March 26, 1963 H. D. MACY 3,082,780

PORTABLE SHELTER

Filed Sept. 15, 1960

Fig. 1

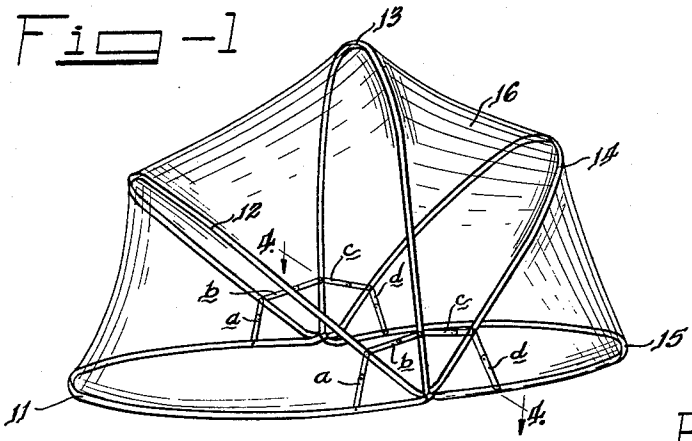


Fig. 2

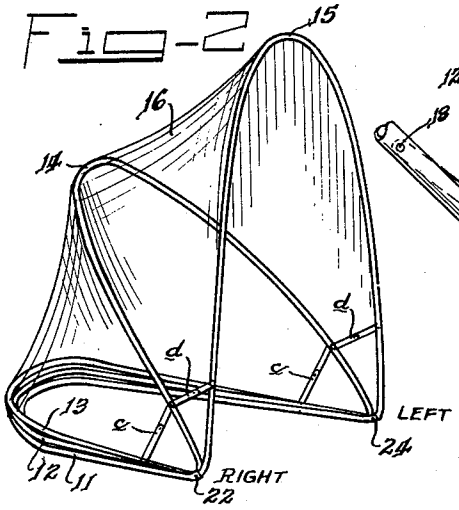


Fig. 3

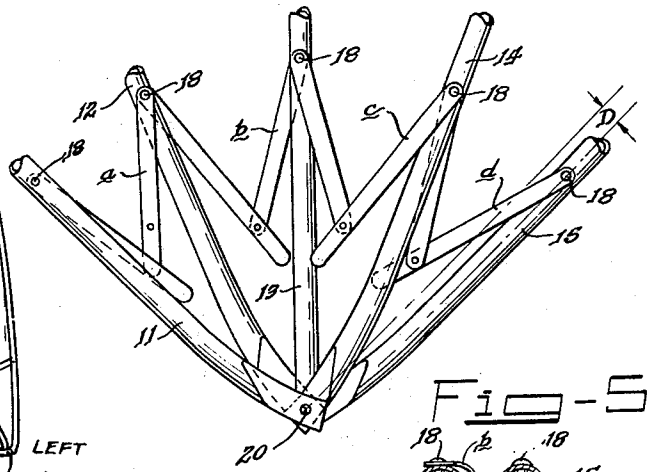


Fig. 5

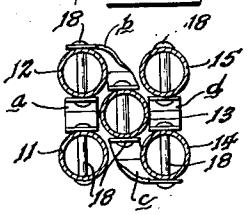
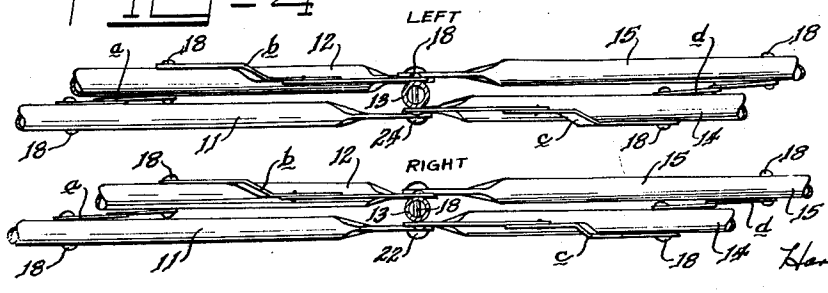


Fig. 4



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3,082,780

PORTABLE SHELTER

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3 Claims. (Cl. 135—4)

This invention relates to a plastic-covered self-heating shelter having shaped, articulated bows with two single-pin hinges.

