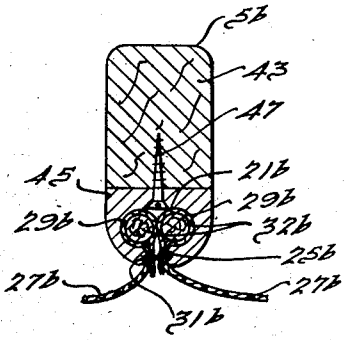

Fig. 4B.

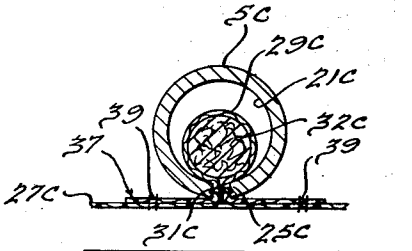

Fig. 4C.

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COLLAPSIBLE SHELTERS AND TENTS

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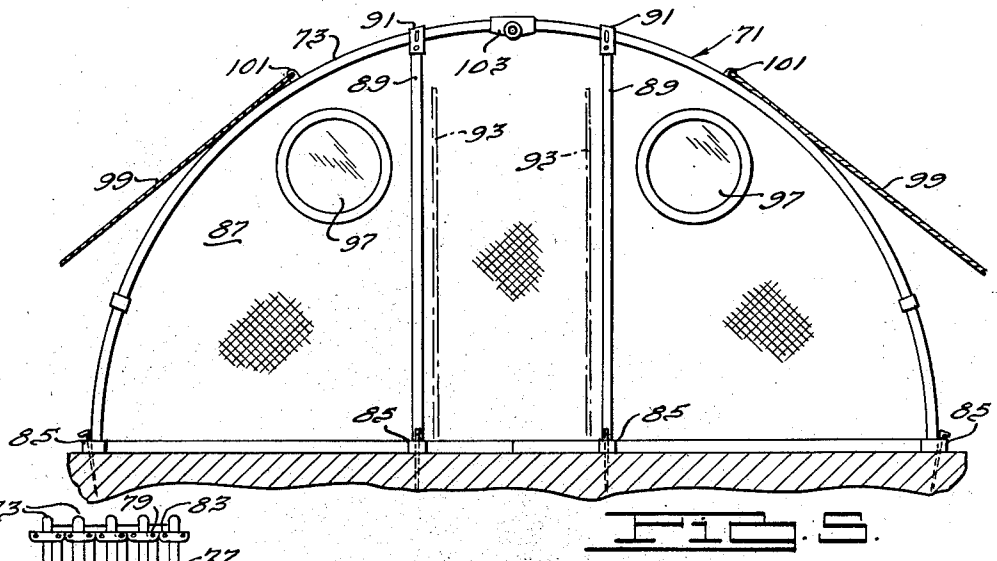


FIG. 5.

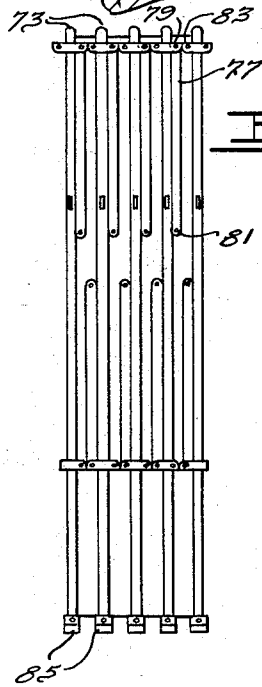
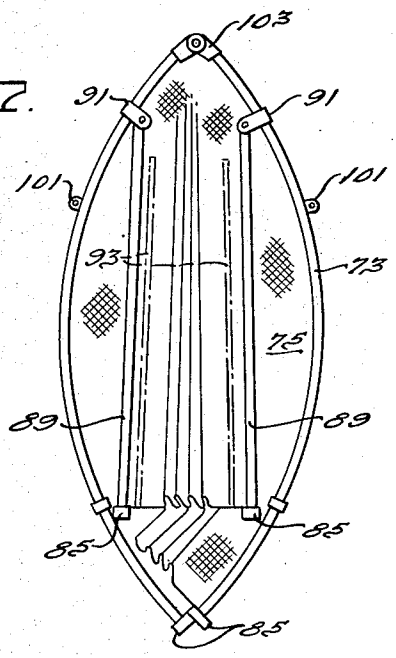


FIG. 6.

