A pair of small pivot arms of box-like construction with projecting tabs at opposite ends are each secured by one of the tabs extending through an opening in the flange and being bent over. The opposite tabs are bent over the tie rods at one end of the shelf to form a hinge connection therewith.

In the solid plate shelf, the shelf is integrally formed of one piece of sheet metal with the longitudinal edges bent over to form a reinforcing flange extending downwardly and inwardly. Pivot arms are welded or otherwise suitably secured to the opposite ends with a pivot rod extended therethrough to which similar hinged end brackets are secured by means of the pivot arms.

Further objects and advantages of the invention will be apparent from the following description taken in conjunction with the drawings, wherein:

Fig. 1 is a perspective view illustrating the parts of a bar-type shelf with one end of the bar broken away; Fig. 2, a plan view of the jig with the bars and tie rods inserted therein and with parts broken away; Fig. 3, a partial sectional view showing the jig support and the die press in opened position; Fig. 4, a similar view showing the parts in closed position with the tie rod swaged into the plus-shape; Fig. 5, an end view of the bar-type shelf with the tie rod swaged adjacent the contiguous sides of the U-bars; Fig. 6, a perspective view of one of the hinged end brackets; Fig. 7, a similar view of the opposite end bracket; Fig. 8, a sectional view of the bar-type shelf assembled with a pair of hinged end brackets, one of which is shown in the folded position; Fig. 9, a sectional view taken on the line 9-9 of Fig. 8; Fig. 10, a perspective view with portions broken away showing one end of the bar-type shelf with a hinged bracket attached to a suitable support provided with a series of vertical slots; Fig. 11, a perspective view similar to Fig. 10 but showing a solid plate shelf; and Fig. 12, a bottom plan view of the shelf shown in Fig. 11, with the end bracket folded down and a portion of the shelf broken away.

Referring now to the drawings in detail and more particularly to Figs. 1 through 5, the U-bars 10, as shown in Fig. 1, are provided with aligned transverse openings 11 therethrough. The U-bars 10 in Fig. 1 are shown with one end portion broken away and only illustrating the aligned openings 11 adjacent one end and the intermediate aligned openings 11. Three tie rods 12 are also shown in Fig. 1.

A relatively shallow box-like jig 13, shown in Fig. 2, is provided with side walls 14 and end walls 15. Spaced supports 16 extend transversely across the end portions and across an intermediate portion. Each of the spaced supports is provided with a curved groove 17 of substantially semi-cylindrical form. Adjacent the opposite ends of each of the grooves is a pair of lugs 18.

A pair of blocks 19 may be provided to rest on the bottom of the the jig and is inserted and removed through suitable openings in the side walls 14. The U-bars are set in the jig, as shown, between the adjacent supports 16 and resting on the blocks 19 so that the openings 11 are slightly above the upper edge of the side walls 14. The tie rods may then be conveniently inserted through the aligned openings, since the spaced supports 16 and the end walls 15 will hold the U-bars in proper position with the openings 11 in alignment. The blocks 19 may then be removed and the end shelf component will drop down into position with the tie rods 12 resting on the lugs 18, as shown in Fig. 3.

The jig is then placed under the die press 20 which has suitable projections 21 corresponding in shape and...
position with the supports 14 and provided with lugs 22 adjacent each end of the curved grooves 23 which are similar to lugs 18. When the press 20 is brought down into position, as shown in Fig. 4, the tie rod 12 is swaged out adjacent the side walls of each of the U-bars 10 into a 4-shape section having a vertical and horizontal web. The horizontal web will be substantially wider than the diameter of the tie rod to securely hold the U-bars in spaced relation and retain the tie rod in operative relation thereto, as shown in Fig. 5, where the swaged portions are indicated by the numeral 24.

Referring now to Figs. 6 and 7, a pair of hinged brackets 25 are shown adapted to be attached to opposite ends of the U-bar shelf in the manner shown in Figs. 8, 9 and 10. Each of the brackets is provided with a reinforcing flange 26 along the top and forward edges thereof and the rear edge is provided with a pair of hooks 27 and a projection 28 adapted to engage in the slots of a shelf support to be described subsequently. The lower edge of the bracket 25 is provided with a substantially perpendicular flange 29 which has suitable slotted openings 30 to receive one end of the pivot arms 31.

The pivot arms 31 are of box-like construction with a tab projecting at each of the opposite ends thereof. One of the tabs 32 is adapted to extend through one of the openings 30 in flange 29 and be bent over, as shown in Fig. 8 to securely hold the pivot arms 31 in position on the flange. The other tab 33 is adapted to be bent over the tie rod 12 between the sides of one of the U-bars 10 to form a pivotal connection therewith, as shown in Fig. 9. The pivot arms 31 are positioned on the flange 29 to come within the end portion of two of the U-bars 10. The hinged brackets 25 may be conveniently folded down, as shown at the right in Fig. 8, for convenient storage, or in the open position may be readily attached to a supporting post 36 provided with a plurality of vertically aligned slots 37 in which the hooks 27 and projection 28 are adapted to engage to support the shelf in any desired adjusted position.

