FIG. 1
This invention relates to structures for folding baby-carrriages, folding chairs, and the like. There are many folding structures of this kind, and most of them fold "flat"; that is to say their extended and basically 2-dimensional envelope is foldable into a basically 2-dimensional envelope disregarding the obviously necessary structural volume when folded. The present invention is concerned with structures which may be colloquially described as "stick folding" as compared to "flat folding." That is to say that when folded they occupy a relatively very small cross-sectional bundle-up area roughly corresponding to a stick-like formation in the sense that a folded umbrella is a stick-like formation. The cross-sectional area of the envelope of the structure when folded, is not much larger than that of the sum of the cross-sectional areas of the component members in their most compact relationship, and occupies the minimum transverse dimensions.

The invention is primarily directed to the structure of a baby-carriage which is "stick folding" and which when folded, can indeed be handled, stowed, or packed, somewhat in the manner of a walking stick or shooting stick and is of light enough construction to make this feasible. The invention may, however, be applied, as a structure, to a folding chair, an invalid chair, a shopping-carrier, or any such article, where a three-dimensional structure is required to be folded into a stick-like formation, and especially when the intended structure must be strong and capable of adapting itself to uneven standing, trundling on wheels, and yet light and economic to make.

According to the invention, a structure for the purpose indicated comprises two X-like frames of intersecting interpivoted rigid elements, which frames are articulately interconnected at two corresponding corners thereof so that when extended these frames lie substantially in planes at an angle one to the other and when collapsed their elements lie near-parallel as a bundle or stick-like formation. Brace elements to complete a triangulate formation when extended of which two sides are representative of the two planes of the frames, and the third side corresponds to the brace elements, and collapsible toggle-bar means connected articularly to the two frames so that when extended such toggle-bar means keeps the frames extended.

According further to the invention, the structure comprises when extended, a bottom X-like frame in approximately horizontal plane, of interpivoted members; a back X-like frame, in a plane very roughly at right-angles to that of the bottom frame and also of interpivoted members, the two adjacent corners of these frames being pivotally interconnected; and brace elements connected to the other corners of the two X-frames so as to form a notionally triangulate pattern in side elevation, the brace elements being foldable; and toggle strut means to interconnect the X-frames transversely and hold them in the extended condition. The toggle strut means to interconnect the X-frames transversely, or, as preferred, may take the form of a separate element.

Such a structure is collapsible into a situation wherein all the members and elements lie nearly parallel, thus forming in what has been termed a stick-like folded condition, by reason of the two X-like frames collapsing, each controlled by the other, and the brace elements folding about their pivoted interconnection so that the outer ends of the X-frames come together.

Further, means preferably in the form of a dead-centre toggle link are provided, folding together with the foregoing, and such that when extended the link in compression locks the structure extended.

The brace members are preferably extended to form handles.

Wheels may be provided—and of course for a baby or invalid carriage are provided; these are located at each corner of the bottom X-frame and one pair may be borne at the lower and slightly extended ends of the brace elements and the other pair on the lower ends of the back X-frame.

Also included in the invention is a structure in which one pair of wheels is borne at the lower ends of struts attached at their upper ends to the brace elements and at points near their lower ends to the back X-frame.

In the case of a carriage or a chair, there is provided a pliable fabric seat, and this is basically a length of fabric attached to the brace elements and folding as they fold. The brace elements also afford lateral support for the occupant and may be protected or upholstered. A foot rest preferably takes the form of a strip of pliable fabric, or a strap extending between the bottom ends of the brace elements or the forward corners of the bottom X-frame; acting as a tension member it may serve to brace the front end of the structure against any tendency to splay.

The structure is preferably held extended by a toggle element which comprises two bars centrally interpolated with a "dead-centre" stop, and pivoted at each end near the bottom corners of the back X-frame; in that situation it is conveniently operable by one foot. However, such a toggle element may be near the upper end of the structure—for example, pivoted near the upper corners of the back X-frame, in which case it is conveniently hand-operated.

Whilst the structure as a whole can easily be carried like a shooting-stick, one pair of wheels remain operable at the bottom end when folded and so the folded structure may be trundled on those wheels. It then becomes practicable to provide a shopping bag or basket, the greater part of the weight being wheel-borne, when the apparatus is not in use as a carriage. A baby carriage or stroller will now be described as an example of the invention, along with a similar carriage with minor structural alterations. These are illustrated by the accompanying drawings in which:

