United States Patent [19]

Parsons

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[54] **FOLDABLE ARTICLES**

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[52] **U.S. Cl.** **108/113**, 273/30

[51] **Int. Cl.** **A47b 3/083**

[58] **Field of Search** 108/113, 112, 111, 108/115, 99; 52/7; 297/159; 297/159; 273/30; 5/154

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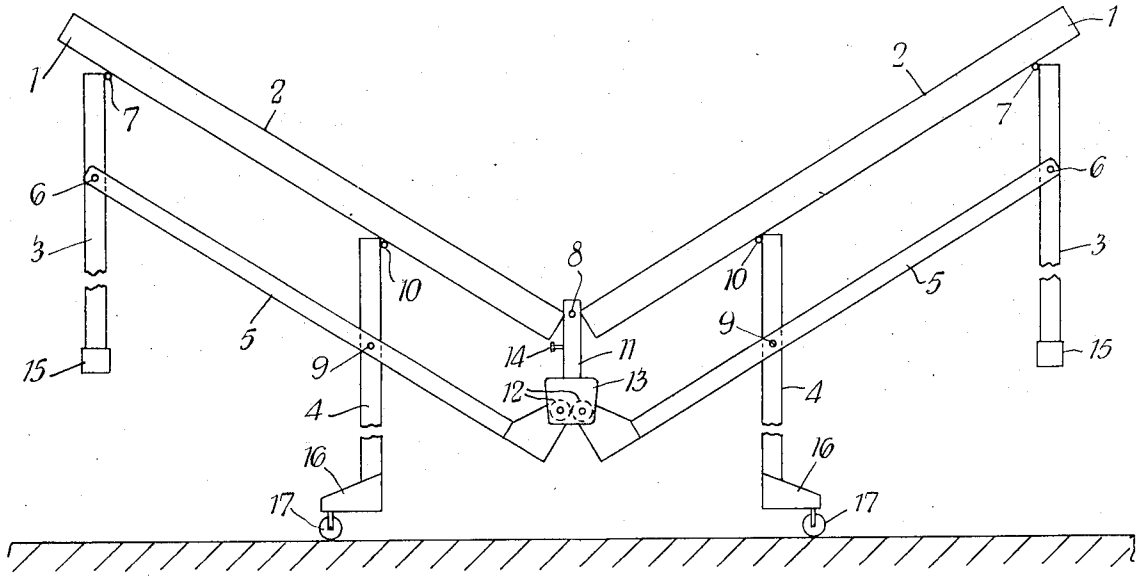
Assistant Examiner—Kenneth J. Dorner
Attorney—David Toren et al.

[57] **ABSTRACT**

A foldable article having a generally planar surface, for example a table-tennis or other table, comprises two halves which are pivotable with respect to one another so as to fold up into a position in which the halves lie against one another. A respective beam is provided below each half, and the beams are pivotally connected to one another such that pivotal movement of one half constrains the other half to move to an equal extent in an opposite sense. The pivot point of the halves and that of the beams are rigidly connected. Each half is supported by a respective leg which is pivotally connected to its half and to a beam. The pivot points of the halves, the beams, the legs with the beams and the legs with the halves define a respective parallelogram below each half. On folding up the article, the legs of each half move towards one another over a supporting surface.