An ice fisherman must move from place to place over the surface of a lake or river to keep up with the movement of schools of fish, or to locate areas where fish are biting. The shelters which are currently available are so bulky or inconvenient to move that it is not possible to move them frequently. These shelters are often further burdened with a stove to supply warmth.

One difficulty with presently available light-weight shelters is that they are not stable by themselves. Most of them have floors or seats integral with the frame whereby the weight of the fisherman provides the necessary stability in winds. However, as soon as the fisherman leaves his shelter for any reason his anchoring effect disappears and the shelter is free to blow away. Thus he is unable to leave his shelter to scout around for fish. The only alternative is to take time to dismantle or disassemble the shelter in order to leave it.

The problem of comfort in cold weather is not restricted to ice fishermen. Duck hunters and deer hunters spend many hours sitting motionless in windy, chilly spots without suitable shelters.

Another need, which exists but is hardly recognized, is the need for a portable sun-bathing shelter for use in cool but sunny weather. Such need obviously has not been exploited due to a lack of suitable shelter. One can readily appreciate the need for a light-weight but stable shelter which requires no mechanical assembling if such a shelter is to be used by the general public for cool-weather sunning.

A major obstacle in designing collapsible structures lies in the task of folding or hinging bows, walls, covers, etc., without binding. Until now no self-supported shelter has been so simplified as to permit full erection in a matter of seconds without a suggestion of mechanical assembly. Most shelters have been built of bulky bows which would cast objectionable shadows if used for sun-bathing. Where there are bulky bows the usual practice is to use a cumbersome hinge plate with individual hinge pins for each bow. Such hinge designs are bulky and tend to reduce structural rigidity. Almost without exception designers have resorted to disassembling and folding the bows to obtain a degree of portability. Jointed bows and multiple hinge points all contribute to structural weakness and instability. Another common solution to the problem of folding has been to remove or detach the cover from the bows before folding.

Past efforts to make rigidly-braced, collapsible shelters have never resulted in single-pin hinges because no method could be devised to make them easily foldable. Shelters have been made using single-pin hinges but these have been based on such expedients as disassembly of the hinge for portability and on external means for support. An ideal hinge joint should pivotally join the bows on a single pin in a compact relationship. Such a joint is accomplished by this invention and will be referred to as a single-pin hinged joint.

In many shelters no means is provided to rigidly space the bows relative to each other. Such an oversight is understandable when one contemplates the difficulty of holding bows rigidly spaced apart by self-contained means when each bow has a different hinge point. Even more formidable is the problem of fitting foldable braces between bows to fold without scraping and binding when there is a single-pin hinged joint.

It is an object of this invention to provide a shelter which combines a light-weight frame, single pin hinged joints, freely folding braces and an integral cover such that all cooperate to form an unusually wind-resistant shelter which is collapsible without binding and without disassembly.

Another object is to provide a shelter having unusual stability in winds from any direction.

Still another object is to provide a shelter which does not require the weight of the occupant for stability.

It is also an object of this invention to provide a light, self-heating, portable shelter.

A further object of this invention is to provide a shelter having a single-pin hinge construction wherein four of the five bows are so bent that they are interchangeable, and are so assembled that they will fold freely without disassembly.

These and other advantages will be apparent from the following description and from the drawing in which:

FIG. 1 is a side view of the shelter.

FIG. 2 is a side view showing the shelter in a half-open position.

FIG. 3 is a side view of a hinged joint.

FIG. 4 is a top view partly in section taken through 4—4 of FIG. 1.

FIG. 5 is a sectional view of a folded bundle of bows taken through the plane of attachment of braces.

Referring to FIG. 1, first, second, third, fourth and fifth bows **11**, **12**, **13**, **14** and **15** respectively, form the supporting framework for this shelter. It will be understood that the term bow refers to a single-piece structural support having a shape ranging from that of a semicircle to that of a parabola, but preferably having the approximate shape of half an ellipse terminated at or near its minor axis.

A flexible cover **16** as shown in FIG. 1 is secured to frame members **11** and **15** and is supported by frame members **12**, **13** and **14**.

As shown in FIGS. 1 and 3 the bows are spaced apart by first, second, third and fourth foldable braces *a*, *b*, *c* and *d* respectively. Each end of each foldable brace is secured to a bow by a brace rivet **18** as shown in FIGS. 3, 4 and 5.