In the solid plate shelf shown in Figs. 11 and 12 the shelf 38 is integrally formed from one piece of sheet metal with inwardly turned flanges 39 along the longitudinal edges thereof. A support 40 is welded, or otherwise secured, in position adjacent each end of the shelf 38 and is provided with a pivot rod 41 which may be suitably swaged at 42 to retain it in position. The opposite ends of the pivot rod 41 extend beyond the bracket and are engaged by the bent over tabs 33 on the pivot arms 31. The end brackets 25 in this modification are identical with those shown with respect to the previous modification. It will be noted in both modifications that the flange 29 engages the corner of the U-bar or the plate shelf with a resilient snap action to hold the end brackets 25 in upright position, and the curved recesses 34 adjacent flange 29 provide for free pivotal movement of the end brackets about the tie rods 12 without interfering with the end portion of the U-bars or requiring that they be cut out or otherwise modified. This provides a neat arrangement with the ends of the U-bars 10 as close as possible to the contiguous surfaces of the end bracket 25.

A book shelf of the present invention may be readily folded and stacked or may be opened out and attached to a support at any desired height in the manner shown in Fig. 10. It will be obvious to those skilled in the art that various changes may be made in the invention without departing from the spirit and scope thereof and therefore the invention is not limited by that which is shown in the drawings and described in the specification, but only as indicated in the appended claims.

What is claimed is:

1. A book shelf comprising a plurality of spaced parallel elongated bars of U-shaped cross-section, said bars having aligned transverse openings adjacent each end and at an intermediate portion thereof, said bars having substantially squared-off ends, headed tie rods extending through said aligned openings, said tie rods being crimped adjacent the side walls of each of said bars to maintain said bars in spaced parallel relation, folding end brackets positioned adjacent each end of said book shelf, said brackets each having a inwardly extending flange disposed continuously along the bottom edge thereof and an outwardly curved recessed portion above said flange and parallel thereto, said flange having spaced slotted openings therein, and a pair of pivot arms each having oppositely extending tabs, one of said tabs on each end of said brackets being pivotally attached to said flange for securement thereto, the other tab being bent around one of said tie rods between the side walls of one of said bars to form a hinge connection therewith, said recess being disposed closely adjacent the ends of said bars to permit the end brackets to be pivoted between positions perpendicular and parallel to the plane of the shelf about the corresponding tie rods without being blocked by the substantially squared ends of the bars, thereby to permit the end brackets to be disposed closely adjacent the ends of the bars with minimum gaps, the flange of each of said end brackets being adapted to underlie the bent over, as shown in Fig. 8, when the brackets are swung into their vertical positions.

2. A solid plate book shelf comprising a shelf formed of sheet material and having downwardly and inwardly extending flanges integrally formed along the longitudinal edges thereof, a bracket attached to each of the opposite ends of said shelf, a pivot rod extending through said bracket, opposite end brackets each having an inwardly extending flange on the bottom edge thereof and an outwardly curved recess adjacent said flange, openings extending through said flange, and a pair of pivot arms having oppositely extending tabs, one of said tabs on each arm extending through said openings to secure said pivot arms to said flange, the other tab being bent over the ends of said pivot rod to provide a hinge connection between said end bracket and said shelf.

3. A book shelf comprising elongated shelf structure having substantially squared off ends, a rod secured transversely thereto adjacent each end of the same, hinged end brackets each having an inwardly extending flange along its bottom edge, a curved recess adjacent said flange and parallel thereto, and openings in said flange, a pair of pivot arms each having oppositely extending tabs, the tabs at one end of said arms being located in said openings and securing said pivot arms to said flange, and the opposite end of said arms being bent over said rod and providing a hinge connection between said end brackets and said shelf structure, whereby hinging movement of the end brackets between positions perpendicular and parallel to the plane of the shelf structure may be effected, the recesses in the end brackets receiving the substantially squared-off ends of the shelf structure to minimize gaps at the hinge area.

4. In a book shelf, elongated shelf structure, a rod secured transversely adjacent one end thereof, an end bracket having an inwardly extending flange along its bottom edge, a curved recess adjacent said flange and openings in said flange, pivot arms mounting said bracket on said rod, said arms having ends located in said openings, and at the opposite ends of said arms tabs pivoted upon said rod providing a hinge connection between said end bracket and said shelf.

5. In a book shelf, elongated shelf structure, a rod secured transversely adjacent one end thereof, an end bracket having an inwardly extending flange along its bottom edge, a curved recess adjacent said flange and openings in said flange, pivot arms mounting said bracket on said rod, said arms having ends located in said openings, and at the opposite ends of said arms tabs pivoted upon said rod providing a hinge connection between the shelf structure.
said end bracket and said shelf, said structure including frictionally contacting portions serving to frictionally maintain said end bracket in operative position.

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