

# A Tuned-Pipe Enclosure for Bass Enhancement

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A simple and easily-built enclosure will give excellent sound quality from any good 12-inch loudspeaker, with low-frequency reproduction equivalent to many larger cabinets.

**A**CCORDING TO LITERATURE presented in the September 1952 issue of *AUDIO ENGINEERING*—I refer specifically to the article written by Mr. John E. Karlson entitled "A New Approach in Loudspeaker Enclosures"—a long closed-end pipe, having a long notch at the open end, will give practically continuous radiation over the frequency range required for good audio reproduction. The pipe length must, of course, be considerably larger than the width and depth in order to achieve the proper effects. With these fundamental characteristics of the closed-end pipe in mind,

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I have developed a fairly simple yet effective corner enclosure for 12-in. speakers, shown in *Fig. 1*.

The configuration was generated by considering first a long triangular shaped pipe 6 ft. long with the speaker mounted at one end and the other end having an exponentially tapered slot, as shown in *Fig. 2*. Since this is obviously a back-loading device, and we are interested primarily in enhancing the low-frequency response, the slot or notch at the open end can be made reasonably short—considerably less than the  $2/3$  indicated for broad coverage. Further, if we now fold the 6-ft. pipe, as shown in *Fig. 3*, we get a package that is of prac-

tical size. This configuration permits direct radiation of the middle and high frequencies while the lows are radiated directly and are also augmented by the back radiation through the short exponential slot. That was borne out by impedance measurements, and was verified by extended comparative listening tests. Note in *Fig. 4* that the free air resonance of 65 cps for the Electro-Voice SP12B is broken up and smoothed out with the curve essentially flat down to 30 cps. The non-resonant character of this enclosure has been demonstrated by extended listening tests using such records as the Cook organ records as well as the Capitol test record. There is

## CORNER HORN

(from preceding page)

indication of the coupling between the cone and the air. Using a single dry-cell as a current source, this test was applied repeatedly to the corner horn enclosure and no audible difference between *make* and *break* was found. It was inferred, therefore, that the damping was adequate and that transient response would be satisfactory. The latter conclusion was substantiated by listening tests. One simple test is to listen to a *good* recording of percussion instruments. Bartok's *Sonata for Two Pianos and Percussion* (Victor) is satisfactory for this purpose.

No finite horn, no matter how carefully designed and constructed, is completely free from resonance phenomena. The horn which has been described ex-

hibits a slight resonance and this is shown by the shape of the impedance curves of *Fig. 6*. There are two humps in the impedance curve where the impedance rises about 30 per cent above the nominal voice-coil impedance. The two humps are nearly symmetrical about the free-cone resonant frequency. This suggests that the resonance frequencies of horn and driver are the same, a desirable condition. There was no deliberate attempt to bring about this desirable state of affairs, the curves just came out that way.

If the horn is used in conjunction with drivers for low-frequency reproduction only, it may be expected that the resonant frequency of the driver may be somewhat lower than for the one shown. If so, a slight readjustment of the internal panels may be desirable. It is for

