DRAWING ON AUTOCAD THE HORN OF THE ICONIC ALTEC LANSING LOUDSPEAKER VOICE OF THE THEATER A7

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Abstract

The horn Altec Lansing model H-811B is one of the main components of the loudspeakers A-7 and Model 19 of this milestone brand. It is not usual that lovers and collectors of a brand of loudspeakers have Internet sites with over 100K followers 44 years after stopping the manufacturing of these classic models. Nowadays, we find that some followers have opened factories to build them anew. However these facilities have made the low frequency woofers and mid-high frequency drivers, but not the horns and the boxes. About the boxes, the blueprints and its construction do not represent a major challenge, after all, in more than 75 years of the first model of the Altec Lansing series Voice Of The Theater, a legion of follower have learned how to make the wood curves as the original. But the cast aluminum horns are a different matter because of the difficulties involved in their process. Some of the followers have built them using wood and Fiberglass horns but very few using aluminum. Neither of the blueprints found have information about the curves of the horn, only the lineal dimensions. For this reason and knowing that there is not a 3D AutoCad drawing on the Internet of this horn, at least one that I could find, I decided to write a method that can be helpful to draw a prototype model that could help enthusiasts and collectors to build the horns using aluminum.

Keywords: Autocad, Computer-Aided Design, Computer Drawing Method, Command Bugs in Design Software.

JEL Classification: C61

Introduction

For this paper the author used the 1968 blueprints of the Altec Lansing loudspeaker sectoral horn, model 811B [1][2][3]. The blueprints that I found only show the lineal dimensions of the horns. I was not able to find any information about the different curvatures of the horns. (See Figure 1).

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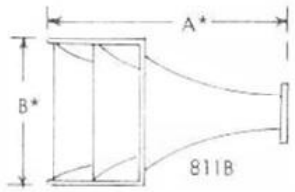

Horn Number	Dimensions		
	Height (B)	Width	Depth (A)
811B***	8⅝"	18¾"	13½"

Figure 3 Dimension of the Sectoral horn 811B

I also used a real Altec Lansing horn, belonging to Model 19 of this brand, in order to get better accuracy for the goal of this paper. Any stage of the drawing was compared with the real horn shown in Figure 2.

Figure 4 Real Altec Lansing 811B sectoral horn

Curves are ubiquitous in nature, design, and fields such as mathematics. In general, drawing curves is a challenging task. For this reason, the main goal of this work is focused on the reproduction of the main body of the horn. In all drawings I have used units that attempt to preserve the external dimensions of the horn.

1. Drawing a reproduction of the horn

1.1 Drawing the side curves of the horn

To draw the horn side curve, the author used the command ARC with three points of AutoCad [4]. To get the coordinates of the three points, I initially thought of applying the Least Square Method to obtain the curve equation, but I estimated that the precision would be the same as graphing these three points over the Cartesian plane. See Figure 3.

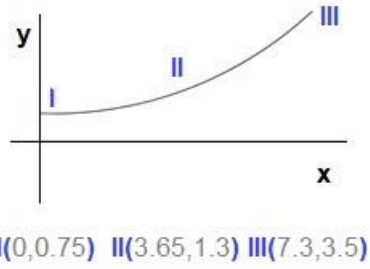

Figure 5 Horn top curve of the 811B horn

The coordinates of three points obtained were (0,0.75), (3.65,1.3), (7.3,3.5). Once the upper curve was obtained I proceeded to use the MIRROR command to generate the lower curve. Then using the MOVE command I displaced the lower curve 1.5 units down along the Y axis. See Figure 4.

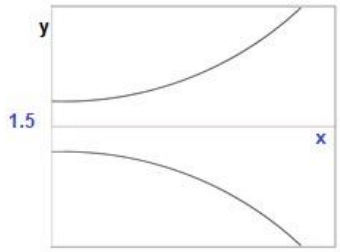

Figure 6 Using the MIRROR and MOVE commands to locate the upper and lower curve on the plane.

1.2 Extruding the up and down side curves.

To extrude the curves in 3D we should apply the 3DFACE command to join both curves to create a face. Having the face, we use the EXTRUDE command 15.5 units along the Z axis to get the wider view of the horn, that will be its mouth. As seen in Figure 5.

