June 22, 1965 J. A. USHER ETAL 3,190,406

COLLAPSIBLE STRUCTURE

Filed Sept. 17, 1962 2 Sheets-Sheet 1

Fig. 1.

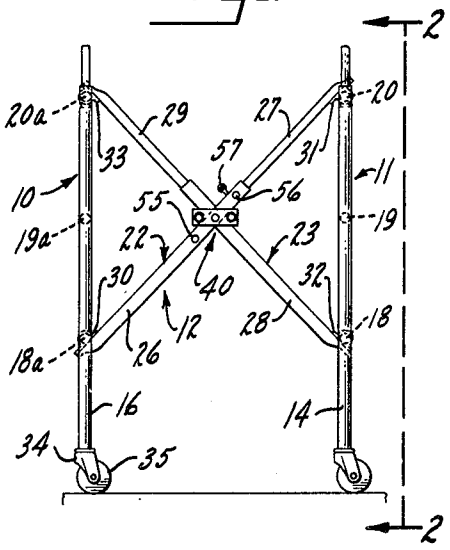


Fig. 2.

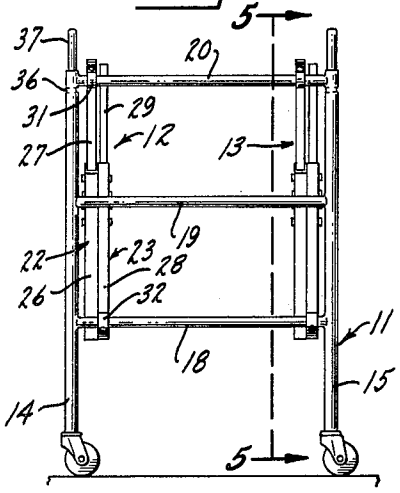


Fig. 3.

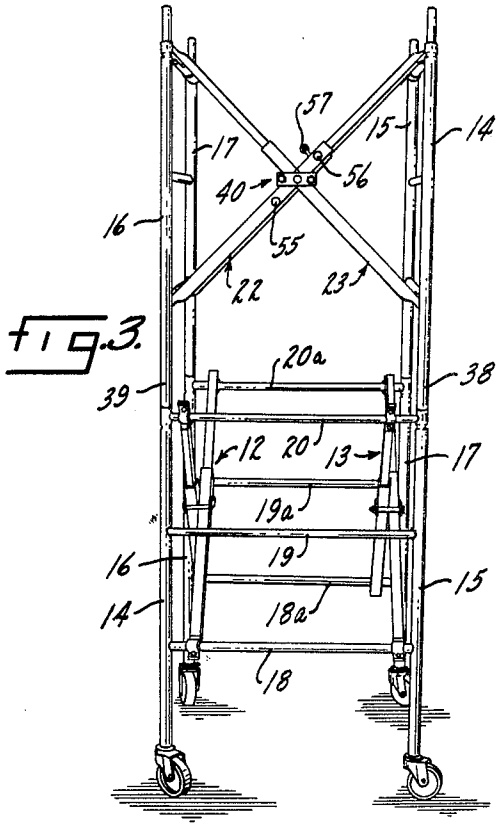
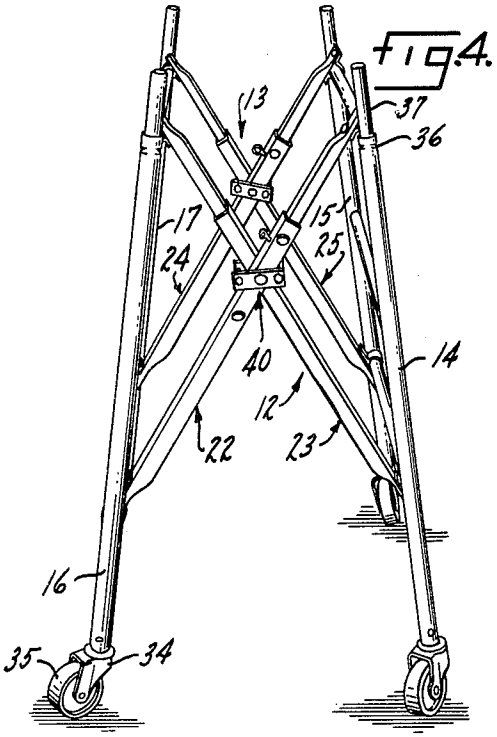


Fig. 4.



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Filed Sept. 17, 1962 2 Sheets-Sheet 2

Fig. 5.