15 Claims, 7 Drawing Figures



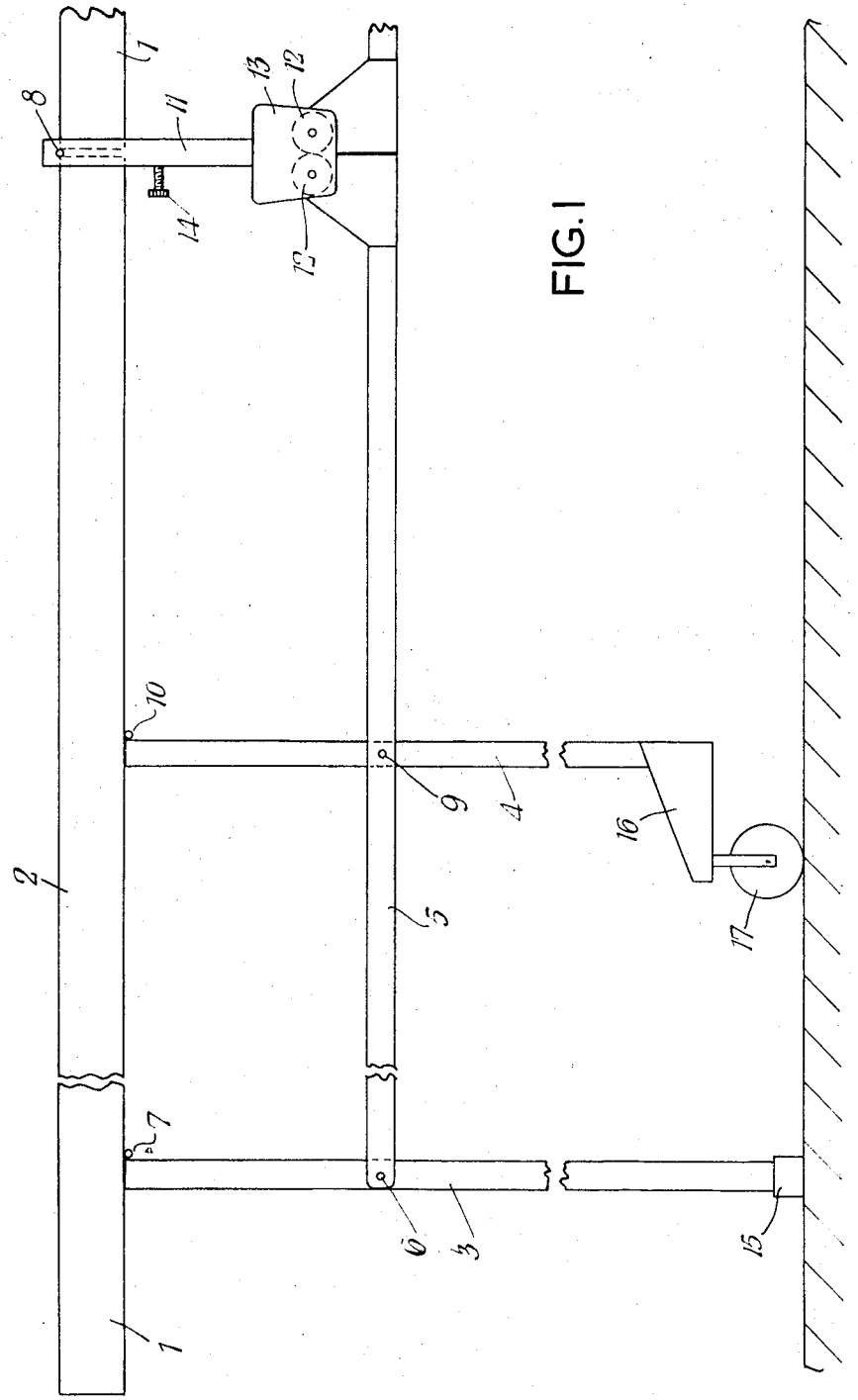


FIG. 1

