

# Ultra Loud Speaker Is Auto - Truck Size



Occupying the entire trailer front end, this horn is limited only by the power feeding it.

*With a good amplifier, this unit can be heard two miles*

By PAUL H. THOMSEN

sary for added strength. Considerable care was taken to make sure each shingle nail was driven into solid wood, for a loose nail might cause rattles or flexing. To avoid chipping, nails were never driven in near the edge of the Masonite.

One of the first and most important requirements of this mobile loudspeaker is that the roof of the trailer be absolutely waterproof. Any rotten lumber on the trailer must be replaced. If the roof leaks, it won't be long before boards will become loose and distorted; nails will not hold fast in rotten lumber.

Clear the trailer of all cabinets, partitions, and doors. Leave the housing over the wheel wells and leave the heater if one is provided and if it does not fall within the projector area.

The following quantities of clear white pine will be needed to build the mobile loudspeaker:

Quantity	Length (Feet)	Size
1	12	2 x 4
1	8	1 x 6
1	12	1 x 12
60	8	1 x 4
10	10	1 x 4

THE loud speaker is the most inefficient unit of a public address system. It is possible, however, to design a more efficient loud speaker by using a suitable air-coupling system consisting of a horn or baffle.

The complete loud speaker is composed of (a) the diaphragm, (b) the driving unit and (c) the section which is least considered by most PA men, the air-coupling system.

For mobile operation the weight and physical size of a loud speaker are very important. All these factors affecting the final results were considered in the construction of this mobile loud speaker system, designed and built by the writer.

There is a practical limit for ease of portability to the size of loud speaker projectors. In this system the size was limited to the tow end and right side of an ElCar 18-foot house trailer, as shown above. The lower frequency limit is approximately 35 cycles; excellent high-frequency projection is obtained up to

6,000 cycles since the projectors have exponential characteristics.

The next problem was to select some type of construction which would not exceed the weight-carrying limit of the trailer. The designer chose the airplane-rib structural method of obtaining rigidity with minimum weight. The rib structure had to be of sufficient strength to prevent vibration at its own resonant frequency.

Tests indicated that  $\frac{1}{8}$ -inch-thick tempered Masonite would be satisfactory when reinforced with ribbing over its entire length. Clear white pine lumber was selected for the ribbing because of its low weight and because it is easy to work into shape.

The problem of securing these white pine ribs in place was solved by using shingle nails, which, with the proper amount of lumber, give sufficient strength and insure maintenance of the shape of the projectors. Wood screws and bolts were used only where neces-

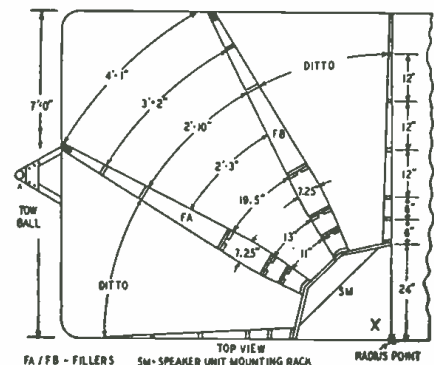


Fig. 1—Floor plan of triple speaker system.

Material below will also be required:  
 10 sheets 1/2-inch tempered Masonite,  
 4 x 10 feet  
 7,000 shingle nails, about 1 inch long  
 3 dozen 1 1/2-inch No. 10 blued wood  
 screws



Fig. 2—How the six speakers are mounted.

- 1 gross 3/4-inch No. 6 blued wood screws
- 12 square yards of canvas
- 6 Rola type G12 or equivalent 12-inch, 20-watt loudspeaker units
- 1 quart quick drying enamel
- 5 lbs. window putty

Remove the inner wall of the trailer carefully within the projector area and make a careful study of all bracing so that all of it which can be used will be left in position. Park the trailer on a level plane, and remove the wall of the trailer through which the projectors are to extend. Use a saw and do not cut into the canvas top. See Fig. 1 for the floor plan and the size of the opening required. Be sure to provide vertical supports for the roof of the trailer. This will give you easy access to the section of the trailer where you will do most of your work.

Point X in Fig. 1 is the point where you should drive a nail from which all measurements should be made. With paint, mark all the dimensions on the floor exactly to scale. The speaker-unit mounting rack should be outlined on the floor and then the two outer walls of the projector. These dimensions are fixed and can be used as the working edges.