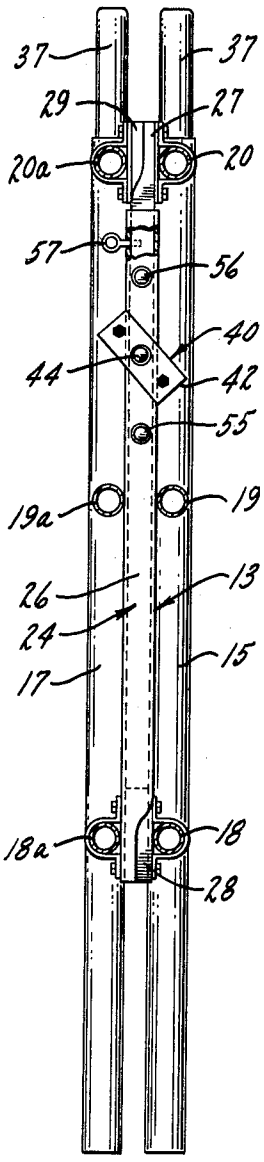


Fig. 6.

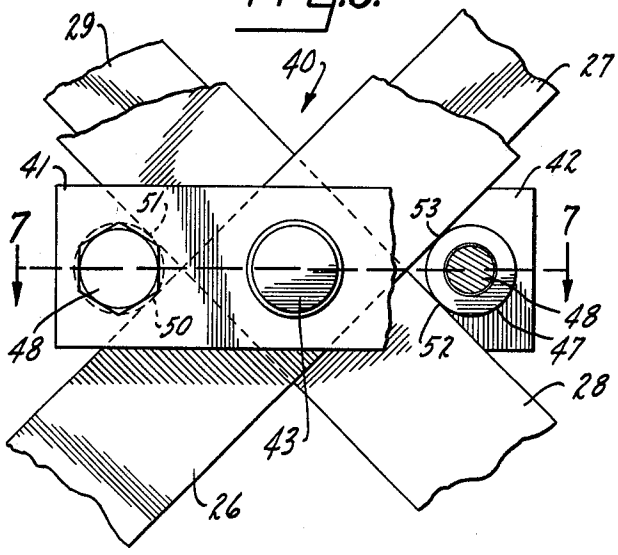
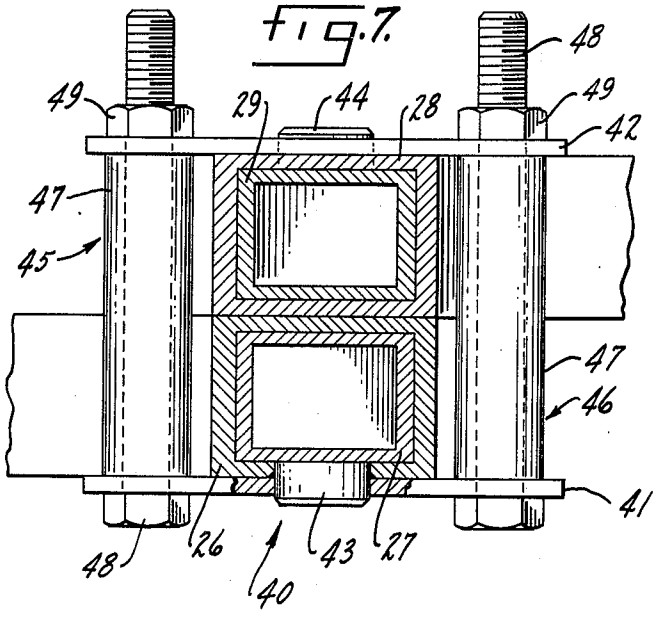


Fig. 7.



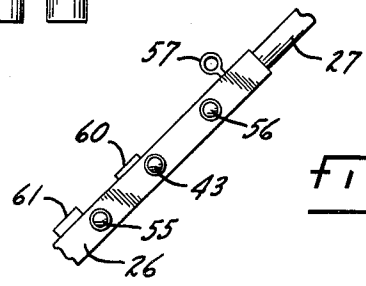


Fig. 8.

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3,190,406

COLLAPSIBLE STRUCTURE

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7 Claims. (Cl. 189—20)

Our invention relates generally to framing and specifically to a framework which may be collapsed into a compact unit for storage and shipment or transporting.

Accordingly, a primary object of our invention is to provide a framework suitable for supporting a scaffold, a similar framework, or the like, which is simple, compact, strong and very light.

A further object is to provide a collapsible framework which can be stacked to build a supporting structure of any desired height.