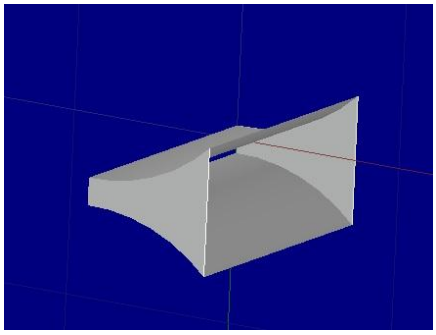

Figure 7 Extrude the side face

1.3 Cutting side planes.

Now we generate two planes, each one perpendicular to the XZ plane. Both inclined with respect to the Y axes.

These planes will be the side walls of the horn. To get their coordinates I used the only blueprint that I could find on the Internet with a top view of the model 811B. [2]. See Figure 6.

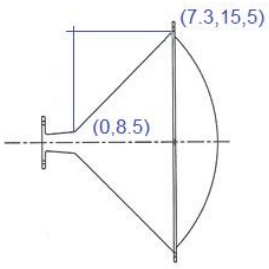

Figure 8 Top view of the 811B horn.

The coordinates of the first plane are (0.3.15,-7), (7.3,3.15,0), (7.3,-3.5,0) and (0,-3.5,-7). The coordinates of the second plane are (0, 3.5,-8.5), (7.3, 3.5,-15.5), (7.3,-3.15,-15.5) and (0,-3.5,15.5). Both boundaries were made using the 3DPOLY command. After the command 3DFACE was used to create the planes. See Figure 7.

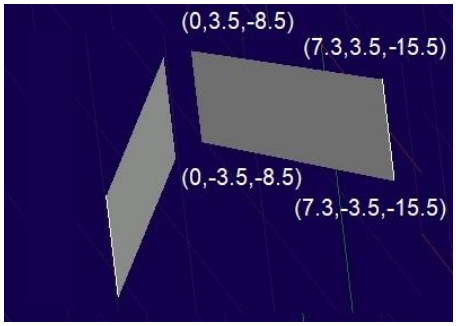

Figure 9 3D view of the two planes.

Once obtained the two planes across the solid I proceeded to use the CONVTOSURFACE command so that all the components were surfaces. See Figure 8.

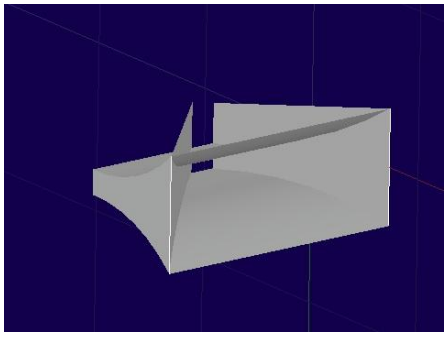

Figure 10 Inclined base of the horn walls

To proceed to remove the leftover parts of the body of the horn I used the command SLICE and its option Surface. See Figure 9.

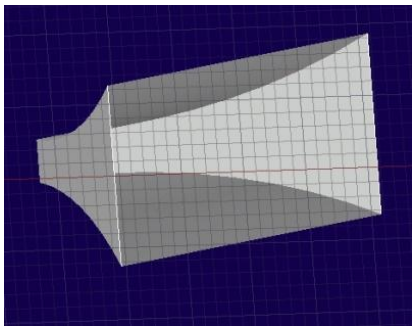

Figure 11 Getting the angle of the inclined panel

1.4 Top and bottom of the horn.

The top and the bottom of the horn are not flat, they are curved, so we need to get rid of the actual up and low surfaces and draw the suitable ones.

To create the top and bottom flat curved surfaces, the first step is to create two flat curves on the mouth using the ARC command with three points. The coordinates of the upper curve are (7.3, 3.5,0), (7.3,1.25,-7.75) and (7.3,3.5,-15.5). The coordinates of the lower curve are (7.3, -3.5, 0), (7.3, -1.25, 7.75) and (7.3,-3.5,-15.5). Because the ARC command is two dimensional, I only used the Y and Z coordinates. (See figure 10).

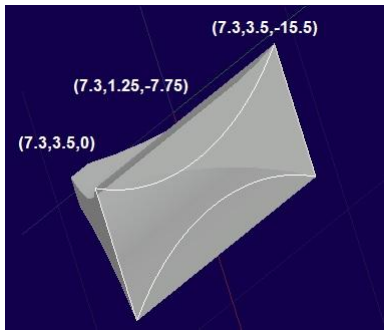

Figure 12 Curve walls sliced

Once the two flat curves of the mouth have been obtained I deleted the actual flat up and low surfaces. Now I need to create a curve region which boundaries are the flat curve of the mouth that I drew before, the two inclined side walls and a line that I draw on the back of the horn as shown in Figure 11.

