Important-Read Before Using These Plans

The plans, suggestions and instructions for making the projects included in this book were prepared by students as entries in The James F. Lincoln Arc Welding Foundation Award Programs. The material has been edited and some of the drawings improved, but neither the projects nor drawings and instructions have been reviewed for accuracy or safety. The Foundation will welcome the comments of persons who, in making a project, uncover an error or fault. This will permit correction in the next printing of the book.

The projects are included because they appear to be interesting, and, in some respects, propose novel applications. However, since the Foundation has not tested the material, nor verified the computations or other aspects described, The James F. Lincoln Arc Welding Foundation cannot, and does not, assume responsibility for the accuracy of the plans or safety of the projects. The projects are submitted for such use as may appear feasible, but those making the projects must assume full responsibility for the results of their efforts to make or use the projects described.

The name of the student, school and teacher that produced the material is shown, if available, for each project. Further information about a project, if needed, should be sought from the teacher involved.

Award Programs Participation

The projects described in this book represent the range of entries submitted in The James F. Lincoln Arc Welding Foundation’s Award Programs both as to type and size of project, and the nature of the descriptive information included. Students make many similar projects each year, yet relatively few of these are submitted to the Foundation in competition for cash awards. The reason for this may be that teachers have not used the opportunities afforded by the Program as incentives to student endeavor.

The planning, design and execution of a project, and then the preparation of a written and illustrated description of how it was accomplished provide a student with: (1) involvement with something of his or her own choosing and desire; (2) a challenge to complete the work successfully, using many different shop skills that are applicable to industry and business; (3) an experience in report writing and communications that is as important in business as other skills; (4) the satisfaction and recognition that come from participating in a national competition.

The Foundation annually sponsors Award Programs for secondary and post-secondary students. To learn more about current Award Programs and obtain a copy of the appropriate rules brochure, go to jflf.org.
Futon Project

**Step-by-Step**

1. Measure out the first four 2'10” long pieces.

2. Cut those four pieces, then measure and cut a 45 degree angle on the end of each piece.

3. Measure and cut the eight 18” long pieces, then measure and cut one 45 degree angle on each piece.

4. Take one piece from Step 2 and two pieces from Step 3 and weld the 45 degree angles together to create a U shape. Weld all around the corners to create a solid angle. Do this four more times and grind down the welds to make a flat surface on them.

5. Take two of the pieces that were just made and put two pieces together side by side to make a thicker U shape.

6. Measure and cut two pieces, each 2’7”.

7. Fit one piece on the left side of the inside of one of the U shapes.

8. Weld the piece into place 8” up from the ground.

9. Take the other piece cut in Step 6 and weld it in the same place only on the right side on the second U shape.

10. Measure out and cut four pieces 6’ long.

11. Measure and cut out 45 degree angles on each end of each piece.

12. Measure and cut out four pieces 2’6”.

13. Measure out and cut 45 degree angles on each side.

14. Take two pieces from Steps 13 and 14 and position them so they make a big rectangle and weld around each corner. Do this two times.

15. Measure and cut out six pieces 2’3” long.

16. Take one rectangle that you just made and three pieces from Step 15 and weld one of the pieces into the middle of the rectangle, then weld the other pieces in half way between the ends and the center piece.

17. Repeat Step 16.

18. Get three heavy duty hinges (I used door hinges) and take the two rectangles and place them

---

**Bill of Materials**

<table>
<thead>
<tr>
<th>Qty</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>3/8” diameter pins (roughly 6” long)</td>
</tr>
<tr>
<td>110’</td>
<td>B-line or box tubing</td>
</tr>
<tr>
<td>3</td>
<td>heavy duty door hinges</td>
</tr>
</tbody>
</table>

*Cut B-line or box tubing into:*

- 4 pieces 2’10”
- 8 pieces 18”
- 2 pieces 2’7”
- 4 pieces 6’
- 4 pieces 2’3”
- 6 pieces 2’
- 2 pieces 6’1”
side by side. Weld in the hinges so that you can move them from side by side, to on top of each other.

19. Drill a hole in each corner of each rectangle on the top and get two pieces of plywood and cut to fit the top, then drill holes in it where the holes in the metal are and bolt them down.

20. Measure and cut two 6’1” pieces of B-line or box tubing.

21. This part gets tricky to explain so try to follow along: take the two U shapes that you made and stand them up with those bars that you welded on the insides of them to where they are closest to each other and put the pieces you just cut in between the pieces lifting them up to right below the cross bar in the U shape and weld that bar on the U shape on each of the four corners (when all welded in it should look like a bed without mattress).

22. Grind down all the welds on all the pieces.

23. Take and lay out the rectangles across the bed-frame shape so the hinges are in the middle, so if you pushed in the middle of them it would fold down to a V shape. But keep it flat and center it up on it, then drill a hole in the center of the cross bar in the U shape all the way through the rectangle. Take the 3/8” pins and slide them in. Once that is done to BOTH sides, get on top of it and check for sturdiness.

24. Stack 2 scrap pieces of B-line and put them under it, then pull out the pins and position the rectangles on the other frame so it looks like a couch, and the bottom of the rectangles are sitting on the B-line (you may adjust it to your own preference on the angle of the back to make it comfortable for you). Drill one hole on each side on the top through the arm rest and rectangle and put the pins in it, then drill a hole in the cross bar of the U shape through the rectangle and put pins in it.

25. Finally, prime and paint the completed futon frame.