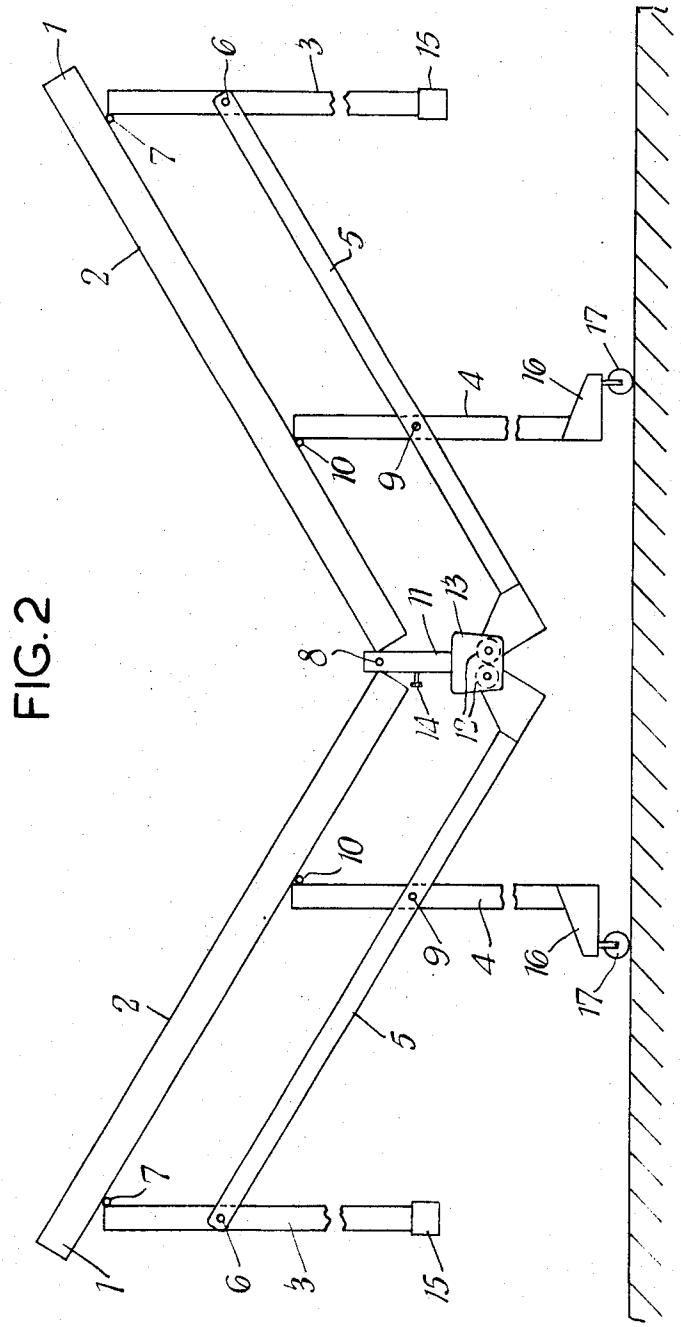


FIG. 2

FIG. 3

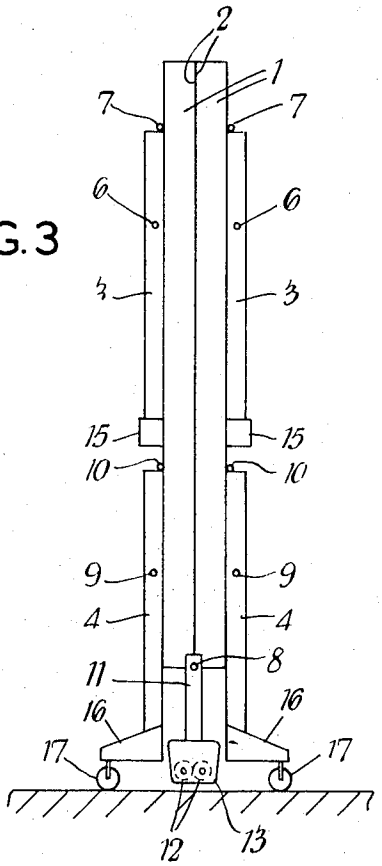