Next draw the floor lines of the inner vertical walls (A and B) of the two outside projectors. Remember that the dimensions given are the final values after the 1/2-inch Masonite has been added over the ribbed structure. The openings for the speaker cones are 10 inches. The contours of the fillers A and B should be roughly drawn, using the approximate maximum filler thickness of 7 1/4 inches as a starter.

A line should be drawn from Point X to the right front corner of the trailer. This line will be the center line for the center projector. From this line all points can be found for the left and right vertical walls of the center projector. Two 2 x 4 vertical roof supports should now be installed to carry the full weight of the roof of the trailer at this corner.

Fig. 2 shows the wooden mounting rack for all six loud speakers. Each pair of speakers is mounted on a piece of clear white pine lumber cut to the dimensions shown in Fig. 3. These three pieces are then mounted on the two pieces of white pine shown in Fig. 4. Prior to their installation within the trailer, all these pieces are screwed to-

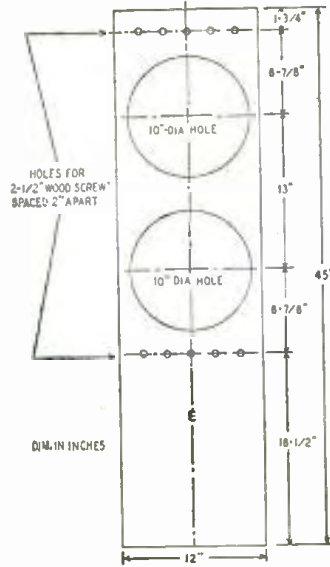


Fig. 3—Detail of one of the speaker boards.

gether for maximum strength. The six speaker-cone openings are covered with ordinary window screening to prevent anything from damaging the cones. This screening is tacked on.

It is suggested that you do not install the speaker units until you have completed all the carpenter work on the entire installation. However, the speaker mounting rack may be screwed to

the floor and left wall of the trailer. Then all floor markings should be completed.

Fig. 1 shows clearly that the ribs are closer near the speaker mounting rack than at the trailer walls. This is because the diaphragm of the speaker places more pressure on the walls in this area of the projector.

The ribbing is positioned every 6 inches up to the 30-inch rib. The ribbing in this area may be 2 x 2's or 1 x 4's with the thin sides facing the projector wall. Seldom were more than two or three nails used to hold each of these members in place. However, it is most important that each nail be of sufficient size and length to insure strength. At this stage of construction each member or vertical rib should withstand a horizontal pull of at least 100 lbs. without showing a tendency to break loose.

The vertical and top ribs are essentially the same, but it was desirable to use a separation of 6 inches for the ribbing on the bottom surfaces. This insured adequate strength for supporting



Fig. 4—Speaker board top and bottom pieces.

several boys and the builder during the construction and painting.

The designer of this mobile loudspeaker found that a tolerance of ± 1/32 inch was permissible up to a distance of 18 inches from the loud speaker mounting board. This could be increased to 1/4 inch at 36 inches. Where possible, a tolerance of ± 1/4 inch was held at 48 inches and 60 inches. Beyond this limit the contour was modified as