FIG. 7.



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United States Patent Office

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COLLAPSIBLE SHELTERS AND TENTS

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Application June 16, 1952, Serial No. 293,784

1 Claim. (Cl. 135—1)

My invention relates to tent-like structures, that is to improvements in light-weight shelters that are portable and collapsible and which have walls of flexible or canvas-like material supported by elongated rigid frame members and connected thereto in an improved manner which has a cooperative relationship with the collapsibility and with other features.

While it will be apparent that its use is not so limited, an object of my invention is to provide a portable and collapsible shelter that is eminently suited for usage by the military forces, particularly ground and air-borne forces as well as other uses as by sportsmen, etc. This demands that the shelter be of minimum weight and bulk and yet have sufficient strength to withstand the widely diversified conditions of military usage. Of substantially equal importance is the requirement that the structure be quickly and easily assembled. In connection with this requirement it is highly desirable that the shelter construction be of such a nature that no particular skill or training be necessary in order to assemble it from the portable, collapsed condition. It is also very desirable that the same construction be adaptable for various sizes of shelters as this will facilitate manufacture and usage of the units. It is, of course, essential that the shelter construction be capable of withstanding widely different weather conditions, from high winds, severe cold, and heavy snow to extreme heat and hard rains.

In the prior art (particularly in the field of large tents having rigid frames) certain problems have not been appreciated or well solved. These include the necessity of a highly practical and sturdy structure for rapid erection or collapse into a compact condition, the desirability of the connections of the flexible material to itself and to the frame members to be armored, shielded or covered to make them leakproof as well as to protect them from injury. They also include the desirability of such a collapsible structure in which the flexible walls may be all or partially left attached to the frame members during collapse to thus give only "one package," a faster erection time, and less danger of losing separate or loose pieces.

The shelter construction of my invention meets all of the above requirements to a degree that has not been attained heretofore by any corresponding constructions of which I have knowledge. In my construction I contemplate the use of transverse frame members, such as upright arches, which are rigidly separated from each other by longitudinally extending purlins and are flexibly interconnected with each other by webs or membranes of canvas or equivalent material. The connections between the canvas and the transverse frame members extend continuously throughout substantially the entire lengths of the frame members and preferably are of a semi-permanent type, such as I describe herein, so that the canvas and members can be separated if desired. These connections are arranged on the insides of the frame members so that the frame members constitute an external skeleton or rigid supporting structure from which the canvas webs are suspended, as distinct from constructions wherein the canvas is laid on and overlies the supporting members. The frame members are preferably braced longitudinally by collapsible or removable purlins, also located externally of the canvas webs, and guy lines and ground anchors may also be employed to strengthen the supporting structure.