FIG. 4

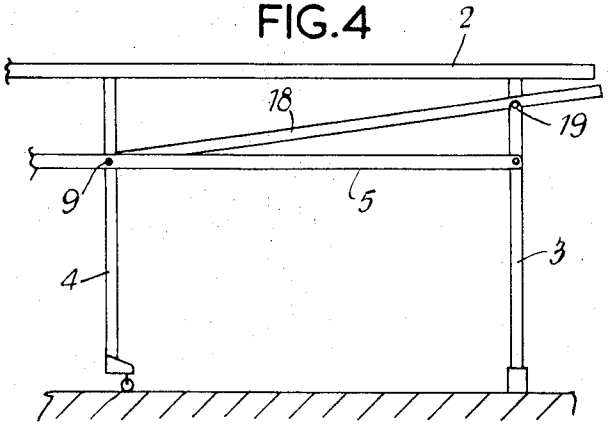
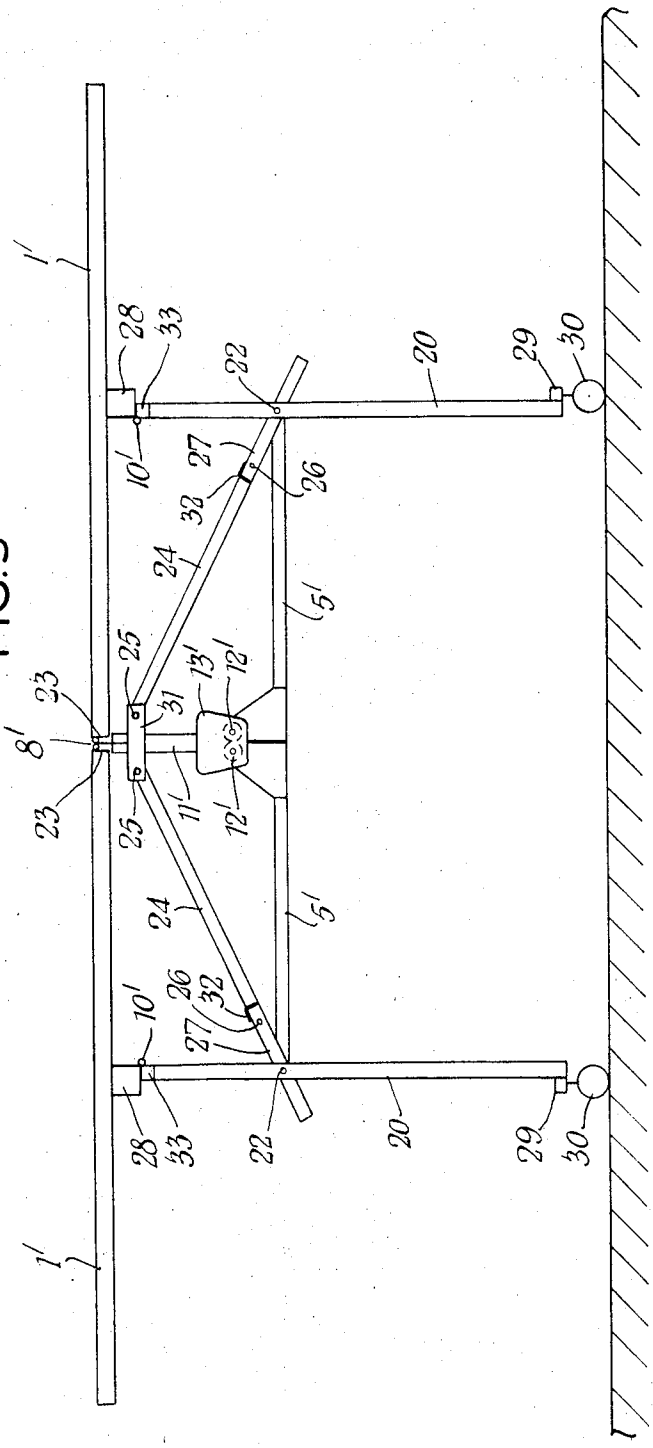