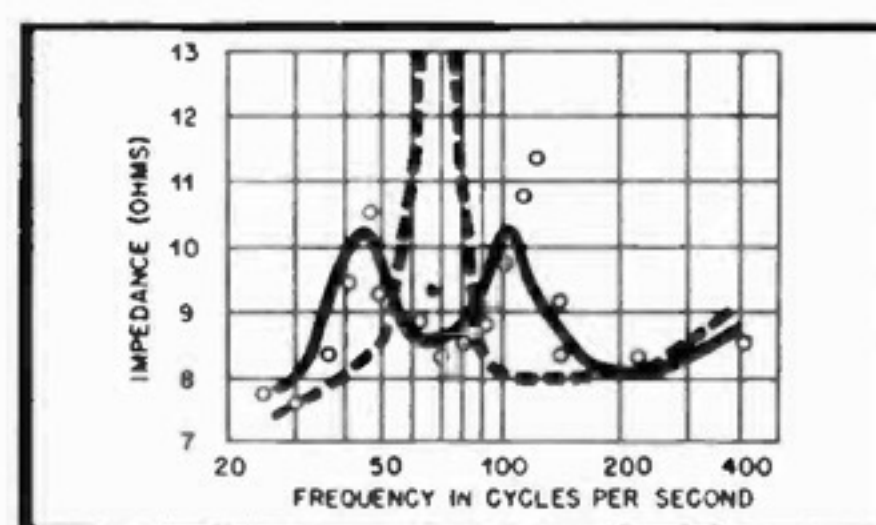


Fig. 6. The solid line shows the impedance curve of the GE speaker in the enclosure, with fiberglass completely filling the space behind the driver. The dots show irregularities which occur when the fiberglass is absent. The dashed line shows impedance peak of the driver without an enclosure.

this reason some of the internal dimensions have been omitted. For example, slight changes in construction will permit the use of a 15-inch driver. Under such circumstances the throat area is easily increased, with a consequent decrease in horn length. Fortunately, the design of the enclosure is such that changes of this type are easily made after construction is nearly complete.<sup>1</sup>

<sup>1</sup> Apparently not all General Electric Model S1201-D cones have the same resonant frequency. If a driver of different resonant frequency is used it should not be expected that the impedance curves will be identical to the ones shown in *Fig. 6*. However, if the fluctuations in impedance with frequency are not severe, good results may be anticipated.

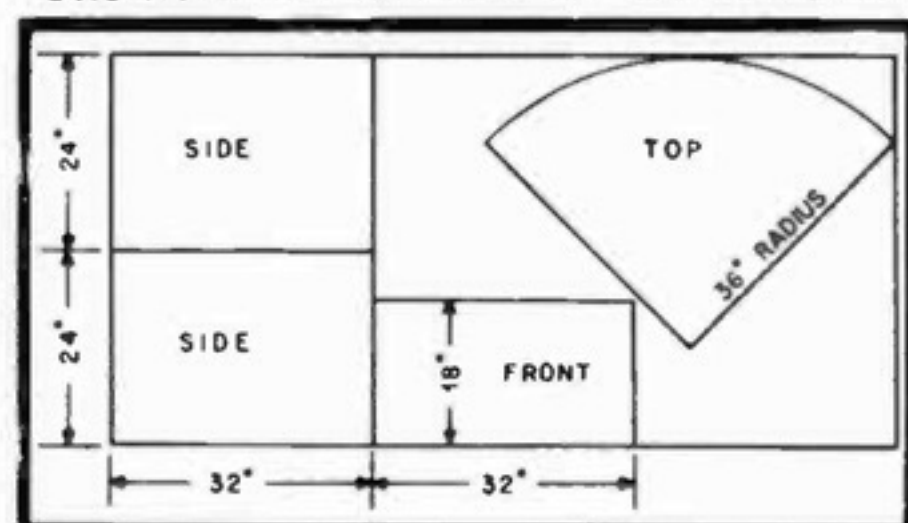


Fig. 4. How to cut all the main panels from a single 4x8-foot sheet of plywood.