This arrangement of frame members and the flexible canvas webs which form the walls and roof is such that the shelter may be collapsed and expanded much like an accordion or a fan since all or most of the essential parts are secured together in both the operative and inoperative positions. Assembly is, therefore, simple and rapid. The connection between the canvas webs and the transverse frame members is preferably an interfitting projection and reduced neck slot and is of such a nature that there is a continuous seal between the canvas and member. This gives optimum structural integrity from the standpoints of resistance to stress as well as resistance to weather. Contact of the wall and roof forming surface areas of the canvas with the supporting structure is avoided by this connection so that there is no internal pressure on the canvas to invite capillary action and "drip" during rainstorms. The nature of the connection is such that there are no points of stress concentration and no chafing or flapping and the possibility of local failure is substantially eliminated. My preferred connection also greatly reduces strain on the canvas by permitting it to shift lengthwise relative to the transverse frame members as it expands and contracts or as it is blown by heavy winds so that it can adjust itself to these forces. The shape and arrangement of the frame members permits them to be adapted to various sizes and shapes of shelters while the preferred reentrant slot type of semi-permanent connection permits the maximum size of any given shelter to be readily increased or decreased by the simple addition or removal of canvas and supporting structure. My frame members are also so shaped as to be an optimum design from the standpoint of high strength and low weight. Since it folds up something like a fan, the entire shelter construction can be collapsed into a small, compact bundle, with hardly any loose parts, and can be readily parachuted or transported otherwise with relative ease since it involves a minimum of bulk.

Summarizing, an outstanding objective of my invention is to obtain and employ the maximum strength value of the canvas or flexible fabric covering, since most tent failures in high winds begin with a failure in the fabric. In prior art combining a rigid frame with a fabric covering, the fabric is attached to the frame at relatively widely spaced intervals by rope ties passing through grommets in the fabric or by narrow canvas ties sewed to the fabric in finger-patch fashion. In high winds, this method causes a heavy concentration of stresses in the vicinity of the grommets or the finger-patches. When thus over-stressed, the fabric begins to tear. With each subsequent gust of wind the failure progresses; the ripping of the canvas continues beyond control and the structure finally collapses.

In my invention, each transverse thread in the fabric is restrained in substantially equal tension through its attachment to rope welts by means of which welts the canvas is uniformly suspended from the transverse frames; there is a continuous load bearing engagement to the frame; the field of concentrated stresses is diminished to an irreducible minimum and optimum strength values of the fabric are thus realized.

A further distinction lies in the fact that in ordinary tents (in which the canvas rests on and is only infrequently attached to the rigid frame members), the primary function of the canvas or fabric is to fair the surface against the wind and the weather. It contributes little or nothing to the inherent strength of the rigid structure. In my invention, not only does the fabric fair the surface against the wind and the weather, but, through being uniformly and tautly restrained between the transverse

frame members by means of suitable purlins, the canvas accommodates the major shear stresses, and thus, adds to the over-all strength and rigidity of the composite integrated structure. In other words, in my invention the fabric takes on the additional duty of an auxiliary structural member or of a tension bracing between the structural frame members, thus reducing the design weight requirements of the rigid frame, a feature not heretofore obtainable in a practical structure for the purposes indicated.

The general construction so far described may be provided with other unique features. Thus, I contemplate the use of doors and windows that are secured by zippers to the canvas webbing. I have pedal anchors at the bottoms of the frame members that are secured to the ground by standard tent pins and I prefer not to use the canvas webbing as a means for anchoring the shelter. Of great practical value are hanger tucks or tabs that I insert into the connections between the canvas webs and frame members. These tucks hang down inside the shelter and serve as means for suspending personal effects, etc. Their most important use is to suspend the insulation batts or blankets adjacent the walls and roof in such a manner as to provide a dead-air space between the batts and the outside tent walls and roof thus substantially improving the insulating properties over the prior art wherein the outside walls and the insulation are in face-to-face contact.

Various other features of my invention will appear upon consideration of the accompanying drawings wherein I illustrate preferred forms of my invention. In the drawings:

Figure 1 is a perspective view of one form of my improved tent structure showing it in assembled, erected position;

Fig. 2 is a side elevation of one end of the external supporting structure or skeleton such as might be used in the tent shown in Figure 1;

Fig. 3 is a section taken along the line 3—3 of Figure 2;

Fig. 4 is a perspective view broken away of one form of frame member having the canvas webbing and hanger strip secured thereto;

Fig. 4*a* is a cross section through another form of frame member having the canvas webbing and hanger strip secured to it;

Fig. 4*b* is a third form of frame member having the canvas webbing secured to it;

Fig. 4*c* is a fourth form of frame member having the canvas webbing secured to it;

Fig. 5 is an end view of a modified form of collapsible shelter embodying principles of the invention;

Fig. 6 is a side elevation showing a part of the tent structure of Fig. 5 in collapsed condition;

Fig. 7 is an end view showing the tent structure of Figure 5 in collapsed condition and may be regarded as being taken from the right of Figure 6.