FIG.5



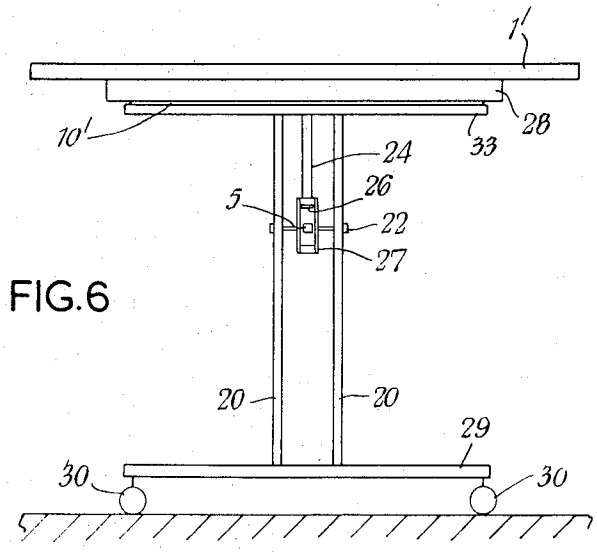

1'
10'
28
33
24
26
5
22
27
20
20
29
30
30

FIG.6

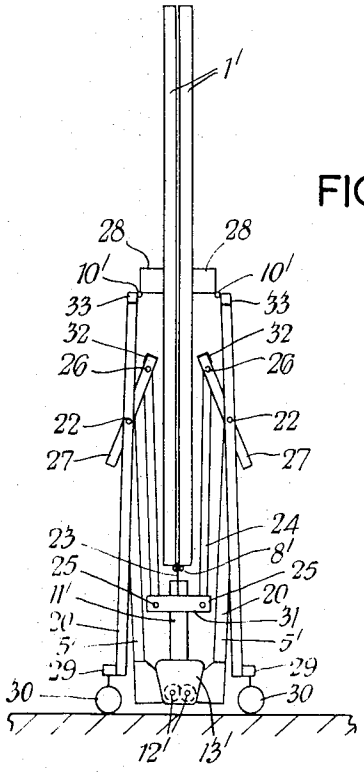

1'
28
28
10'
10'
33
33
32
32
26
26
22
22
27
27
24
23
8'
25
25
11'
20
31
5'
5'
29
29
30
30
12'
13'

FIG.7

FOLDABLE ARTICLES

This invention relates to foldable articles, for example a piece of furniture in which a structure having a generally planar surface is supported on legs. The piece of furniture may be a table-tennis or other table or a bed.

The present invention provides a foldable article comprising a structure formed in two halves, means coupling the halves together in such a way that they can be folded from an open position to a closed position in which the two halves lie against one another, an elongate member spaced from each half, means coupling the ends of the two elongate members together, a rigid coupling member on which the means coupling the two halves and the means coupling the two elongate members are pivotally mounted, two leg members each pivotally connected at one end to a respective half and intermediate its ends to a respective elongate member and spaced from the rigid coupling member, the lines joining the pivot points of a leg member to a half and to a respective elongate member and the pivot points of the couplings of the half and the elongate member in the rigid coupling member forming a parallelogram, the pivotal axes of said pivot points being parallel, the leg members serving to support or assist in supporting the article and each optionally carrying at its lower end a wheel, castor, roller, slide or like mechanism whereby the leg member can be moved over a supporting surface, the means coupling the two halves and/or the two elongate members being such that, when the article is in an open position and one end is lifted, the other end is constrained to move with a motion of equal magnitude and opposite sense and the two leg members move towards one another on said wheels or like mechanisms, the distance between the pivot point of each supporting leg in the elongate member and the end of the supporting leg being such that when the structure is folded so that one half lies up against the other half, the coupled ends of the elongate members or an attachment thereon do not impede movement of the structure over the supporting surface on the wheels or like mechanisms.

Each side of the structure may be supported by an arrangement of two elongate members, a rigid coupling member and two leg members. Two additional leg members may be provided, each pivotally connected at one end to a respective half and intermediate its ends to a respective elongate member, the lines joining the pivot points of a leg member and an additional leg member to a respective half and to a respective elongate member defining a parallelogram. The leg members may be formed with crutch or other feet, in which case any wheels or like mechanisms may be retractable. The additional leg members need not have wheels. Legs which are pivotally connected to a half of the supported structure but which are not attached to an elongate member may also be provided

The means coupling the halves of the structure and/or the elongate members may be meshing gearwheels or any of the means disclosed in British Patent Specification No. 903,116. If only one of these coupling means is effective to constrain movement of the structure as specified hereinbefore, another coupling means may be a pivot.