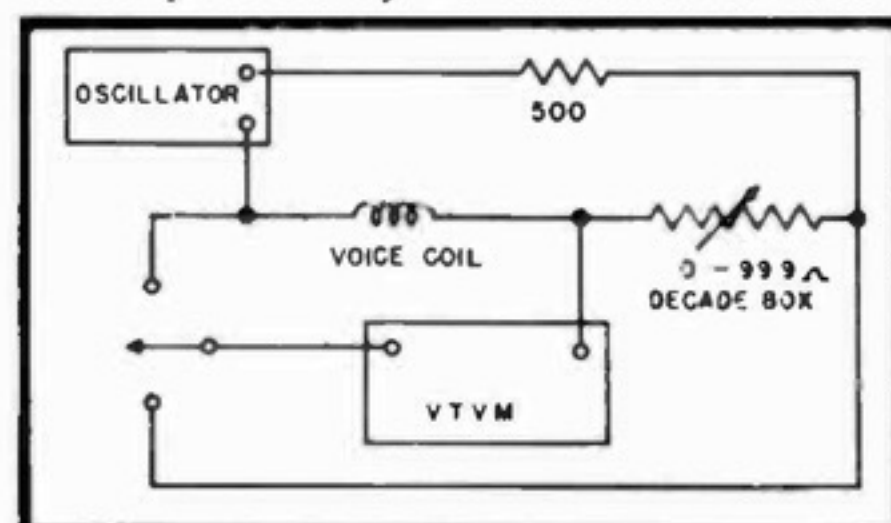


Fig. 5. Circuit used for impedance measurements. At each frequency the decade resistance is adjusted for similar voltmeter readings in both switch positions. The resistance is then equal to the absolute value of voice-coil impedance.