Referring first to the embodiment of the invention illustrated in Figures 1–4*c*, the improved portable and collapsible tent-like structure **1** shown therein has an external supporting skeleton or frame structure **3** to the inside of which is secured sheeting of canvas or other type of flexible plastic or fabric material, canvas being presently preferred, the term "canvas-like" being used herein to generically designate various suitable materials. The supporting structure **3** includes a series of ribs or major frame members **5**. In Figures 1–4 these are illustrated as curved arches but it will be evident that various other shapes can be employed within the spirit and scope of the invention. The central and major portion of the shelter intermediate its ends is supported by arches **5** which are vertical and arranged parallel to each other. They are spaced from each other by purlins **7** that are suitably connected to adjacent frame members so they can be removed or simply moved to permit the frame member to be collapsed together. Various expedients can be employed to effectuate this type of connection. At present

I prefer to place fittings **9** on the frame members **5** to receive opposite ends of the purlins **7**. The fittings **9** preferably each have a clevis that receives an end of the purlins **7**. A clevis pin (not shown), secured by a chain (not shown) to the frame member **5**, can be used to pivotally secure the end of the purlin in the clevis. When it is desired to collapse the shelter and move the frame members **5** closer together the clevis pins can be removed and then the purlins **7** taken out of the fittings. The purlin pivots are preferably arranged so that one end of the purlin may be allowed to remain captive in the clevis and the purlin folded up against and parallel to the adjacent portion of the frame member to which it is pivoted.

The frame members **5'** at the ends of the shelter **1** may also be curved arches but they are preferably arranged to radiate from common hinged fittings **10** (Fig. 2) on opposite sides of the shelter that may be secured to the feet of end arches **11**. Additional purlins **7'** and fittings **9'** may be used to space the frame members at the end of the shelter, they being adapted in shape to suit the angular arrangement of the members **5'**. Double frame members **5** may be used at the center and ends of the central portion of the shelter as shown at **11**.

The frame members **5** interconnected by the purlins **7** form a relatively rigid external skeleton as a supporting structure for the shelter. Longitudinal forces thereon may be taken by suitable guy ropes **13** that can be secured to hooks **15** on certain of the members **5**. The frame members **5** have pedal anchors **17** which are suitably apertured to receive standard tent pins **19** whereby they are firmly secured to the ground.

The canvas-like sheet material which forms the walls and roof of the shelter is suspended from the insides of the frame members **5**. This is preferably accomplished by a type of connection between the canvas and members, as shown in Fig. 4, which includes a slot **21** that extends along the length of each frame member **5** and opens out of the inside surface **23** thereof through a reduced neck portion **25**. The canvas material used in the shelter **1** is illustrated as a single sheet **27** which has loops **29** formed therein that are rendered permanent by stitching **31**. The loops **29** correspond to the length, spacing, and arrangement of the members **5** and **5'** and constitute projections that fit within the recesses **21** after insertion through the reduced necks **25**. A rope **32** may be inserted throughout the length of each loop **29** so as to enlarge it and form a welt which is incapable of passing through the reduced neck **25**. However, the slot **25** passes the double thickness of sheeting **27** which is therefore suspended from the inside surface **23** of the frame member. The canvas sheeting **27** is connected to each of the frame members **5** and **5'** in this manner and it is to be particularly noted that this connection extends throughout substantially the entire length of each frame member.