Another object is to provide a collapsible brace assembly having a novel angular expansion limit means which acts as a pivot for crossing, overlapping brace members, and positively limits their relative angularity with respect to one another.

Yet a further object is to provide a collapsible framework in which the top collapses inwardly faster than the bottom to thereby provide a base of maximum width and stability, at all times.

Yet another object is to provide a collapsible framework of adjustable width.

Other objects and advantages will be apparent from a reading of the following description of the invention.

The invention is illustrated more or less diagrammatically in the accompanying drawings in which:

FIGURE 1 is a front elevation of our framework;

FIGURE 2 is a view taken substantially along the line 2—2 of FIGURE 1;

FIGURE 3 is a view of two of our frameworks stacked, one atop the other with corresponding parts in the two frameworks rotated 90 degrees from one to the other;

FIGURE 4 is a perspective view of our framework in a partially collapsed position;

FIGURE 5 is a section taken substantially along the line 5—5 of FIGURE 2 showing our framework in a completely collapsed condition;

FIGURE 6 is a detail to a larger scale of an element of the invention;

FIGURE 7 is a view taken substantially along the line 7—7 of FIGURE 6; and

FIGURE 8 is a detail view of a modified brace assembly on a reduced scale.

Like reference numerals will be used to refer to like parts throughout the following description.

Referring first to FIGURES 1 and 2, our collapsible framework includes a pair of rigid sideframes 10, 11, and one or more, usually a pair, of folding cross braces indicated generally at 12, 13. The folding cross braces form, in effect, collapsible sideframes. Each of the rigid sideframes includes a pair of rigid corner members 14, 15 and 16, 17. (See FIGURES 3 and 4.) The corner members are maintained parallel to one another by a plurality of struts 18, 19, 20, and 18*a*, 19*a*, 20*a*. Although three struts on each side have been illustrated in this instance, a greater or lesser number may be employed depending upon the strength and rigidity to be built into the framework.

Each folding cross brace consists of a pair of crossed, overlapping diagonal brace assemblies 22, 23 and 24, 25, as best seen in FIGURE 4. Each diagonal brace assembly consists of, in this instance, a pair of sliding telescopic rectangular tubular members 26, 27 and 28, 29, as best seen in FIGURES 1 and 7. The lower end of outer tubular member 26 is pivotally connected to strut 18*a* by a flanged, half-moon shaped bracket 30 shown best in FIGURES 1 and 2. The upper end of internal tubular member 27 is connected to strut 20 by a similar connecting bracket 31. As best seen in FIGURE 2, the points of connection of diagonal brace assembly 22 to struts 18*a* and 20, and of diagonal brace assembly 23 to struts 18 and 20*a*, lie inwardly from the joint between the strut and corner member a distance sufficient to permit the corner members to practically abut one another when our framework is completely collapsed, as in FIGURE 5.

The lower end of outer tubular member 28 is pivotally connected to strut 18 by a similar bracket 32, and the upper end of inner member 29 is connected to strut 20*a* by bracket 33. The relative positions of the brackets along the struts and the clearance between the brace and corner members are best seen in FIGURE 2.

The connections of folding cross brace 13 to its associated strut members are substantially identical.

The ends of the cross braces may be pivoted to structure other than the struts, for example pivot stubs or brackets extending from the corner members.

The corner members 14, 15, 16 and 17 are tubular as shown in FIGURE 4. A caster consisting of a swivel bracket 34 and wheel 35 is received in the bottom of each corner member. The upper end of each corner member may be necked down as at 36 to provide a stop beyond which a short extension 37 will not travel. The short pipe extensions provide a base to receive the bottom ends of similar corner members 38, 39 of a substantially identical framework which thereby enables the frameworks to be stacked one on top of the other. Such an arrangement is illustrated in FIGURE 3.

Means for limiting the angle between the overlapping diagonal braces in each folding cross brace, and for maintaining said braces in abutted coupled and pivoted relationship, is indicated generally at 40. The limiting means is a limiting and pivoting device which consists essentially of a pair of tie plates or bars 41, 42 which are pivotally received on oppositely located stub pivot shafts 43, 44 welded to the outer faces of tubular sleeves 26, 28. A pair of spacers connecting the tie plates together are indicated at 45, 46. Each spacer consists essentially of a sleeve 47 which is held between the tie plates by a bolt 48 running therethrough and nut 49. While stub shafts 43, 44 are shown on the sleeves 26, 28, it will be understood that a plurality of oppositely positioned holes or depressions could be formed in the outer tubular members, and stub pivots could be formed on the tie plates for entry into such depressions.