Means may be provided for locking the structure in fully open or fully folded position, for example a strut.

However, the structure may be so weighted as to be stable in these positions. The folded position may be safeguarded by a latch or safety chain connecting the or each pair of elongate members. The open position may be made more rigid by a strut, for example positioned diagonally or approximately diagonally with respect to the parallelogram, or by a latch connecting the coupling means or elongate members. A strut may for instance connect two leg members. It will be appreciated that as the present structure is folded, the dimensions of parallelograms defined by pivot points of the structure alter, and in particular, one diagonal of each parallelogram increases in length and the other diagonal decreases. Thus a strut must be mounted in such a way as to allow for this, for example by there being a slot in the strut by means of which the strut can slide over a pin on a leg member to which the strut is connected.

Stability against rocking may be enhanced by arranging that top ends of the leg members butt up to the underside of the halves, or to beams or blocks provided on the underside of the halves, and/or by the ends of the elongate members butting against one another.

In order to enable the invention to be more readily understood, reference will now be made to the accompanying drawings, which illustrate diagrammatically and by way of example two embodiments thereof, and in which:

FIG. 1 is a side view of part of a foldable table-tennis table in an open position for play;

FIG. 2 is a side view on a smaller scale of the table-tennis table shown in FIG. 1 in a partly folded position;

FIG. 3 is a side view of the table-tennis table shown in FIG. 2 in a fully folded position, but with elongate members removed for the sake of clarity;

FIG. 4 is a side view of part of the table shown in FIGS. 1 to 3 on a smaller scale, showing a supporting strut in position;

FIG. 5 is a side view of another table in an open position;

FIG. 6 is an end view of the table shown in FIG. 5, again in open position; and

FIG. 7 is a side view of the table shown in FIGS. 5 and 6 when in fully folded position.

Referring now to FIGS. 1 to 3, a table-tennis table comprises a top 1 formed in two halves pivotally connected by a pivot 8 and having a playing surface 2. The top 1 is supported on each side by a first pair of legs 3, a second pair of legs 4, and a pair of beams 5, the ends of which butt up against one another when the table is in fully open position. Each leg 3 is pivotally connected to an end of a beam 5 by means of a pivot 6, and to a half of the top 1 by means of a pivot 7. Each leg 4 is pivotally connected to a beam 5 by means of a pivot 9, and to a half of the top 1 by means of a pivot 10. Lines joining the pivots 6, 7, 10 and 9 form a parallelogram.

A gearwheel 12 is mounted on a generally triangular endpiece of end beam 5, the endpieces being at the ends of the beams remote from the pivots 6. The gearwheels are journalled between two plates 13, and are so located that they mesh with each other. Lines joining the pivots 8, 10 and 9 and the centre of that gearwheel 12 which is nearer the pivot 9 form a parallelogram. The plates 13 are connected to the pivot 8 of the halves of the table through a rigid hollow stock 11, which also serves as a support for a table-tennis net. The stock 11 and plates 13 together constitute a rigid coupling member on which the pivot 8 and the gearwheels 12 are

mounted. A clamping screw **14** is provided for clamping the net in position.

The lower end of each leg **3** is provided with a cup **15** of resilient material which serves to protect a floor or other supporting surface on which the table stands, and to prevent slipping. The lower end of each leg **4** is provided with a foot **16,** which supports a wheel **17.**

It will be appreciated that a half of the table top **1** and the beam **5** beneath it (as viewed in FIG. **1**) are free to move relative to one another, but that they will always remain parallel. Similarly the legs **3** and **4** are free to move relative to one another but will always remain parallel. Because the beams **5** are coupled to one another through meshing gearwheels, when the table is in a fully opened state and one end is lifted, the other end lifts with a motion of equal magnitude and opposite sense, and the legs **4** move towards one another on the supporting surface on the wheels **17.** The effect of this is that the table is always symmetrical about a plane passing through the pivot **8** and bisecting the meshing gearwheels **12,** no matter what position the table takes up as a result of relative movement of the pairs of legs **3** and **4,** the beams **5,** and the halves of the table top **1.**