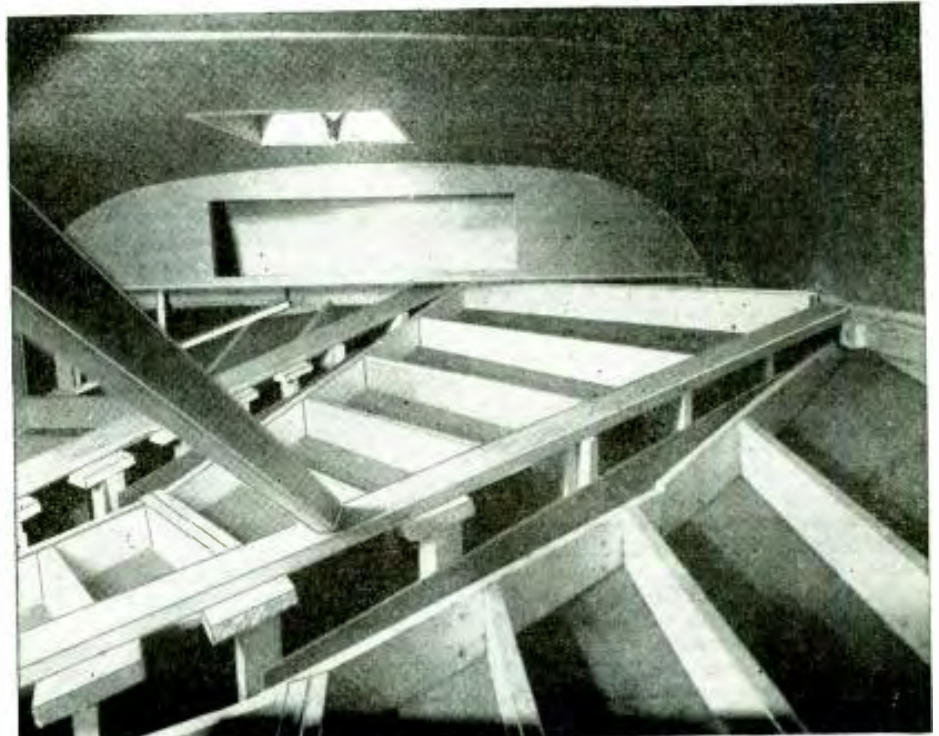


Fig. 5—This top view of the horns shows the construction details and framing excellently.

rapidly as the Masonite would permit without cracking to fill the opening in the trailer, as shown in the photographs.

Remember that the sound pressure on the surfaces of the projector is greatest near the loud speaker mounting board. For that reason extreme care was taken to fit the pieces properly. This

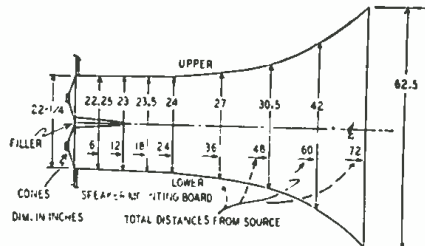


Fig. 6—Sidewall plan of the projector horns.

close fitting requires well-seasoned wood and careful nailing. Clamps were used during the nailing of the vertical ribs. It was found very convenient to use a piece of steel about 1 x 2 x 5 inches as a back stop when nailing into sections of ribbing that appeared to be springy.

### Fitting the Masonite

After the vertical ribbing is finished, the vertical sheets of  $\frac{1}{8}$ -inch tempered Masonite may be fitted in place. For convenience in handling, the pieces nearest the loud speaker mounting board should be not more than 30 inches long. The portion for the vertical panel contacting the loud speaker mounting board should be screwed on. Use  $\frac{3}{4}$ -inch No. 6 blued wood screws for additional strength. The screws are placed in clearance holes spaced about 1 inch apart. The vertical sheets of Masonite are at least 4 inches above and below the estimated upper and lower horizontal surfaces of the projector (see Fig. 6). Pencil marks should be placed on the vertical ribbing approximately where the

upper and lower surfaces will fall. However, the horizontal center line on each side of the three projectors should be drawn in first to give a working line.

Since you have now covered the horizontal center lines on all of the vertical ribbing, it becomes necessary to draw this line on the inside surfaces of the three projectors. From this line draw again the upper and lower surface lines on the tempered Masonite. Make them clear. Now proceed to nail, above the upper line and below the lower line, a 1 x 4 white pine side mounting rail. If, due to the curvature of the side walls, you cannot fit the 1 x 4 close to the side wall through its entire length, cut it into shorter pieces (see Fig. 5). However, be sure that each piece is securely nailed to the vertical ribbing. It will be necessary to curve the lower edge of the upper mounting rail and the upper edge of the lower mounting rail to keep within the tolerances specified.

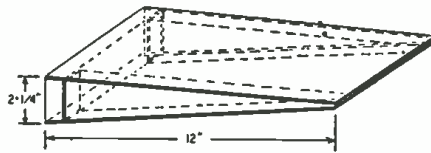


Fig 7—Construction detail of filler wedges.

To the upper and lower side mounting rails are toe-nailed horizontal 1 x 4 white pine supports. A minimum of 4 nails was used at the ends of the pieces. The inner edges of the pieces were shaped to follow the contours of the top and bottom surfaces.

As in the case of the vertical panels, small sheets of Masonite were shaped to fit in place to form the upper and lower surfaces of the projectors. To prevent rain from running down the top, a 2-inch strip of canvas is hung over the upper edge of the outer wall of the trailer.