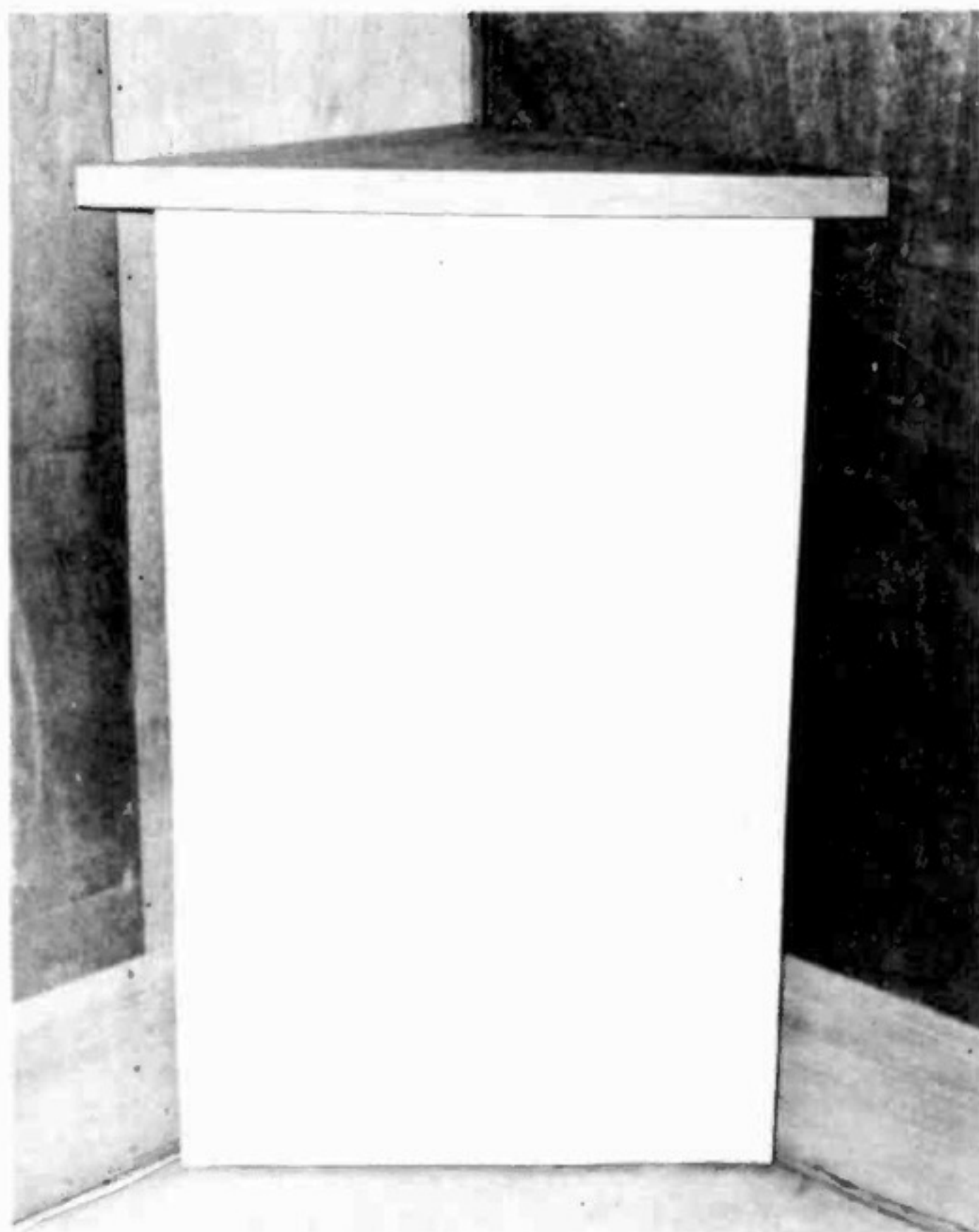


Fig. 1. The author's cabinet in finished form. Light appearance of front is due to the use of natural-colored monk's cloth for the grille.

no audible boomy or boxy sound.

For those who are interested in constructing this enclosure the diagram shown in Fig. 5 will serve as a guide. The usual precautions of using wood screws and glueing all joints for an airtight seal apply. The slot dimensions are indicated on the drawing.

Figure 6 indicates the various pieces needed to assemble the enclosure. In assembly the two sides should be nailed together first after wood glue has been applied to the contacting surfaces. Next