When the table-tennis table is positioned for play (i.e. with the playing surface **2** horizontal) the lower ends of the pairs of legs **3** and **4** lie in a horizontal plane constituted by a supporting surface such as a floor. When it is desired to fold the table, the centre of the table top is depressed and/or one or both ends of the table top is or are raised, the halves of the table top pivoting about the pivot **8.** Owing to the symmetry resulting from meshing of the gearwheels, the lower ends of the legs **3** always lie in a plane parallel to the supporting surface. As the legs **3** rise, they and the legs **4** are displaced inwardly, the legs **4** moving on the wheels **17.** FIG. **2** illustrates a position in which the table is supported on the wheels **17** and the legs **3** are in mid-air. MOvement of the halves of the table top about the pivot **8** is continued until the two halves lie against one another, as shown in FIG. **3.** The distance between the pivots **9** and the ends of the legs **4** including the wheels is such that when the table is fully folded, the ends of the beams **5** do not impede movement of the structure on the wheels **17.**

Means are provided for locking the structure in fully open or fully folded position, for example a diagonal or other strut, or a latch or safety chain connecting each pair of elongate members.

An approximately diagonal strut **18** is shown in FIG. **4.** The strut **18** is pivotally mounted at one end on the pivot **9,** which is a pivot point for the leg **4** and elongate member **5.** At its other end, the strut is formed with a slot into which a pin **19** on the leg **3** can fit. In order to lock the table in fully open position, the strut is lowered until the slot fits over the pin **19.** To prepare the table for folding, the strut is simply lifted so that the pin no longer engages the slot.

The tops of the legs **3** and **4** may be arranged to butt up to the underside of the halves of the table, or to the underside of beams or blocks provided on the underside of the halves, to enhance stability against rocking. For the same reason, the ends of the beams **5** may be arranged to butt against one another.

Referring now to FIGS. **5** to **7,** the table comprises a top **1'** formed in two halves pivotally connected by a pivot **8'** to be described subsequently. Each half of the top is supported by a pair of legs **20** and a beam **5'.** A crossbar **29** is attached, e.g. by welding to the bottom of the legs of each pair, and carries castors **30** at its ends. The ends of the beams **5'** butt up against one another when the table is in fully open position. Each beam **5'** is journalled between a pair of legs **20** by a pivot **22.** Each leg **20** is joined, e.g. by welding to crossbar **33** which is pivotally connected to a beam **28** on the underside of a half of the top **1'** by means of a pivot formed by a hinge **10'.** The beams **5'** are coupled through meshing gearwheels **12'** in the same manner as described with reference to the beams **5** and gearwheels **12** in connection with FIGS. **1** to **3.** Lines joining the pivots **8', 10', 22** and **12'** form a parallelogram below each half of the table. The gearwheels **12'** are journalled between two plates **13'** mounted at one end of a stock **11',** which at its upper end supports a plate **23,** which extends between the halves of the top **1'.** The pivot **8'** is mounted on the plate **23,** and comprises two hinges, one mounted on each side of the plate. Thus the halves of the top are each hinged to the plate rather than directly hinged to one another. The two hinges and the top of the plate occupy the space between the halves of the top and form a flush surface with the halves.

A strut extends from the pivot **22** to a short cross-piece **31** mounted on the stock **11'.** The strut is hinged to the cross-piece at **25.** The strut comprises two portions **24** and **27** which are pivotally connected by a pivot **26.** As the table is moved into fully open position, the strut snaps into a linear configuration and secures the table in fully open position. A flat extension **32** is provided on the portion **24** to prevent movement beyond the linear configuration.

When fully folded the present table is compact and can be easily transported on its wheels or castors and stored. Moreover, the uppermost surface of the table is not exposed, and so is unlikely to be damaged while the table is being moved or stored. This is clearly important in the case of the table-tennis table.