FIGURE 1 is a perspective view of one form of the structure extended;
FIGURE 2 is a side-elevation illustrating the geometry of the structure extended, and in dotted line, partially folded;
FIGURE 3 is an elevation of the structure in its folded state, and represents what is herein called "stick folding";
and
FIGURE 4 is a perspective view of a second form of the structure extended.
3. The bottom X-frame is two tubes 1, 2, pivoted at their intersection at 3. The tubes 1, 2, can be considered to be divided by a rectangle of which the four corners are the effective ends of the tubes. The so-called front corners are at 1A, 2A and rear corners at 1B, 2B. The back X-frame is two tubes 4, 5, pivoted at their intersection at 6. Its upper corners are at 4A, 5A and bottom corners at 4B, 5B. As seen in FIGURE 2, the tubes 1 and 2 as an X-frame and lie in one plane when the structure is extended and this plane is substantially horizontal. They are slightly bowed so that the corners lie in one plane. The tubes 4 and 5, likewise as an X-frame, occupy a plane which is inclined by a fairly small angle, from the vertical and comprise the back frame. Near the corners 4B, 5B, the ends of parts 1, 2, 4 and 5 are conjoined articulately, and it is convenient to think of the two X-frames as a "lazy tongs" linkage in two planes. It follows that if either X-frame is collapsed about its intersection 3 or 6, the other must likewise collapse. When collapsed the members 1, 2, 4, 5, lie nearly parallel; since both frames collapse together, the four tubes can be arranged to come mutually near-parallel (see FIGURE 3) and this is fairly representative of what is called "stick folding."

From near the corners 1A, 2A respectively to the corners 5A, 4A, and extending upwards (as at 7A, 8A) there are elements. Each of these consists of a set of tubes 7, 8, which is knuckle-jointed at 7B, 8B, and articulated near the corners at 4A and 5A to the back X-frame. The lower extent of these brace elements, are lengths of tubes 7C, 8C. The knuckle joints between 7, 8 and 7C, 8C are such that when extended these respectively are aligned with 7, 8, or just over a dead-centre, and are positively stopped in that condition: in that condition the braces are therefore capable of acting as compression members. At the upper extremities of 7A, 8A, the tubes are bent and having appropriate grips, form handles 7D, 8D. These may be of D-section as shown, so that they can nest together and form an easily handled single grip when the structure is folded as in FIGURE 3.

Between the corners at 4B, 5B, there is a toggle bar or strut; this is two rigid parts such as tubes or bars, namely 9A, 9B, and a knuckle-joint 10 which, like the brace, is arranged to lock just at or over a dead-centre. The toggle bar obviously controls the lateral dimension of the structure when extended. It will be noted that it acts as a strut between corners 4B, 5B and it can easily be operated (for erection) by the foot of the user bearing down, or released by the foot hooking it upwards. As an example, the child's seat consists of an area of pliable fabric 11 such as woven plastic. It is hung at its upper edge 11A, on a cord or cable attached to tubes 7, 8, preferably in a marked catenary curve to minimise tension. A safety strap 11C is provided. At its lower (front) corners, the seat 11 is attached to the front ends of two bars 12A, 12B which are pivoted at or near the corners 1B, 2B and pivoted to the brace tubes 7C, 8C. The seat fabric may also be attached to 12A, 12B along about half their length, whereby a bucket-like seat is formed.

A foot-rest is shown at 11B. This is a band or strap, again preferably of woven plastic, and it is attached to the parts 1, 2 near and forward of the corners 1A, 2A, and it can not only act as a foot rest but as a tension member to resist spaying apart of the corners 1A, 2A.

The bottom ends of parts 7C, 8C, extend somewhat below 1A, 2A, and on stub-axles, bear front wheels 13, 14. Extensions of the tubes 4, 5, likewise bear rear wheels 15, 16. The pair of wheels 13, 14 are so spaced that when the structure is folded (FIGURE 3) the wheels come just outside the stick-folded bundle of structure; and in the folded condition it will be noted that the wheels 15, 16, now canted (see FIGURE 3) are still able to be used if the stick-folded structure is to be trundled on the ground.

In addition to the seat part 11, a shopping bag or basket may easily be hung from the parts 7A, 8A for use either when the structure is extended or collapsed, so that the carriage can conveniently be used simply as a shopping-carrier in its stick form, or have a shopping bag as an accessory when a child is being trundled.

To fold the structure from the condition of FIGURE 1 to that of FIGURE 3 (as is seen by the dotted lines in FIGURE 2) the user "breaks" the toggle 9A, 9B, upwards and upwards and the tubes 7D, 8D together and collapses the X-frames and this action is accompanied by "breaking" of the braces (about pivots 7B, 8B) so that corners 1A, 2A, rise towards the upward, folded, position.

Continued folding, beyond the condition dotted in FIGURE 2, although possible in theory by continuing to bring the handles 7D, 8D together, is in fact not practicable, so the user assists folding by directly raising the forward end of the structure (or pressing down the handles towards the ground) until the folded condition of FIGURE 3 is reached.

Spring stirrup-clips (not shown) may be provided, at locations such as 17, to hold the structure together when folded, these clipping on to 7 and 8.