The space between the pairs of loud speaker units is effectively removed, in so far as the load on the diaphragm is concerned, by placing a filler of two sheets of tempered Masonite between two or, preferably, three 11-inch wedges made of 1-inch clear white pine and then nailing all the pieces together and to a 1 x 10-inch crosspiece 2 inches wide, as shown in Fig. 7.

Previously it was pointed out that a tolerance of only  $\pm 1/32$  inch was permissible. It is equally important to seal the corners of the projector near the diaphragm of the loud speaker where there are great pressures. Regular window putty or plastic wood may be used when the Masonite is dry.

The last job is installing the loud speakers. All the voice coils are connected in parallel, and the fields are so connected that all voice coils operate in phase.

The amplifier equipment was mounted in the rear of the trailer. Bear in mind the importance of balancing the weight on the trailer for ease of handling and greater safety. The gasoline-driven generator was placed in rear center to reduce the weight placed on the tow ball of the car. The operating table, preamplifier and equalizer rack and turntable were placed along one side of the trailer, with the main amplifier on the other side.

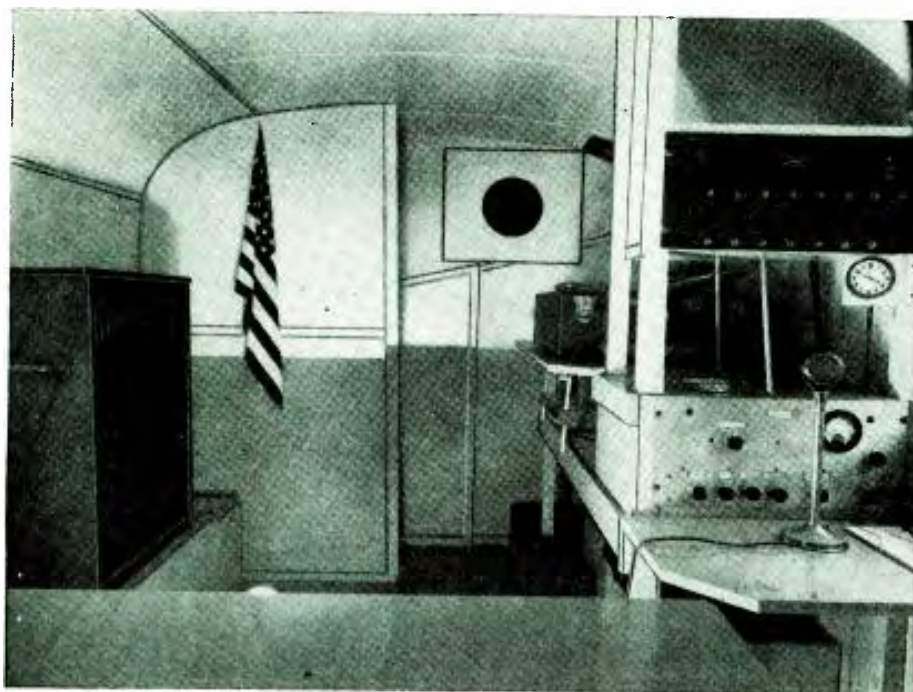
The photograph below shows the audio equipment within the trailer as viewed through the rear window. The 4-channel preamplifier, the Tonalizer or equalizer, the 8-day clock, turntable (recorder) all are in back of the microphone which is located on the operating table. The large power amplifier is located on the left. The monitor loud speaker can be seen in the upper left partition above one of the projectors.

### Amplifier equipment

The power amplifier for this PA system should be able to deliver at least 100 watts of audio frequency over the frequency range of 30 to 6,000 cycles with relatively low total harmonic distortion. Tests indicate that distortion should be less than 5% at full power output. The equipment illustrated is capable of delivering 230 watts, class AB operation.

The full significance of the expression "Mobile Loudspeaker" will strike you when you get your first stationary PA job. Then and only then will you realize you need about 500 feet of microphone cable to permit placement of this speaker, not up on a telephone pole, but out in the lot several hundred feet away from the gathering. The relatively high projector efficiency along with good frequency response will insure not only adequate coverage of the immediate gathering but of several complete blocks.

The designer would like to suggest a 500-ohm T-pad on a 75-foot cable as a remote volume control. This permits anyone to monitor the volume from outside the walls of the trailer, more or less as it is heard by the audience.



Inside the truck. The 230-watt amplifier is at left, the turntable and preamps at right.