My invention relates generally to an improved folding mechanism for card tables, banquet tables, benches, beds and other articles, and more particularly to articles having foldable or collapsible members, whereby the article can be compactly folded for storage when not in use.

The primary object of my invention is to provide a folding means whereby the folding and unfolding movements of the collapsible members are automatic, in that the movement of any one of said members affects the movement of all the other of said members.

Another object of my invention resides in the provision of such a folding means which involves the use of loosely coupled actuating members for connecting the various collapsible members of the article, whereby an initial folding or unfolding movement of one of said members is permitted before simultaneous movement of all the members is affected.

A still further object of my invention lies in the provision of a guide means for each loosely coupled actuating member which lies in a plane coinciding with the plane in which the actuating members move.

Another object of my invention is to provide an improved form of catch or fastening means for releasably locking the foldable members in the unfolded position.

Another object of my invention lies in the provision of improved hardware for a folding mechanism which may be sub-assembled in units independently of the article to which it is secured.

Another object of my invention is to provide an improved construction in hardware for a folding mechanism whereby the completed article is composed of a number of duplicate sub-assembled units.

A major improvement of my invention lies in the provision of a construction which permits all riveted joints, pivots, etc., to be completed before attaching to the foldable article.

Another object of my invention lies in the provision of a folding mechanism which will permit variations in the completed article after assembly, such as, warping, expansion and contraction without impairing the intended operation of the various elements as the foldable members are moved to the folded or unfolded positions thereof.

Another object of my invention is to assemble the spring catch or locking device as an integral part of one of the guide means, so that a definite relation between the guide member to be locked, and the locking device can be established regardless of variations in the article controlled by said folding mechanism.

Another object of my invention lies in the provision of an improved pivot for the foldable or collapsible members which effectually provides a sturdy and inexpensive means for bracing the foldable members in the unfolded position.

With these objects in view the invention is carried into effect by instrumentalities illustrated by the annexed drawings and specification as applied to a table. It should be clearly understood at the outset that my folding mechanism herein illustrated, described and claimed, has a wide and varied application to many articles. For illustrative purposes only, the invention has been applied to a table such as a card table, but it will be obvious that the same is equally applicable to banquet and other types of tables, benches, luggage stands, beds and many other articles.

The other objects and advantages will be apparent as the description proceeds, reference now being had to the figures of the accompanying drawings forming a part of this application and wherein like reference numbers and characters designate like parts.

In the drawings:

Figure 1 is a bottom plan view of a card table illustrating the folding mechanism with the legs in the folded position.

Fig. 2 is a transverse sectional view of the table taken along lines 2—2 of Fig. 1 but showing the legs in the full extended positions.

Fig. 3 is a bottom plan view of a portion of the table showing the leg in its extended position.

Fig. 4 is an enlarged detail view of a portion of the guide shown in Fig. 3 and indicating the relative position of the loosely coupled actuating members and locking means, when the parts are influenced by the legs being moved to their unfolded positions.

Fig. 5 is a detail sectional view taken along lines 5—5 of Fig. 3 showing the means for mounting the leg on the table top.

Fig. 6 is a detail sectional view taken along line 6—6 of Fig. 3 showing the relation of the actuating means to the guide means.
ing members, guide and pivot, when the legs are moved to the unfolded position.

Fig. 7 is a detail sectional view taken along line 1-1 of Fig. 3 illustrating the relation between the spring locking means and actuating member when the legs are in an unfolded position.

Fig. 8 is a detail sectional view along line 6-6 of Fig. 3 illustrating my improved pivot connection between the actuating member and connecting link.

Fig. 9 is an enlarged plan view of the actuating member guide illustrated in Figs. 1 and 3.

Fig. 9a is a partial elevational view of Fig. 9.

Fig. 10 is a plan view illustrating the construction of the ends of the actuating members.

Referring specifically to the drawings, the numeral 1 refers to a supporting surface, in this case a table top, which is provided with the usual side flanges or frame members 2. Hinged to the face members 2 at each corner thereof is a leg 3 mounted on an axis extending parallel with one of the frame members 2 so that the leg can be folded against the table top within and substantially parallel to an adjacent frame member. The legs may be mounted on the table top in any suitable manner but preferably each leg and its supporting structure is first assembled as a unit and then secured as a unit to the table top. As illustrated in detail in Fig. 5, each leg is carried by a pin 5 which has a reduced portion 5a at one end carried in a supporting bracket 4, which in turn is mounted on one of the frame members 2 of the table top. The other end of pin 5 is mounted in a socket 6c in an adjacent frame member. This bracket 4 comprises an apertured arm for receiving the reduced portion 5a of pin 5 and an attaching portion bent laterally as shown in Fig. 3. The other end of the attaching portion of bracket 4 is provided with a similar arm having an aperture to receive the reduced portion 5a of a pin 6. As illustrated in Fig. 3 the axes of pins 5 and 6 are adapted to substantially co-incide with each other.