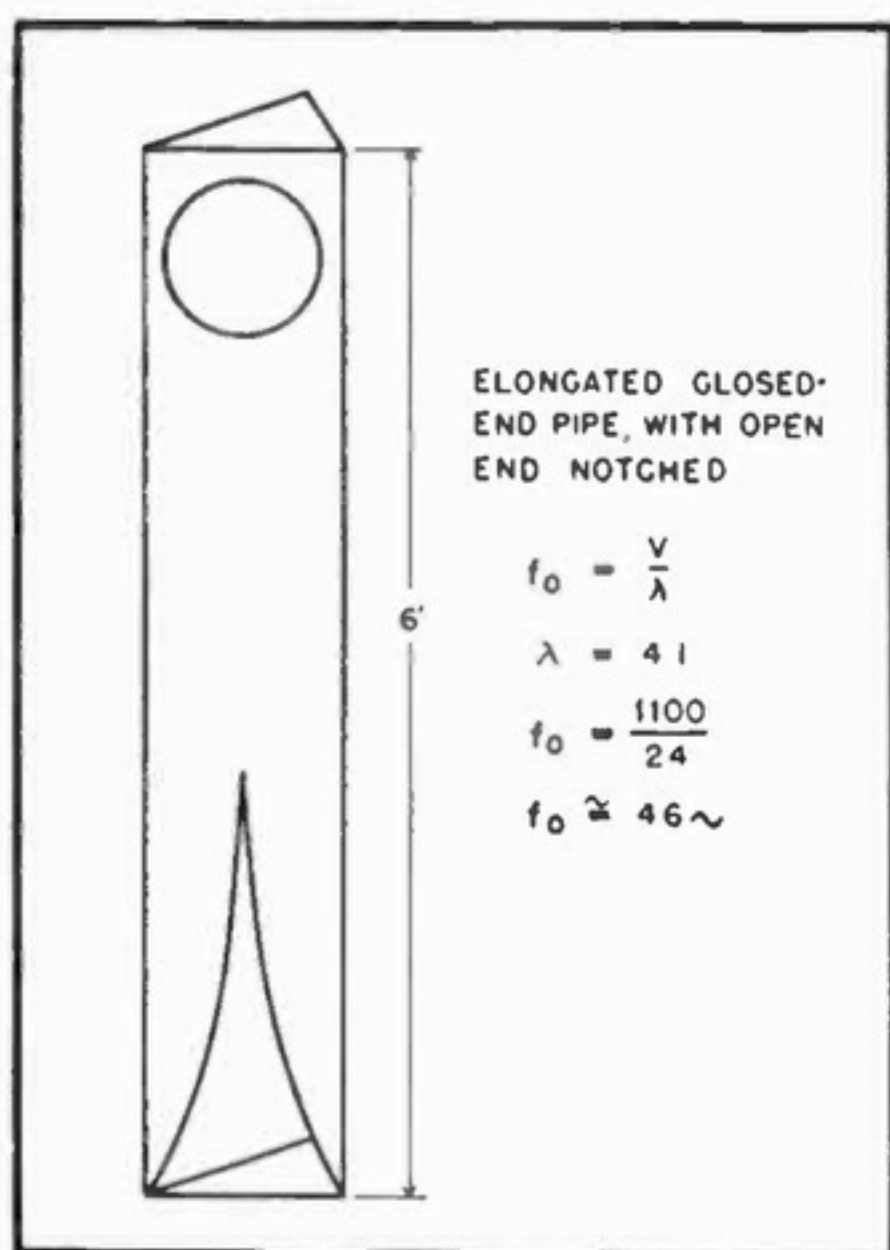


Fig. 2. Design of cabinet was developed from this long closed-end pipe with notched front.

the top and bottom pieces should be assembled, again using nails and wood glue, for a neat joint. Now the two lower left pieces of Fig. 6 should be assembled using nails and wood glue, and then this sub-assembly should be glued and screwed to the two sides already assembled. See Fig. 5 for proper location of this sub-assembly. The front panel should next be fastened as indicated in Fig. 5, using wood screws and glue generously to insure an airtight seal at all contacting surfaces. This whole package should now be allowed to set for whatever time is indicated on the can of wood glue you may have used. I used Casco and let the enclosure set overnight, and should resemble Fig. 7.

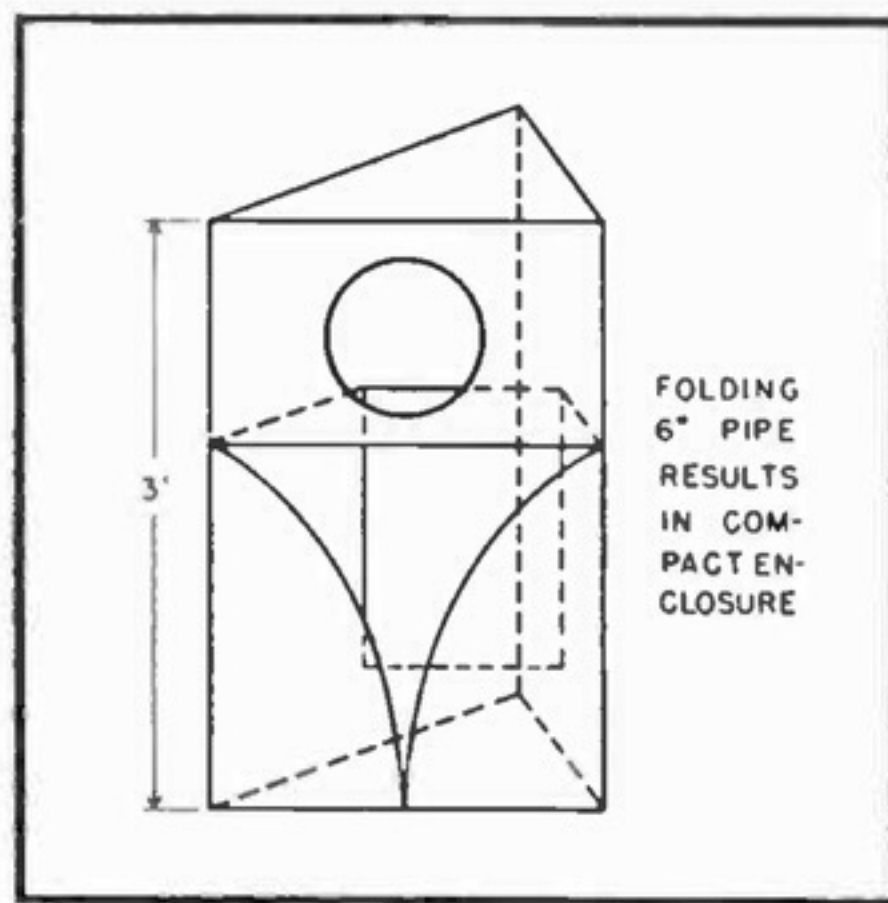


Fig. 3. Appearance of cabinet after folding from the original "pipe" of Fig. 2.