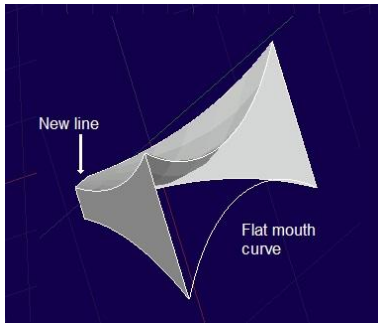

Figure 13 Line at the end of the horn to close the region

The command EDGESURF that creates a mesh (A 3D surface) between four contiguous edges or curves that form a close loop, was used to generate the region. Before using this command, I need to get the edges from the side walls to generate the four sides needed to close the region. For this purpose, I use the command XEDGES, (Extract Edges in the 3D Tools Menu/Solid Editing.). I perceived also that the command EXPLODE works well to break down a compound object into its individual components.

1.5 Drawing the brims of the mouth.

To create the extension brim of the mouth of the horn, I must draw a line between the front limits of the mouth and then use the command REGION (Menu Draw.). Selecting this last line and the flat curve that I created in the section 2.4 I generated a front surface. (See Figure 12).

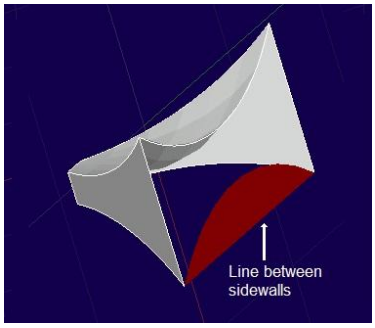

Figure 14 Front surface color in red to create the brim.

To finish the brim I rotate the front surface 90° using the command REVOLVE around the axis formed by the line that joins the side boundaries as shown in Figure 13.

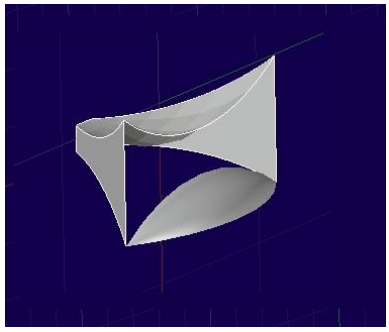

Figure 15 The first brim showed

I can draw the second brim and make visible all the sides of the horn as show in Figures 14 and 15.

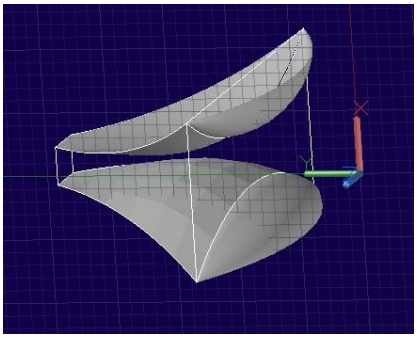

Figure 16 View of the first side wall

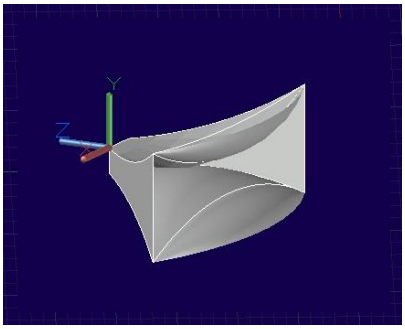

Figure 17 View of both panels with realistic visual style

1.6 Drawing the vanes of the horn.

The vanes dimension and angles were measured from my own 811B horn, showed in Figure 2. Because the scope of this work is the methodology to draw the body of the horn, I did not build any special device or tool to get the correct horn curves measurements.

With the measurements shown in Figure 16 the angle of the incline vane is 30°.

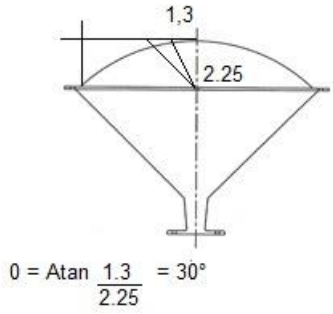

Figure 18 Angle of the inclined vanes

The vanes are symmetrically distributed, the center vane coordinates are (7.3,3.5,7.75), (9.55,3.5,7.75), (9.55,-3.5,7.75) and (7.3,-3.5,7.75) as showed in Figure 17. To draw the plane of the vane I used the 3DFACE command.