In order to provide means for suspending various articles within the tent, such as weapons, utensils, personal effects, partitions, insulation blankets, etc., I provide hanger tucks **33** in all or some of the joints between the canvas and frame members. These may also be formed of canvas-like fabric and sewed between the opposite sides of the loop **29** by the stitching **31**. Grommets **35** may be provided in the hanger strips **33** to serve as convenient attaching points.

In Figure 4*a* is illustrated canvas sheeting **27***a* which is made up of individual strips of canvas that are attached together by stitching **31***a* and **36** to form the loop **29***a*. The loop **29***a* is expanded into a welt by the rope **32***a* and this fits in the slot **21***a* so that it cannot be pulled out of the reduced neck portion **25***a* through which the lapped canvas strips and the hanger **33** extend.

In Figure 4*b* is illustrated the use of separate and independent canvas strips **27***b* to span the space between adjacent frame members **5**. The longitudinal edges of these strips are turned over into loops **29***b* that are held by stitching **31***b*. The ropes **32***b* extend through each of the loops **29** to shape them into welts. The two welts for the

adjacent two strips 27*b* fit into a slot 21*b* on a frame member and the strips extend out of reduced neck opening 25*b* on the inside faces of the member 5*b*. A hanger strip 33 could be trapped into the recess 21*b* between the welts, if desired. It will be noted that here the slot 21*b* serves the additional function of connecting the two canvas pieces together and is a useful design for large shelters where a single piece of canvas would be unwieldy.

In Figure 4*c* I illustrate the use of a single sheet of canvas 27*c* that is suspended from the frame members by loop pieces 37 which have tabs 39 that are sewed on to the canvas sheet 27*c* by suitable stitching. The suspension piece 37 has a loop 29*c* formed therein which may be defined by stitching 31*c* and filled by a rope 32*c* to form a welt. The welt fits within the interior slot or bore 21*c* of the frame member 5*c* and is unable to pass through the reduced neck opening 25*c*.

Figures 4–4*c* also illustrate some of the various constructions that can be used in the ribs or frame members 5 and 5'. In Fig. 4 the frame member 5 is an extrusion having a hollow area 41 extending throughout its length to reduce its weight. It is preferably made of magnesium alloy or aluminum alloy in order to provide a maximum strength-weight ratio. In Fig. 4*a* the frame member 5*a* is made up of left- and right-hand pieces of hard wood or preferably laminated or ply wood that are cut out to form the interior lengthwise hollow 41*a* and the slot 21*a*. These pieces are then secured in face-to-face relationship by suitable means such as waterproof glue. It will be noted that screws 42 may be used in addition to the glue or without the glue to provide detachably secured halves that can be used to clamp the welt in the slot 21*a* without the necessity for threading the welt through the length of the slot.

In Figure 4*b* is illustrated a composite frame member 5*b* formed of an upper wooden section 43 and a lower metal extrusion 45. The extrusion 45 has the slot 21*b* and the reduced neck 25*b* formed therein and it may be screwed or otherwise secured to the bottom face of the upper section 43 by means of fastening members 47.

In Figure 4*c* is illustrated a frame member 5*c* which is a simple tube having a slot formed on its lower side to provide the reduced neck opening 25*c*.

It will be apparent to those in the art that the canvas features of Figs. 4–4*c* can be used with any of the rib constructions of these figures and that the various rib cross sections can be used with any of the canvas arrangements.

The canvas welts may be threaded into the slots 21—21c from the ends thereof or from a suitable enlarged opening intermediate the ends, that is, a full width mouth instead of neck 25. If it is not desired to insert the welt this way, the two-piece rib 5*a* of Fig. 4*a* can be used.