It will be further noted that the reduced portions 5a and 6a of respective pins 5 and 6 extend slightly beyond each respective arm of the bracket to which they are attached, so that each pin may be held in the bracket or riveted as indicated by 50—59 to secure the pins to their respective arms. Pin 6 is provided with a head indicated at 6c. Between head 6c and the arm of bracket 4, is pivotally held brace 8. From the foregoing it will be apparent that the bracket 4, pins 5 and 6, and brace 8 may be carried as a sub-assembled hinge unit. In assembling the leg unit, pin 5 is first extended through an aperture in the upper end of leg 3. A pin 9 having a head 9c and reduced portion 9a is inserted in a second aperture of leg 3 at a point below pivot pin 5. The aperture of connecting link 10, indicated in Fig. 9a, is pivotally placed on the end of pin 8, whereupon brace 8 is secured to the reduced portion 9a by upsetting or riveting as indicated by 9b.

In assembling the leg unit to the table top, it becomes necessary to merely insert the hook member 16 into the connecting link 10 and permit aperture 16a of actuating arm 16, as illustrated in Fig. 8.

It is important to note in Fig. 8 that hook 10b is joined to link 10 through bearing portion 10a and reduced portion 10c. Fig. 8 illustrates the relative position of link 10 and actuating member 16 when the legs are in the unfolded position, at which time advantage is taken of the angular dis-

placement of bearing portion 10a to bind in aperture 16a and eliminate all lost motion between link 10 and actuating member 16. When the leg is moved to the folded position, bearing support 10a assumes a perpendicular position with respect to the surface of actuating member 16. This organization permits a rigid pivot connection between members 10a and 16 while the legs are being moved, which is automatically transferred to a rigid connection when the legs are in the unfolded position.

As herebefore mentioned, hook 10b having been inserted in aperture 16a, pin 5 is then provided with spacer 7 and inserted in socket 6c in frame member 2, whereupon bracket 4 is secured to the adjacent frame member by means of screws 4a or their equivalent.

From the foregoing it is obvious that the hardware for leg member 3 may be carried in a sub-assembled stage, and which in turn is quickly and easily assembled to the leg prior to securing same to the table top. This arrangement not only greatly facilitates the assembly of the table but provides a distinct advantage for quantity production as well as permitting concentrated sub-packages for efficient shipment.

The several legs are connected one to the other in such a manner that the movement of any one of the legs in either direction will cause a similar movement to be imparted to all of the other legs, thus by grasping one leg and moving it to its extended position, all the legs will be caused to move substantially in unison to their extended positions.

Preferably this is accomplished by mounting 33 beneath the table top an actuating device which is capable of part in a substantially parallel with the table top 1. Further since the tops of tables of this classification are usually made of light material which has a tendency to warp or buckle, it is desirable that such actuating device be supported and guided entirely independently of the top. With this object in view I have fashioned my actuating device to be supported solely by guides carried by the flanges or frame member 2. Thus all mechanical hardware for my improved table construction is supported entirely by the frame of the table top. As illustrated, and as is the accepted practice adopted by present table manufacturers, it may be carried in a sub-assembled stage and which in turn is quickly and easily assembled to the frame of the table top. As illustrated, and as is the accepted practice adopted by present table manufacturers, it may be carried in a sub-assembled stage and which in turn is quickly and easily assembled to the frame of the table top.

My invention makes use of only the sturdy elements of the table, eliminating the need of auxiliary braces or supports.

My actuating device consists namely of four actuating members 16, one being provided for each leg of the table. These members are illustrated in detail in Fig. 10, and are fashioned principally from light rectangular iron bars. One end of the actuating member 16 is provided with an aperture 14a for receiving the reduced portion 12a of a pin 12, and a notch 14b to be engaged by a spring catch 13. The other end of member 16 is slightly offset and is provided with a slotted opening 15 for slidably engaging a pin 12. Near the slotted opening is disposed aperture 16a herebefore mentioned for receiving the reduced portion 12b of a pin 12, and a notch 14c to be engaged by a spring catch 15.

My invention further provides that four such actuating members are joined and carried as a sub-assembly.