Spacer members 47 are slightly longer than the distance between the outer faces of members 26 and 28 to insure free swinging movement about the stub pivots. As best seen in FIGURE 6, outer tubular members 26, 28 make substantially line contact with the spacers 47 at 50, 51 and 52, 53. By the addition of shims between the spacers and the outer tubular members, or by the use of spacers having diameters different from that shown, the angle between the brace assemblies may be varied as needed. To provide for use of one-diameter spacers in association with each of the pivot points 55, 43, 56, for example, shims of varying thicknesses can be affixed to sleeves 26, 28, the diameter of the spacers being set for use with pivot 56 and shims 60, 61 of increasing thickness being located for use with said spacers when pivots 43 and 55 are employed, as best seen in FIGURE 8.

A plurality of additional pairs of oppositely positioned stub pivots are indicated generally at 55, 56 in FIGURE 3. Although only two additional pairs have been shown, it will be understood that a greater or lesser number may be employed as desired.

Means for locking the outer tubular members to the inner members are indicated at **57**. In this instance a set screw threaded through tubular member **26** has been illustrated but it will be understood that within the scope of our invention a removable pin or other suitable locking or clamping device may be employed.

The use and operation of our invention are as follows:

The width between the substantially rigid sideframes **10, 11** is determined by the location and components of the limiting and pivoting device **40**, and the adjustment of the diagonal brace member. The sideframes **10, 11** are collapsed to the point at which a pair of oppositely positioned stub pivot shafts or indenture pivots are in approximate alignment. In FIGURES 1 and 2 the center set of stub pivots **43, 44** has been selected. The tie plates **41, 42** are then slipped on the stub pivot shafts, the spacers **47** aligned with the apertures at the end of the tie plates, and bolts **48** passed through the tie plate apertures and spacers. The nut **49** is then secured tightly against the tie plates to prevent the tie plates from slipping off the stub pivots.

The length of each diagonal brace member is then set by loosening or withdrawing set screw or pin **57** and sliding interior tubular members **27, 29** out of the exterior tubular members **26, 28**, until a desired operative position is reached. The locking screw or pin is then repositioned. The framework is opened by pulling outwardly on the rigid sideframes to the position of FIGURES 1 and 2. In this position the upper struts **20, 20***a* provide a two-point support for a platform or similar structure.

The framework is of course movable on wheels **35**.

By proper adjustment of the length of the diagonal brace members, the distance between the substantially rigid sideframes **10, 11** can be adjusted to be identical with the width of one of the rigid sideframes. In this event a second framework can be placed on top of a lower one as illustrated in FIGURE 3. Preferably, the frameworks are so positioned that corresponding parts from framework to framework are rotated 90 degrees with respect to one another. The struts of the lower framework provide increased rigidity in the framework in the direction parallel to the longitudinal axis of the struts, and the struts in the upper framework provide increased rigidity in the framework in a direction perpendicular to the lower struts. The combination of the two frameworks thereby provides a strong compact framework which will enjoy maximum rigidity when subjected to the imposition of forces from any direction.

The width of our framework is governed by suitable adjustment of the length of the diagonal brace members, the location of the tie plates, and the angle between the crossed brace assemblies.

One important advantage of our invention is the fact that when the framework is being collapsed the upper part can be made to collapse further inwardly than the lower portion to thereby provide a base of maximum width and stability. Our framework is thereby self-sustaining and more stable until it is completely collapsed. This is accomplished by adjusting the telescopic members with respect to one another to a position in which the distance between the point of connection of the diagonal brace members to the upper struts and the stub pivot **43** is less than the distance between the point of connection of the diagonal brace members to the lower struts and the stub pivot **43**. For any given increment of collapsing thrust against the rigid sideframes, the upper struts **20, 20***a* will move inwardly a further distance than lower struts **18, 18***a*. Our framework in a partially collapsed condition is illustrated in FIGURE 4. This is of advantage in that the framework in a partially collapsed condition can be wheeled from place to place thereby avoiding lifting by hand or machine. Moreover, the lock pin **57** can be provided with suitably placed apertures in members **26, 27** to lock the framework of the invention in a partially collapsed configuration similar to that in FIGURE 4, in which configuration the framework may be useful for a variety of function, such as that of a sawhorse for example.

By locating the diagonal brace members inwardly along the struts a distance sufficient to clear the corner members **14, 15, 16, 17**, our framework may be collapsed to the compact position illustrated in FIGURE 5. Similarly, the cross braces may be pivoted on stud shafts extending outwardly from the corner members. Referring to FIGURE 2, for example, it will be noted that a clearance is provided between the ends of the stub pivot shafts and corner members **14, 16**. This permits the rigid sideframes to be collapsed to a position in which the distance therebetween is equal to the width of the exterior members **26, 28** since these members strike against mid struts **19, 19***a*, as best seen in FIGURE 5.