In the shelter 1 of Figs. 1–4*c*, the arcuately arched frame members 5 are preferably collapsible themselves so that they can be readily reduced in size. I presently prefer to accomplish this by forming each member 5 of four segments, as shown best in Fig. 3, there being an upper and lower segment on each side of the center of the arch. The two upper segments are joined together with a toggle-type hinge 51 of suitable design while the upper and lower segments may be joined together with suitable sleeve type hinges 53. The hinges selected must hold the member 5 in a rigid, erected (full line) position and also permit its fold-up to the dotted line position of Fig. 3. It will be clear that this foldup of the arch members 5 is such that it can be done with the canvas 27 still attached to them so that the canvas, in effect, serves as a flexible hinge between saparated sections of the arch members. The various other frame members and canvas-like sheeting shown in Figs. 4*a*–4*c* can obviously be constructed and used in the same way.

In preparing for stowage or transportation, the guy lines 13 and tent pins 19 are removed along with such flooring 55 as may be used. Portholes and doors and other extra structures may also be removed at this stage if of a type that will not flex with the canvas sheeting 27. The purlins 7 and 7' are disconnected and pivoted along their adjacent members 5 and 5' and then the end frame members 5' are folded up against end frames 11. In large tents the purlins may be removed entirely when collapsing the structure for storage or shipment. The lower segments of the arches 5 and 5' along first one side and then the other of the shelter are then folded up to dotted position 57 of Fig. 3. The frame members 5 and 5' are then compressed toward each other, the canvas webs folding inwardly. When longitudinal collapse of the members 5 and 5' is completed, the bundle is turned 90 degrees on its side (and this may be into an open canvas container or the like) so that the frame members 5 and 5' are horizontal and stacked on top of each other. The opposite sections of the frame members may then be folded toward each other about hinges 51 to the position 59 shown in Fig. 3 whereupon collapse of the shelter 1 is completed. Erection of the shelter 1 is accomplished by a procedure which is just the reverse of that described.

Figs. 5–7 show a second form of supporting structure that may be used to embody the principles of my invention. The shelter 71 of these figures has a series of curved arches 73 which serve as ribs or external frame members for the canvas webbing 75. The ribs 73 may be of the various forms illustrated in Figs. 4–4*c* or other suitable shapes and the canvas 75 may be arranged according to these figures or in other suitable ways. The arches 73 are arranged parallel to each other and are spaced lengthwise from each other by purlins 77 each of which is permanently connected at one end by a pin 79 to one of the arches and at its other end has an aperture 81 that can be detachably connected to an aperture 83 in the adjacent arch by a suitable pin (not shown). When the purlins 77 are pinned at each end to the adjacent arches they serve to space the arches and act as load-transmitting members. Removal of the pivot connection at one end of the purlin 77 permits it to be swung to a position parallel to the arch to which it is still pivoted so that the assembly can be collapsed or folded up as shown in Fig. 6. The various arch members have pedal supports 85 that are similar to the supports 17 described hereinbefore. The end walls of the shelter 71 are vertical rather than of the curved shape shown in the shelter 1. The canvas forming the end wall 87 may be inserted in the slot at the endmost arch 73 along with the adjacent piece of canvas 75 which forms the wall and roof of the shelter. The end wall 87 may be formed of three separate sections of canvas as shown in Figure 5. The two end sections are supported by their welts on the arch 73 and also fit in suitable slots in vertical frame members 89 that are hinged by fittings 91 to the arch 73. The members 89 may be of the same shape in cross section as the arches and thus will have narrow mouthed slots to receive suitable welts on the canvas sections. Since the connection between the members 89 and the canvas is along a straight line, a non-flexible rod can be used to enlarge the welt instead of the ropes 32 that have been illustrated hereinbefore. The frame member 89 may be provided with pedal supports 85 as illustrated.

Intermediate the two frame members 89 the canvas may be slit as shown at 93 and the adjacent edges of the slits provided with zipper means whereby a door is formed at this location. This corresponds to the location 95 in Figure 2. Windows or portholes 97 of tinted plastic or other suitable material may be removably secured to the canvas sections as illustrated in Figure 5. Guy lines 99 may be secured to suitable anchor fittings 101 on the arches 73.