Referring in detail to Figs. 1 and 4 it will be noted that pin 12, which is provided with head 12b, is inserted in a slotted portion 15a of one member; the reduced portion 12a thereof being
inserted in an aperture 14a of an adjacent actuating member 16 and secured thereto by upsetting or riveting as indicated by 12b. As illustrated in the selected embodiment of my invention, four guide and supporting members 14, are required. Figs. 9 and 9a deal principally with the construction of these guide members, which are preferably formed with an angularly disposed leg for mounting same to frame 2 by screws 11s or their equivalent. Fig. 6 indicates the angular construction of member 11, and the mounting thereof by a screw 11e. Referring in particular to Fig. 9, it will be noted that the vertical leg of guide 11 is provided with holes 11h for receiving the mounting screws 11s. The other leg thereof is fashioned with an elongated slot 11d substantially dividing the leg into two surface portions 11f and 11e. The width of slot 11d is organized to slideably engage pin 12.

One end of slot 11d, preferably the end engaged by pin 12 in the folded position of the table legs, is enlarged to provide an opening 11g of sufficient diameter to admit the head 12c of pin 12, for the purpose of which will be dealt with later. The folded leg of guide 11 is also provided with bosses 11c which serve to automatically determine the proper spacing between the surface of the guide member 11 and the table top 1. Referring to Fig. 9a it is important to note that each of the legs, of the folded leg, is offset with respect to portion 11f, to provide a cam surface gradually increasing in height toward the end of the slot which is engaged by pin 12 when the legs are moved to the unfolded position. Adjacent each end portion of slot 11d is positioned cam members 14a and 14b, but are so positioned that they will automatically engage the end of the actuating member 16 adjacent slot 15 when the legs are in the respective unfolded and folded positions.

As hereinbefore mentioned opening 11g is of sufficient size to admit the head 12c of pin 12. Obviously this construction permits the guide members to be assembled with the actuating members 16 after same have been loosely joined one to another by reason of slotted openings 15 and pins 12.

As hereinbefore mentioned each actuating member 16 is provided with a locking notch 14, however, only one of the guide members 11 is equipped with a locking spring 13 as illustrated in Fig. 1. Figs. 3, 4, 6 and 7 illustrate the relation between the locking spring 13 and associated parts when the legs are in the unfolded position. To assemble my actuating device, each actuating member is provided with a guide member 11 for each pin 12 as hereinbefore described, and is laid on the underside of the table in a position similar to that indicated in Fig. 1. A leg unit is then mounted on each corner as hereinbefore described with the hook portion 10b of each connecting link properly lodged in its respective aperture 16a. Each leg is then moved to a position which will be regarded as the unfolded position thereof. One guide member 11 is then carried on the apron and the actuating member 16 thereby gripping the associate leg, the guide member is moved until cam 14a forcibly engages the end of member 16 adjacent slot 15 and forces pin 12 against the edge of portion 11e of guide member 11. This relation is carefully indicated in Figs. 4 and 6. At this time the guide member is carried on the frame 2 by screws 11s or their equivalent. Advancing in a counter-clockwise direction each guide member and associated leg is similarly treated and secured to frame 2. Thus this procedure of assembly, definitely assures that all lost motion between the loosely coupled actuating members 16 will be removed when the legs are in the unfolded position.

Further, it will be evident that through the use of loose couplings effected by pins 12 and slots 15, and by the method of assembly indicated above, appreciable variation in the size of the table tops can be accommodated without impairing the operation of my device. In the event the table tops are less than a normal size the guides when anchored will merely be located to the left of the center, and when the table tops are larger than normal, the guides will be located to the right of the center. With the guide members thus secured in place the table becomes a completed article. To move the legs to the folded position, spring lock 13 is disengaged from notch 14 and pressure applied to any leg, whereupon similar movement will be imparted through members 16 and connecting links 18 to the other legs of the table. Referring again to Fig. 1, it will be evident that members 16 move counter-clockwise when the legs are moved to the unfolded position and move clockwise when the legs are moved to the folded position. By carefully noting Fig. 1 and considering pressure applied to the leg in the lower right hand corner to close same, it will be obvious that as soon as member 16 disengages cam 11a the pin 12 will become free to move in slot 15. Therefore, before similar movement is imparted to the leg in the lower left hand corner, it will be required to take up the lost motion of the slot 15. This is effected by organizing the parts to cause the end of member 15, which engages cam 11a, to follow the incline of cam 11a until the supporting leg of guide 11 is engaged thereby. Thus at each end of the movement one or other of cam surfaces 11a or 11b is engaged by the end of member 16, while in between these cam surfaces the members 16 engage the supporting leg of their respective guides.