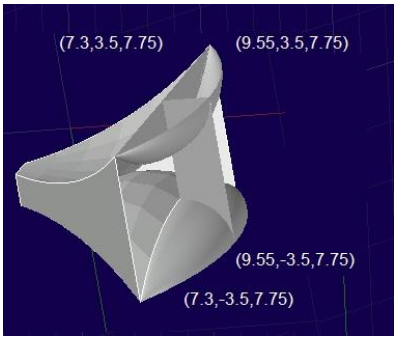

Figure 19 Coordinates of the center vane

With the generated planes it was necessary to cut off the spare over the brim using the SLIDE command as I did at the end of 2.3 section.

The coordinates of the inclined left and right vanes are as follows: Left one (7.3, 3.5,3.5.174), (9.55, 3.5, 3.875), (9.55,-3.5,3.875) and (7.3,-3.5,5.174). Right one (7.3, 3.5,10.3260), (9.55, 3.5, 11.6250), (9.55,-3.5, 11.6250) and (7.3, -3.5, 10.3260). Once the inclined vanes were drawn and the spare parts were cut off I used the SLICE command to obtain the view of Figure 18.

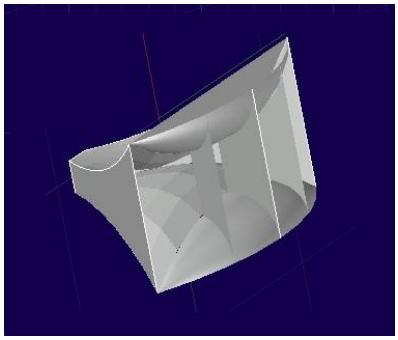

Figure 20 Body of the horn without spare parts

2. Drawing the throat

Now proceed to draw the throat with a depth of 2.95 units. I started from the end of the side curves previously obtained. The coordinates to get the additional points to create the four 3DFaces needed to build the throat are, (-2.95,0.625,-7.125), (-2.95, 0.625, -8.375), (-2.95,-0.625,-8.375) and (-2.95,-625,-7.125), as showed in the Figure 19.

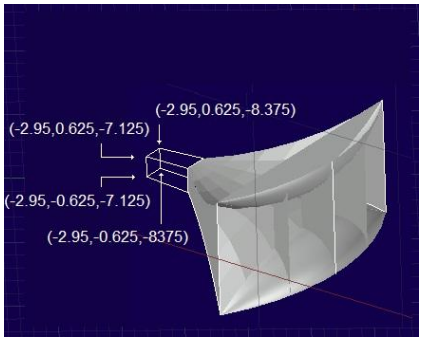

Figure 21 Building the throat

2.1 Drawing the base of the driver.

The base of the driver is a circle with the center on the axis of the horn at (-2.95,0,-7.75). Once created , I used 3DROTATE to make it perpendicular to the axis of the horn. See Figure 20.

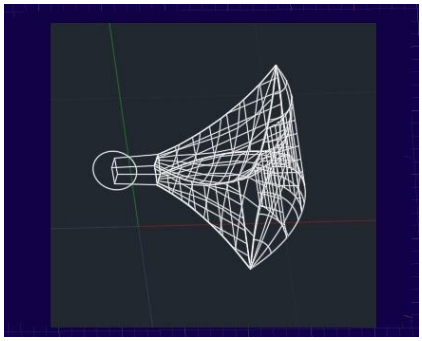

Figure 22 Circle as Driver base to rotate

Because the base of the driver is perpendicular to the axis of the horn, I used the EXTRUDE command with 0.2 depth and converted the object to solid with the CONVTOSOLID command. See Figure 21.

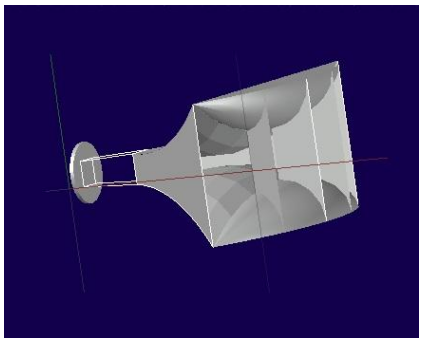

Figure 23Circular solid base

I have to repeat all the previous procedures to create a smaller circular hole at the center of the solid base. I used the CIRCULAR command with the Radius and Center coordinate options. The Radius is 0.5 units, and the center is at (-2.95,0,-7.75). After the EXTRUDE command I used the SUBTRACT command to show the empty space. Alternatively, I could have used the PRESSPULL command also to get the hollow, but this command is cumbersome to use because one has to follow one particular sequence of instructions to get the desired effect. See Figure 22.