Referring now to FIGURE 4, reference numerals corresponding to those in FIGURE 1 are used where applicable and corresponding parts of the description are not repeated comprises a vehicle.

Double wheels generally indicated at 20, 21, 22 and 23 are used instead of the single wheels used in the first embodiment. The front double wheels 20 and 21 are mounted as before on the lower extent 7C, 8C of the brace elements 7 and 8, but the rear double wheels 22 and 23 are mounted not on the back X-frame tubes 4 and 5 but are mounted on separate wheel carrying struts 40 and 41 pivotally connected to the brace elements 7 and 8 a short distance above the knuckle joints 7B, 8B. The strut tubes 40 and 41 are also mounted pivotally at the corners 4B and 5B to the two X-frames.

All the double wheels are provided with a rubber suspension. To this end each of the wheels are mounted on plates 42 and 43 to the appropriate wheel carrying tubes 7C, 8C, 40 and 41 the plates of each pair of wheels being joined so as to pivot together as a single unit. A rubber block 44 is attached between each of the pairs of plates 42 and when the structure is loaded, the block 44 will bear resiliently against its wheel carrying tube thus providing a sprung suspension.

A brake is provided for one pair of rear wheels and comprises a bar 46 hinged to the tube 40 and connected to a pair of rubber brake pads 47 by a cam arrangement indicated at 48. Downward movement of the front brake lever 49 on the bar 46 applies the pads 47 to the wheels 24, the pads 47 being spring urged away from the wheels 24 by a spring 53.

Also provided is a clip arrangement consisting of a clip 50 and strut 51 for retaining the structure in its folded position.

It will be understood that the modifications shown in FIGURE 4 will provide a more sturdy structure capable of carrying a greater load, the double wheels giving greater stability and the rubber suspension providing a smoother ride.

In a further modification of the invention (shown by dotted lines in FIG. 1) which may be applied to either of the previously described forms of structure, the toggle bar comprised by the parts 9A, 9B is moved from its position interlatching the corners 4B, 5B of the rear X-frame to a position interlatching the corners 4A and 5A where it is more accessible for hand operation. I claim:

1. A collapsible support assembly comprising a bottom cross frame of interriveted rigid members, a back cross frame of interriveted rigid members, a two-axes pivot joint interrivetively attaching one of each of the bottom frame members to one of each of the back frame members at each of two corners of said cross frames,
said axes being oriented to permit the members of each cross frame to pivot with respect to each other and to permit said cross frames to pivot with respect to each other, two foldable brace members pivotally attached to the bottom cross frame near the other two corners of the bottom cross frame, respectively, and to the back cross frame near the other two corners of the back cross frame, respectively, first releasable means to hold the members of at least one of the cross frames in an extended position when the assembly is unfolded, and second releasable means to hold said brace members in an extended position when the assembly is unfolded.

2. An assembly as claimed in claim 1, wherein four wheel sets are provided, one at each corner of the bottom cross frame.

3. An assembly as claimed in claim 2, wherein two of the wheel sets are mounted on slightly extended ends of the brace members.

4. An assembly as claimed in claim 2, wherein each wheel set is a single wheel.

5. An assembly as claimed in claim 2, wherein each wheel set is formed of two identical wheels mounted for rotation about the same axis.

6. An assembly as claimed in claim 2, wherein the wheels are provided with a resilient rubber block.

7. An assembly as claimed in claim 1, wherein said first releasable means comprises a toggle bar.

8. An assembly as claimed in claim 7, wherein said toggle bar interconnects both cross frames at the points where the two cross frames are joined.

9. An assembly as claimed in claim 7, wherein said toggle bar interconnects the members of the back cross frame at the top thereof.

10. An assembly as claimed in claim 1, wherein said second releasable means comprises a pair of strut members, each pivotally connected to one of said brace members and to a cross frame.

11. An assembly as claimed in claim 10, further comprising a length of fabric attached to said brace members and to said strut members to form a seat.

12. An assembly as claimed in claim 1, wherein each of said brace members comprises a pair of tubes connected together for relative angular movement.

13. An assembly as claimed in claim 2, further comprising a pair of strut members pivotally interconnecting said brace members to the rear corners of the bottom cross frame, two of said wheel sets being mounted on downwardly extending portions of said strut members.

14. An assembly as claimed in claim 1, wherein each of the brace members has a handle at one end thereof.

15. An assembly as claimed in claim 1, wherein, in side elevation, said brace members and said cross frames form a substantially right triangle, the hypotenuse of which is formed by the brace members.

References Cited

UNITED STATES PATENTS

2,690,792 10/1954 Moss _____________ 155—140
2,722,972 11/1955 Altruda _____________ 155—140
3,024,035 3/1962 Tapiusara _____________ 280—47.4

FOREIGN PATENTS

555,815 7/1923 France.

BENJAMIN HERSH, Primary Examiner.

J. SIEGEL, Assistant Examiner.