The right and left ends of bows **11**, **12**, **14** and **15** are laterally flattened as illustrated in FIG. 4. Left and right are understood for purposes of description as that indicated in FIGS. 2 and 4. As shown in FIG. 3 the flattened ends are then bent slightly to displace the center of a hinge-pin hole **20** which is drilled near the end of each bow by an amount equal to at least the diameter of the bow from the centerline of the bow. This centerline displacement D is indicated in FIG. 3 on bow **15**. Then, as shown in FIGS. 2 and 4, the right and left ends of the bows are assembled respectively on a single right hinge-pin **22** and a single left hinge-pin **24**. The left ends and the right ends of the bows are assembled in a particular order on their respective hinge-pins from right to left as shown in FIGS. 3 and 4, that order being **11**, **14**, **13**, **12**, and **15**.

As shown in FIGS. 3 and 4, brace *a* is pivotally attached to the left side of bow **11** and the right side of bow **12**. Brace *b* is pivotally attached to the left sides of bows **12** and **13**. Brace *c* is pivotally attached to the right sides of bows **13** and **14**. Brace *d* is pivotally attached to the left side of bow **14** and the right side of bow **15**.

When the shelter is folded as shown in FIG. 5 the brace *a* nests in the space provided between bows **11**, **13** and **12**; brace *b* nests in the space provided between bows

12, 13 and 15; brace *c* nests in the space provided between bows 11, 13 and 14; and brace *d* nests in the space provided between bows 14, 13 and 15. This construction gives a most compact yet freely folding N-shape to the cross section of the folded bundle of bows and braces proceeding in order from the first bow to the fifth bow.

The single-pin hinged joint with foldable braces as shown in FIGS. 3 and 4 has an unusual symmetry as a result of this construction. Both right and left hinged joints are identical in appearance due to the manner in which they are assembled whether viewed from right, left, inside, or outside of the shelter. Such symmetry will be appreciated especially from the standpoint of simplification in manufacture.

The single-pin hinged joint is made possible by flattening and bending the ends of four of the five bows identically. That is, each end of each bow is bent the same amount and at the same distance from the end of the bow. As a result, the first, second, fourth and fifth bows are identical and interchangeable, while the ends of the third bow are neither flattened nor bent. Such qualities are highly desirable for simplicity in manufacture and construction.

The single-pin hinged joints constructed as described herein make it possible to use bows which are all curved to the same semi-elliptical contour without springing or reshaping for assembly. This likewise is a simplification which promotes greater efficiency in manufacture.

The cover 16 of this shelter is formed of four panels of polyethylene film about four thousandths of an inch in thickness which are joined together by heat sealing or taping along lines formed by the bows. The cover is attached by taping to the horizontal bows 11 and 15 which serve as a means for keeping the cover under tension when the shelter is open as shown in FIG. 1.

Suitable ventilation may be provided by a series of small holes in the cover placed to admit air in a diffused manner. The holes are placed to take advantage of natural convection in the event that a wind is not blowing.

The bows for this shelter were made of ¾" diameter thin-wall steel conduit each ten feet in length and formed to the approximate shape of half an ellipse having a minor axis of about three feet. Bows made of aluminum tubing, fiber glass and the like will be satisfactory, also.

For hinge-pins 22 and 24 as well as for brace rivets 18, pins with peened, swaged or spun ends are preferable, but bolts with self-locking nuts may be used.

This shelter with a light-weight plastic cover weighs only twenty pounds but was found to be stable in snow even though unanchored in a winter blizzard having a steady wind velocity of about 22 miles per hour. Common sense would tell a person that a shelter nearly eight and a half feet long and over four feet high without the benefit of heavier covering materials such as the canvas used in the prior art should be very unstable in a wind.

This shelter surprisingly appears to be somewhat more stable when broadside to the wind than when endwise in that it tends to orient itself broadside on a slippery surface. Some theories have been advanced to explain this unusual stability. It is likely that the smooth surfaces of the cover are so inclined to the horizontal that a wind is deflected from any surface with a resultant component in a downward direction. However, I do not wish to be bound rigorously by this explanation.

The configuration of bows provides exceptionally efficient use of shelter space in width, length and height. For a seated man this configuration provides ample foot and knee room as well as adequate, but not excessive, shoulder and head room. The length of this shelter is sufficient to accommodate two ice fishermen seated either face to face, or back to back. There is ample space for a person to sunbathe in this shelter on a lounge chair, cot, or pad. One person, whether hunting, ice fishing or barbecuing in the back yard, may use this shelter in a half-open position to ward off chilling winds in milder weather.