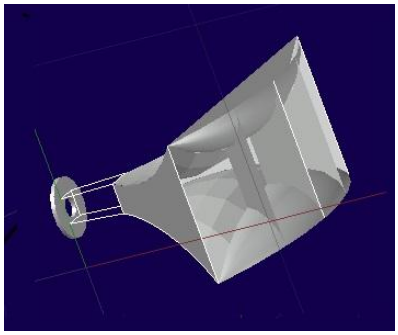

Figure 24 Driver base hollow

3. Drawing the driver

Because the main purpose of this work is to show a methodology to draw the curves of the body of the horn, I only wanted to draw the driver as a non-detailed visual reference in the final drawing. For this purpose, I only considered the contour side section view of an Altec Lansing driver specification sheet[5]. See Figure 23.

Figure 25 Specification sheet of Altec 807 and 808 drivers

From the shape of the image of Figure 23, I drew an approximation of a half of the driver using AutoCad. See Figure 24.

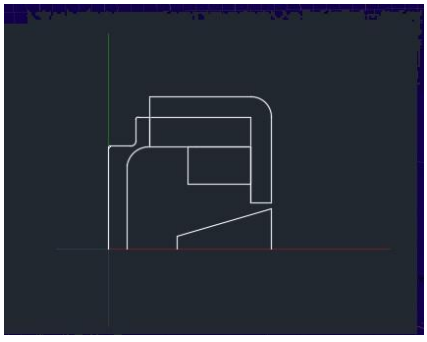

Figure 26 Approximation of a half of the Altec driver

Now I use the REVOLVE command to get the driver in 3D. See Figure 25.

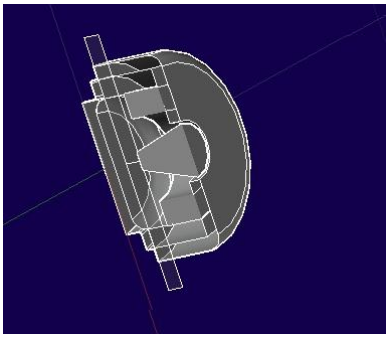

Figure 27 Driver sectional view

I created the driver scaled in a single file and used copy and paste to join with the figure in the horn file. At this step I must use the 3DROTATE and ALIGN commands to connect the driver to the horn.

4 End view of the entire horn and driver

Finally, I have the entire drawing of the horn with its driver as shown in the following Figures.

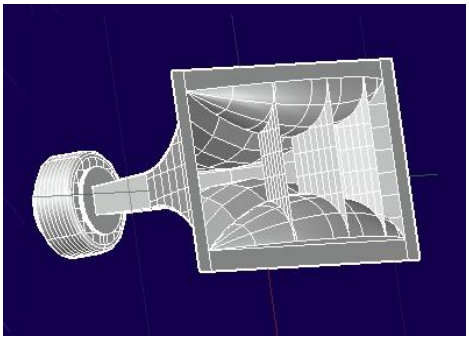

Figure 28 Full wired view of the horn

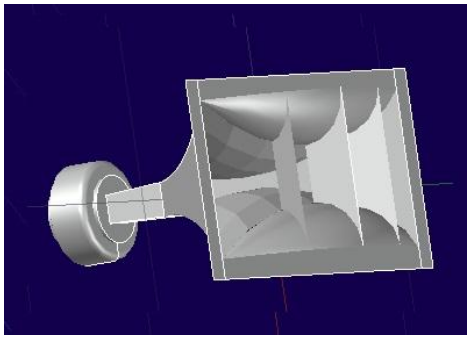

Figure 29 Full conceptual view of the horn

5 Conclusions

The view of the Altec Lansing horn 811B never cease to astonish its followers. It not only reaches the collector micro universe but also the general audiences who admire the unique characteristics of this marvelous horn.

New technologies in the midrange horns surpasses the sound quality of the Altec Lansing horn 811B but not the experience to see and hear it. You can compare this with the experience of seeing and listening to a Gramophone or a vintage vinyl record player. Therefore, Altec Lansing horn 811B followers will continue growing through the years to come. It is my hope that this paper can be used and be useful as a reference or starting point for those who in the future will attempt to get the perfect dimensions of the Altec Lansing horn 811B.

Acknowledgement

The author wishes to express his gratitude to Dr. Ramon Mata-Toledo (James Madison University) for his thorough review and constructive criticism of this work. His input, highly appreciated by the author, contributed to improve this work significantly.

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