In view of the obvious variations which are possible from the foregoing exemplary description, it is our intention that the scope of our invention be measured not solely by the description, but rather by the following claims as interpreted in light of the prior art, having due regard to the doctrine of equivalents.

We claim:

1. A foldable cross brace including a pair of crossed diagonal brace assemblies, a pair of tie members spaced outwardly of said brace assemblies on opposite sides thereof and extending across the intersection of said assemblies in alignment with each other, pivot means formed on said tie members and outer facing portions of the brace assemblies to permit the brace assemblies to be rotated relative to each other about said pivot, and a pair of spacers extending between said tie members and located on opposite sides of said pivot between said brace assemblies with said spacers and the pivot lying in the same plane, said spacers being engageable with said brace assemblies to limit rotation of the brace assemblies toward each other, said spacers being removable so that spacers of varying thickness can be substituted to vary the minimum angle between the brace assemblies.

2. A foldable cross brace including a pair of crossed diagonal brace assemblies, a pair of tie members spaced outwardly of said brace assemblies on opposite sides thereof and extending across the intersection of said assemblies in alignment with each other, pivot means formed on said tie members and outer facing portions of the brace assemblies to permit the brace assemblies to be rotated relative to each other about said pivot, and a pair of spacers extending between said tie members and located on opposite sides of said pivot between said brace assemblies with said spacers and the pivot lying in the same plane, said spacers being engageable with said brace assemblies to limit rotation of the brace assemblies toward each other, and a pivot shaft extending from the outer facing portions of the diagonal brace assemblies, each tie member being pivotally carried by an associated pivot shaft.

3. A foldable cross brace assembly including a pair of crossed variable-length brace members, a pair of tie members, one on each of the opposite outer sides of said brace members and extending across the intersection thereof, conformations on said brace and tie members providing a separable pivotal connection between each of said tie members and the opposed surface of its adjacent brace member, and a pair of spacers removably secured to and extending between said tie members, said spacers being located on opposite sides of said intersection.

4. A foldable cross brace assembly including a pair of crossed variable-length brace members, a pair of tie members, one on each of the opposite outer sides of said brace members and extending across the intersection thereof, conformations on said brace and tie members providing a separable pivotal connection between each of said tie members and the opposed surface of its adjacent brace

member, and a pair of spacers removably secured to and extending between said tie members, said spacers being located on opposite sides of said intersection, and additional conformations on and spaced along each of said brace members, said additional conformations being substantially identical to the first-named conformations on said brace members whereby said pivotal connection may be selectively affected with said tie members at a variety of points on said brace members.

5. A brace assembly including a pair of crossed variable-length brace members and means removably connected with said brace members to abut, pivot and couple said brace members at their crossing point, said means including a set of tie bars, each of said tie bars being separably, pivotally connected to an outer surface of one of said brace members and a pair of spacers, each of said spacers extending between and removably secured to aligned end portions of said tie bars to couple said brace members together in abutting relationship and to hold said tie bars in pivotal connection with said brace members.

6. A foldable brace assembly including a pair of crossed, variable-length brace members, each of said members including a first, hollow, elongated member having an uninterrupted inner area and a second elongated member slidable in said first member, and means removably coupling said brace members in abutted, pivotal relationship, said means including a pivot-forming conformation on the outer surface of each of said brace members, a pair

of tie members, each of said tie members having a pivot-forming conformation adapted for separable pivotal mating with said brace member conformations and spacers removably secured to and extending between said tie members on opposite sides of said brace members.

7. For use in a collapsible framework structure, a pair of crossed, variable-length brace members, and means removably connected with said brace members, said means including a set of tie bars, each of said tie bars being separably, pivotally connected to an outer surface of one of said brace members, and spacer members extending between and removably secured to said tie bars to couple said brace members together in abutting relationship and to hold said tie bars in pivotal connection with said brace members.

References Cited by the Examiner

UNITED STATES PATENTS

153,270	7/74	Newhard	182—152
164,386	6/75	Merrick	248—164
326,514	9/85	Moross	287—51
2,352,090	6/44	Faller	108—118
2,897,013	7/59	Delp	189—15.5
3,105,572	10/63	Nesslinger	182—152

FOREIGN PATENTS

16,099	3/27	Netherlands.

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