As hereinbefore described, portion 11e of each guide is gradually offset toward the unfurled end of the guide slot 14d. Note Fig. 9a. The purpose of this arrangement is to make all vertical lost motion the head of pin 12 and the surface 11f of the guide. Thus the loose coupling between each adjacent actuating member 16 is transferred into a rigid connection in both the vertical and horizontal planes when the legs are in the unfolded position. Because of the elevation of surface 11e only at the unfolded end of slot 11d, the vertical lost motion will not be removed when the legs are in the folded position, however, cams 11b will function in the folded position of the legs to substantially remove the lost motion in the horizontal plane. While cams 11b serve to remove lost motion between adjacent members 16 when the legs are folded, they additionally serve to "free" the initial movement of members 16 from the folded position of the legs. From the foregoing description it is apparent that I have provided a simple and economical folding mechanism which synchronizes the folding movement of the legs and which produces a smooth, even and easily operable folding means. It will be clear that by virtue of the connecting links 18 and actuating members 16, the folding of any one leg will pull all legs moving to the folded position or vice versa. As adverted at the outset, my invention resides principally in a folding mechanism which is
equally applicable to many collapsible or foldable articles and I do not desire to limit myself to the specific embodiment selected to illustrate my invention, likewise there are changes which may be made in the details of construction and arrangement of parts without departing from the spirit and scope of my invention, and I therefore do not limit myself to the exact form herein shown and described other than by the appended claims.

I claim:

1. In a table, a plurality of supporting legs pivoted to the table on individual pivots arranged so that all the legs move in the same direction with respect to the periphery of the table, a longitudinally slotted guide bar for each leg and secured to the table interjacent each leg, an actuating member for each leg, each actuating member fashioned at one end with a guide means for operating in the slot of its respective guide bar and an elongated aperture at the opposite end loosely and slidably engaging the guide means of a successive actuating member, and a connecting link pivoted to each leg and pivotally embracing its respective actuating member near its apertured end whereby the operation of any one of said legs will impart similar movement to each of the other legs in succession.

2. In a table, a plurality of supporting legs pivoted to the table on individual pivots arranged so that all the legs move in the same direction with respect to the periphery of the table, a longitudinally slotted guide bar for each leg and secured to the table interjacent each leg, an actuating member for each leg, each actuating member fashioned at one end with a guide means for operating in the slot of its respective guide bar and an elongated aperture at the opposite end loosely and slidably engaging the guide means of a successive actuating member, and a connecting link pivoted to each leg and pivotally embracing its respective actuating member near its apertured end whereby the operation of any one of said legs will impart similar movement to each of the other legs in succession.

3. In a table, a plurality of supporting legs pivoted to the table on individual pivots arranged so that all the legs move in the same direction with respect to the periphery of the table, a longitudinally slotted guide bar for each leg and secured to the table interjacent each leg, an actuating member for each leg, each actuating member fashioned at one end with a guide means for operating in the slot of its respective guide bar and an elongated aperture at the opposite end loosely and slidably engaging the guide means of a successive actuating member, and a connecting link pivoted to each leg and pivotally embracing its respective actuating member near its apertured end whereby the operation of any one of said legs will impart similar movement to each of the other legs in succession.

4. In a table, a plurality of supporting legs pivoted to the table and foldable against same, means connecting the legs with each other so that movement of any one leg will give similar movement to the other legs including, a separate actuating member for each leg equipped with a guide pin, each member loosely and slidably engaging the guide pin of an actuating member for an adjacent leg, a guide bar secured to the table interjacent each leg and provided with a guide way, the guide pin of each actuating member being loosely guided in the guide way of an adjacent guide bar, a connection from each leg to its respective actuating member, and cooperating locking means on the guide bars and said actuating members to remove lateral and vertical movement of each guide pin in its respective guide way when the legs are moved to an extended or supporting position.

5. In a table, a table top, a plurality of supporting legs pivoted to said table top and foldable against same, a series of longitudinally slotted guides mounted beneath said table top, a plurality of actuating members one for each leg having their ends loosely and slidably connected one to another and slidably mounted in said guides, and an operative connection between each leg and its respective actuating member, whereby the movement of any one of said legs will successively impart similar movement to each of the other said legs through said connections.

6. In a table, a plurality of supporting legs, mounted on said table top, means connecting all of the legs so that movement of any one of said legs will successively impart similar movement to each of the other legs, said means including for each leg, a slotted guide mounted beneath said table, an actuating member loosely and slidably connected to the slot in said guide, an operative connection between said leg and said actuating member, and a cam carried by said guide cooperating with said actuating means to restrict the loose connection in said slot and rigidly secure said actuating member when the table legs are moved to their extended or supporting position.

BENEDICT E. WILLETT.