The basic enclosure is now ready for final finishing. If you like the simple modern appearance that mine has, as shown in Fig. 8, you may now screw a foot piece to the bottom, cut the same size as the bottom piece, and then glue a 1/4-in. sheet of foam rubber thereon for acoustic insulation from the floor. The enclosure should now be set in whatever corner you have chosen for it (preferably one on the longer axis of the listening room) so that the sides of the enclosure do not touch the moulding along the base of the corner walls of the room so you can measure the top finishing piece. This piece should be sufficiently large to fit snugly against the two corner walls and still jut out over the front grill of the enclosure approximately 1 inch for good appearances. In my case this turned out to give dimensions of 20 x 20 x 28 in. Mount this piece to the top by inserting wood screws through from the

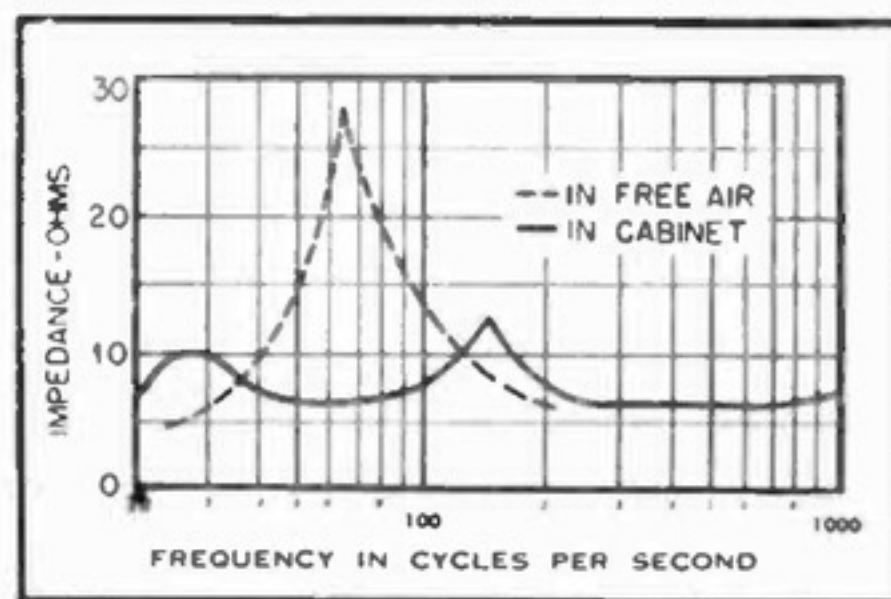
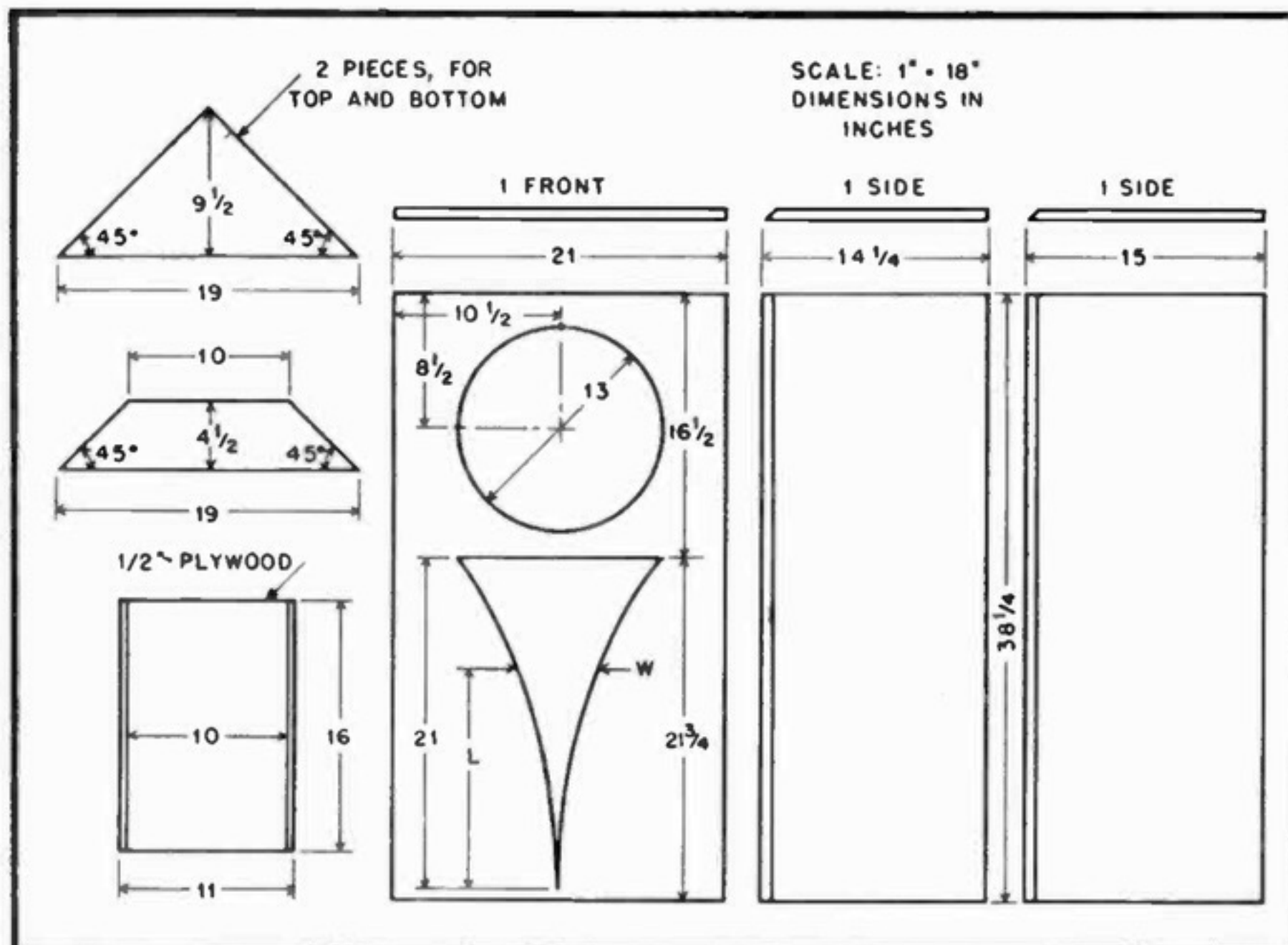
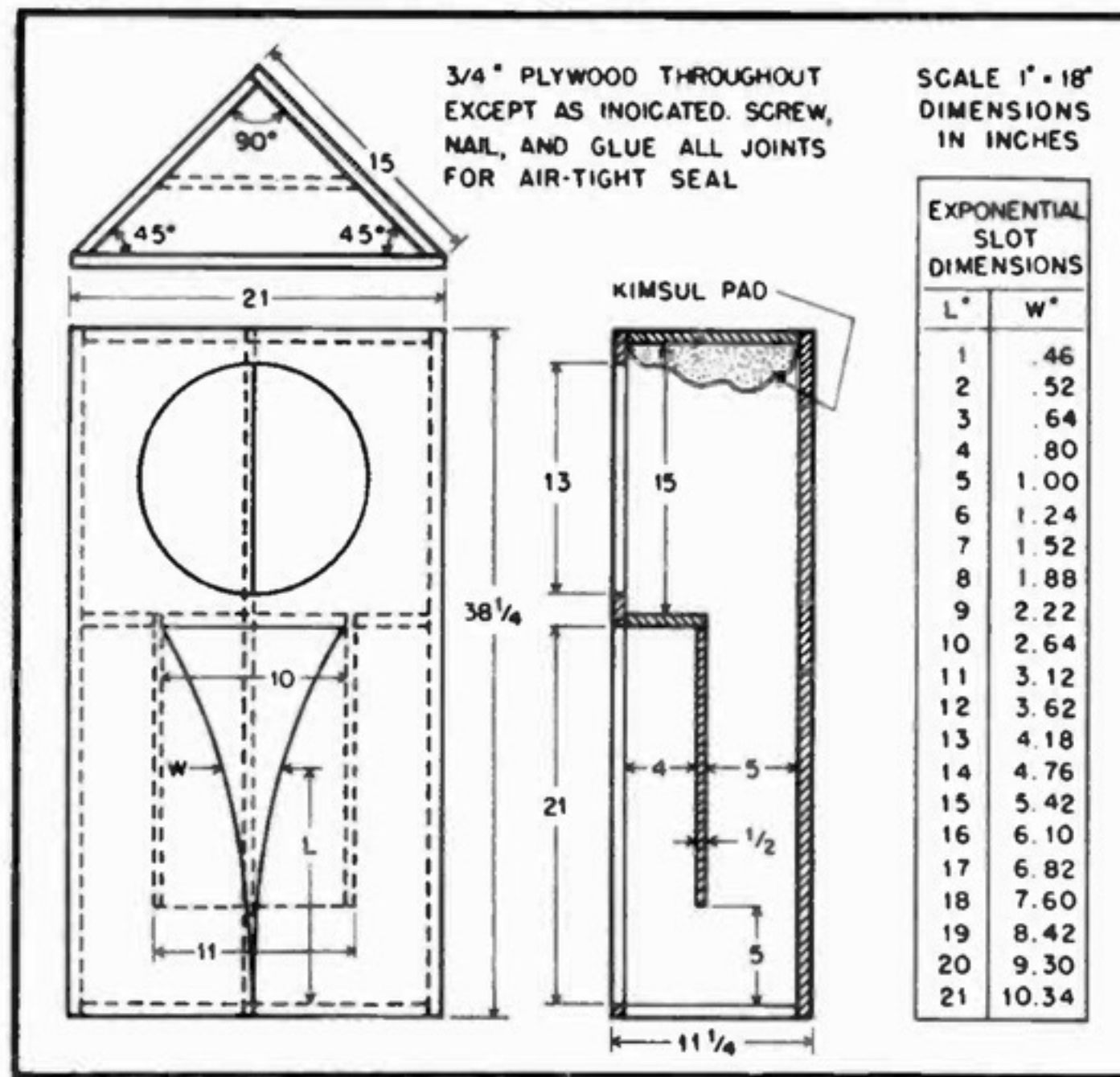