In a modified embodiment of the table shown in FIGS. **5** to **7** the legs **20** of each pair are spaced further apart and are joined by a crossbar at the level of the beam**5'** so that the legs and the crossbar form an 'H'. The beam **5'** is pivoted to the crossbar at its midpoint. In this embodiment, a diagonal strut which is not pivoted between its ends may be employed, the strut being hinged at one end to the lower surface of a half of the table and being arranged to drop into locking engagement wit the crossbar as the table reaches its fully open position. The castors in this embodiment are at the bottom of the legs, and no beam **29** is provided.

Although the invention has been particularly described with reference to elongate members being connected through meshing gearwheels, so that the angular motion of one beam is constrained to be equal in magnitude and opposite in sense to that of the other, other means of prducing the same effect may be employed, for example any of the means disclosed in British Patent Specification No. 903,116.

What we claim is:

1. A foldable article comprising a structure formed in two halves with each half having a top surface, means hinging the halves together in such a way that they can be folded from an open position to a closed position in which the respective top surfaces of two halves lie against and face one another, an elongate member spaced from each half, means coupling the ends of the

two elongate members together, a rigid coupling member on which the means hinging the two halves and the means coupling the two elongate members are pivotally mounted, two leg members each pivotally connected at one end to a respective half and intermediate its ends to a respective elongate member and spaced from the rigid coupling member, the lines joining the pivot points of a leg member to a half and to a respective elongate member and the pivot points of the hinging means and coupling means of the half and the elongate member respectively in the rigid coupling member forming a parallelogram, the pivotal axes of said pivot points being parallel, the leg members serving as means for supporting the article and each carrying at its lower end enabling means enabling the lower end of the leg member to be moved over a supporting surface, said coupling means including an operable couple operable to provide that, when the article is in an open position and one end is lifted, the other end is constrained to move with a motion of equal magnitude and opposite sense and the two leg members move towards one another on said enabling means, the distance between the pivot point of each supporting leg in the elongate member and the end of the supporting leg being such that when the structure is folded so that the top surface of one half lies up against the top surface of the other half, the coupled ends of the elongate members do not impede movement of the structure over the supporting surface on said enabling means.

2. A foldable article as claimed in claim **1**, wherein each side of the structure is supported by an arrangement of two of said elongate members, said rigid coupling member and two of said leg members.

3. A foldable article as claimed in claim **1**, wherein two additional leg members are provided for the structure, each additional leg member being pivotally connected at one end to a respective half and intermediate its ends to a respective elongate member, the lines joining the pivot points of a leg member and an additional leg member to a respective half and to a respective elongate member defining a parallelogram.

4. A foldable article as claimed in claim **1**, wherein said leg members are formed with feet, and wherein said engageable means are retractable, whereby the article can be supported solely on said feet.

5. A foldable article as claimed in claim **1**, wherein said operable couple includes meshing gearwheels.

6. A foldable article as claimed in claim **1**, wherein locking means are provided for locking the structure in fully open position.

7. A foldable article as claimed in claim **6**, wherein said locking means comprises a strut, which, when the structure is fully open, is diagonal or is approximately diagonal to said parallelogram formed by the lines joining the pivot points of a leg member to a half and to a respective elongate member and the pivot points of the hinging means and coupling means of a half and an elongate member respectively in the rigid coupling member.

8. A foldable article as claimed in claim **1**, wherein when the structure is in fully open position, the top ends of the leg members butt up to the underside of the halves.

9. A foldable article as claimed in claim **1**, wherein when the structure is in fully open position, the ends of the elongate members butt against one another.

10. A foldable article as claimed in claim **1**, wherein locking means are provided for locking the structure in fully folded position.

11. A foldable article as claimed in claim **1**, wherein the underside of said halves are provided with abutment means whereby when the structure is in fully open position, the top ends of the leg members butt up to the underside of said abutment means.

12. A foldable article as claimed in claim **1**, wherein said enabling means are wheels.

13. A foldable article as claimed in claim **1**, wherein said enabling means are castors.

14. A foldable article as claimed in claim **1**, wherein said enabling means are rollers.

15. A foldable article as claimed in claim **1**, wherein said enabling means are slide elements.

* * * * *