The arches 73 are formed in two segments as compared to the four-segmented arches of the preceding

modification. The two sections of each arch are joined together by a hinge **103** which prevents over-center movement. It is apparent from Figure 7 and from Figure 6 that this shelter may be collapsed lengthwise and then opposite sides folded toward each other to provide a compact, disassembled package in which the canvas is still secured to the frame members **73** and **89** and the purlins **77** are still connected to the arches **73**.

A rather unexpected advantage of my shelter construction is of great importance in localities where extreme high wind velocities are encountered, for example, in the arctic regions. In these areas wind coming transversely to the length of the shelter results in the shelter acting as an airfoil. As a result, there is a very substantial lift vector on the downwind side of the shelter and it is not uncommon for such shelters to be torn from their ground anchors and blown away. In my shelter, however, the external frame members, especially the purlins, introduce substantial discontinuities and act as spoilers making the construction a very poor airfoil. Further, the fact that the canvas is secured underneath the frame members provides a marked resistance to its being torn from the shelter.

Summarizing, the principal advantages of my invention, but not to the exclusion of other novel features, are as follows: The basic structure consists of a true combination of three major elements, so interrelated or interacting that when acting together, they develop and utilize the maximum strength values of each element with minimum over-all weight of the resultant composite structure. Specifically, these three major elements are delineated as follows:

1. The first major element consists of the generally upright parallel (arched) frame members which may be described substantially as being "bow-string arches" in which the ground (to which the bottom ends of the arches are appropriately anchored) is the string or tension member, and the arch itself is the bow or compression component therefor.

2. The second major element consists of the longitudinal interframe (compression) members (known as purlins) which join the transverse frame members together and serve a dual function, either as compression or tension members depending upon the angle of attack of the wind. Essentially, they also serve to hold apart the upright frames and tension or stress the intervening canvas.

3. The third major element consists of the flexible fabric tent wall, which is subtended in continuous load transmitting attachment by means of rope welts threaded dove-tail fashion into appropriate slots located along the interior edges of the transverse frame members, and thus serves as the stressed-skin element that completes the essential combination of this organization.

Not only does the stressed-skin fabric, as herein described, satisfy the usual requirements normally ascribed to any tent wall of previous orthodox design, i. e. to fair the surface against the wind and to afford protection against the atmosphere and the weather, but, in combination with elements one and two, it takes on new and additional functions not heretofore achieved, namely:

(*a*) It serves as a valuable structural component since it transmits and distributes the wind load uniformly, through tension, to the upright frames in a manner that utilizes maximum strength values of both the fabric and the frame, and reduces vibration to a minimum. This feature practically eliminates the danger of reaching the fatigue limit in the material which heretofore has been the primary cause of failure in orthodox or prior art constructions where the fabric is disposed on the outside of a rigid frame or else is hung underneath by means of widely-spaced rope beckets or finger-patch ties thus giving rise to non-uniform or high local stresses in the canvas or the like.

(*b*) In connection with the rigid frame members, it insures a stiffness or rigidity against collapse of the parallelogram by resisting transverse shearing deflections.

(*c*) Since it accommodates transverse shearing stresses, it eliminates the heavier complicated system of diagonal shear wiring which otherwise would be required to obtain equal strength characteristics.

(*d*) At oblique angles of attack by severe gusty winds, the localized tendency of distortion of any rectangular panel of the structure, as defined by any pair of adjacent transverse arches or upright frames and its intervening pair of longitudinal purlins, into a parallelogram of unequal angles, is successfully resisted. In prior constructions, this critical condition is a matter of common experience and often leads to buckling and complete collapse of the structure when high winds of gale proportions persist for any extended length of time.