When half open this shelter is unexpectedly stable without anchoring in winds up to 22 miles per hour if the open side is oriented downwind. In this position the shelter not only resists closing or tipping but also creates a quiet air zone within the shelter which is a considerable relief from chilling winds. Here again the occupant enjoys the benefit of warmth from solar radiation transmitted through the cover.

This shelter is self-heating when the cover is made of a material such as clear polyethylene, which is capable of transmitting solar radiation. It is not unusual for the air temperature inside this shelter to rise 20° F. over outside air temperature in the winter even when the sun is almost completely obscured by overcast skies. In bright sunshine I have recorded air temperatures as high as 80° F. inside this shelter when the outside temperature was 16° F.

This invention may be adapted for spear fishing or any other activity where a darkened interior is desirable by covering the shelter with fabric or a black plastic film such as black polyethylene. This involves giving up the benefit of warmth from direct solar radiation. However, the loss of warmth may be partially offset by heat re-radiated to the interior by a black cover. This source of heat is by no means as effective as that from direct solar radiation through a transparent cover. Basic protection from the chilling effect of winds is always in effect, of course.

Another possible use for this shelter is as a tent for camping in warm weather. For such use it is desirable to cover the shelter with a fabric, or a plastic film which has been coated or impregnated with a heat reflector such as aluminum flake. Of course coating with aluminum flake which would be desirable in warm weather destroys the self heating effect of the plastic shelter.

This invention now makes it possible to construct a portable shelter of single-piece bows having ends pivotally joined in single-pin hinged joints with the bows rigidly spaced apart by foldable braces, and yet to have a structurally sound, wind resistant, self-heating shelter which is freely collapsible in a matter of seconds without the necessity for disassembling.

It is understood that this invention is not to be limited by the details given herein but that it may be modified within the scope of the appended claims.

I claim:

1. A light-weight, self-warming shelter of the single-pin hinged joint type comprising: first, second, third, fourth and fifth single-piece bows, of equal length and equal curvature, each of said bows having ends pierced with a hinge-pin hole, the ends of the first, second, fourth and fifth bows being bent identically and sufficiently to displace said hinge-pin holes from a centerline of each of said bows by an amount at least equal to the diameter of said bow, said ends of the first, second, fourth and fifth bows being laterally flattened; a single right hinge-pin on which is assembled an end of each bow to form a right hinged joint, said bows assembled in the order from right to left first, fourth, third, second and fifth, said first and second bows having their centerlines displaced to one side of the third bow when folded and said fourth and fifth bows having their centerlines displaced to an opposite side of the third bow, and a single left hinge-pin on which are mounted in identical manner remaining ends of said bows to form a left hinged joint; a plurality of foldable braces pivotally secured to said bows near each of the hinged joints, of which braces a first brace is secured between said first and second bows, a fourth brace is secured between said fourth and fifth bows, a second brace is secured to the left sides of said second and third bows, and a third brace is secured to the right sides of said third and fourth bows; and a snug, flexible, transparent cover comprising, four similar panels joined along lines

formed by said second, third and fourth bows and secured to said first and fifth bows.

2. A light-weight, self-warming shelter of the single-pin hinged joint type comprising: first, second, third, fourth and fifth single-piece bows of equal length and equal curvature each having a hinge-pin hole drilled near each end, the ends of said first, second, fourth and fifth bows being bent slightly and flattened; a single right hinge-pin inserted in the hinge-pin holes of the right ends of said bows, said bows arranged from right to left on said hinge-pin in the order first, fourth, third, second and fifth, and a single left hinge-pin on which left ends of said bows are mounted in identical manner; a plurality of foldable braces one of each being pivotally secured between each pair of consecutively numbered bows and being disposed in an N-shaped nesting relationship therebetween when said shelter is folded; and a flexible, transparent cover attached to said bows.

3. A light-weight, self-warming shelter of the single-pin hinged joint type comprising: five single-piece bows of equal lengths and equal curvature, right and left ends of said bows pivotally hinged together on single right and

single left hinge-pins in the order first, fourth, third, second and fifth, said ends of the first, fourth, second and fifth bows being bent sufficiently to displace hinge-pin holes in the ends of said bows from the centerline of each of said bows; foldable braces pivotally secured between consecutively numbered bows extending said bows in a circumferentially spaced apart relationship, and foldable in an N-shaped nesting relationship between said bows when the shelter is folded; and a flexible cover attached to said bows.

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