(*e*) Since the longitudinal purlins may be preferably and purposely designed to be of greater length than the width of the fabric disposed between the upright or transverse arches which they connect, when the purlins are wedged or extended into position, they introduce prestressed tension uniformly into each thread of the intervening fabric wall that completes the panel. This taut condition, combined with the rope welt method of attachment of the fabric to the transverse arches, enables the intervening fabric wall to serve a gusset-like function similar to that which obtains in a plate girder. This stressed-skin produced strength advantage, to my knowledge, has not been accomplished heretofore with flexible material in a rigid-frame tent or closed shelter construction.

(*f*) The combination or interaction of these three major elements of the structure thus divides the entire longitudinal surface of the tent into a series of, in effect, separate panels of approximately equal dimension whose total number is determined by multiplying the number of arches minus one by the number of purlins plus one. For example, in a hospital tent 48 feet long and wherein the arches, spaced on four foot centers, have a radius of ten feet, the number of such panels would be 72. In stormy weather, each of such panels reacts to the wind load as an individual field of stress while all of the panels integrated together into a whole, produce a finished structure having a maximum strength-weight ratio. In other words, loads in the canvas are not transmitted past or beyond any one upright frame. Thus, the engineer's ideal is realized of approaching the irreducible minimum of area in the field of stresses.

Contrasted with a tent of orthodox, or prior art construction and of the same dimensions, to all practical purposes, the longitudinal surface of such a tent may be described as being divided into only two major panels, one on the windward side and one on the lee side. In a high wind, the fabric wall bellies inward on the windward side and whips outward on the lee side, both with a pulsating motion which induces alarming vibration throughout the entire structure, and under prolonged extreme conditions, threatens initial failure in the fabric due to fatigue of the material. Under equal wind load condition, the danger of failure, through fatigue, of a tent of orthodox or prior art construction would be of a much higher magnitude of range as compared to a tent built in accordance with my invention.

From an engineering point of view, the foregoing analysis leads to the inevitable conclusion that in orthodox, or prior art rigid-frame tent construction, the fabric wall not only contributes little or nothing to the strength of the tent, but, in reality, it becomes a structural liability in high winds because (1) of the insecure manner in which it is attached to the frame and (2) the alarming vibrations it induces, which disadvantages combine to weaken the structure as a whole. Thus, in my invention, the fabric wall is a positive structural element, which adds to the inherent strength of the structure as a whole, and in so doing, it reduces the design weight require-

ments of the rigid frame, all of this by its positive interaction with the upright frames and purlins.

From the foregoing description of two different types of shelters and various other modifications of the features of this invention it will be apparent that a wide variety of collapsible constructions can be obtained. Large shelters to serve as hangars and mess halls, etc. can be obviously made by using sections that are easy to handle and then uniting them in a final assembly. In this arrangement some of the canvas webs would be allowed to remain connected to the arches in collapsed condition while other canvas webs would be disconnected from the arches in disassembled condition. When canvas strips of the type shown in Figure 4*b* are used it will be apparent that it is a simple matter to vary the size of the shelter by simply adding or removing the strips 27*b* and corresponding frame members. Instead of this arrangement pairs of arch members can be clamped together to increase the length of the shelter. Various other modifications and rearrangements of the structure shown herein will be apparent and it is not intended to limit the invention to the precise details of construction that have been illustrated herein.

I claim:

A collapsible shelter having in interacting relation an external skeleton of collapsibly inter-connected elongated frame members extending transversely across the space enclosed by the shelter and defining cross sections thereof, said frame members having connecting means extending substantially continuously along their lengths on their inner faces, wall forming canvas-like material having elongated and cooperatively formed connecting and stress transmitting means thereon operatively secured to said first connecting means in the erected or collapsed condition of said shelter and covered by said overlying frame members when erected to prevent leakage, and rigid compression members collapsibly interconnecting and holding apart said frame members to thus stress said canvas-like material and cooperatively strengthen the shelter as a whole, said first connecting means being a slot having a reduced throat or necked-down entrance and the connecting means on the canvas-like material being an elongated flexible portion enlarged to prevent undesired withdrawal through the said reduced entrance of said slot.

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