Fig. 4. Measured impedance curve of E-V SP-12B loudspeaker in the author's cabinet. Note reduction of natural resonant peak and extension of low-frequency range.

inside of the enclosure. Now glue a thin strip of foam rubber along the edges that contact the wall in order to obviate any vibrations being set up at the points of contact. Next the Kimsul pad can be fastened to the top with glue and a few furniture tacks. You are now ready to mount the speaker. A 15 x 15 in. speaker mounting board should be cut from 5/8-in. plywood stock, with a 10 1/2-in. circular hole cut in the center for mounting the 12-in. loudspeaker. Speaker lead-in wires should be connected through two 1/8-in. holes conveniently placed in one side of the enclosure near the top. The speaker board may now be mounted over the 13-in. hole in the front panel using eight wood screws equally spaced about the periphery of the mounting board as shown in Fig. 9. Finally the front grill frame, 38 1/4 x 23 in., should be fabricated from 3/4-in. square pine stock. This frame should be covered with lumite in your choice of color. The completed front cover may now be fastened to the enclosure front by means of four cabinet door catches. These should be mounted on the sides, two near the top and two near the bottom. This



Fig. 5. (right). Sectional drawings of the simplified corner enclosure. Fig. 6 (below). Details for cutting plywood pieces for the cabinet. 15x15 in. speaker mounting panel.



expedient allows for ready access to the speaker in case you want to change speakers etc. In my case, the top was finished by sanding and then applying clear varnish to bring out the natural grain of the mahogany. The over-all effect is very modern. The simplicity of this basic enclosure permits of flexibility in final exterior finish so that if you do not like the modern approach you may apply some other type finish.

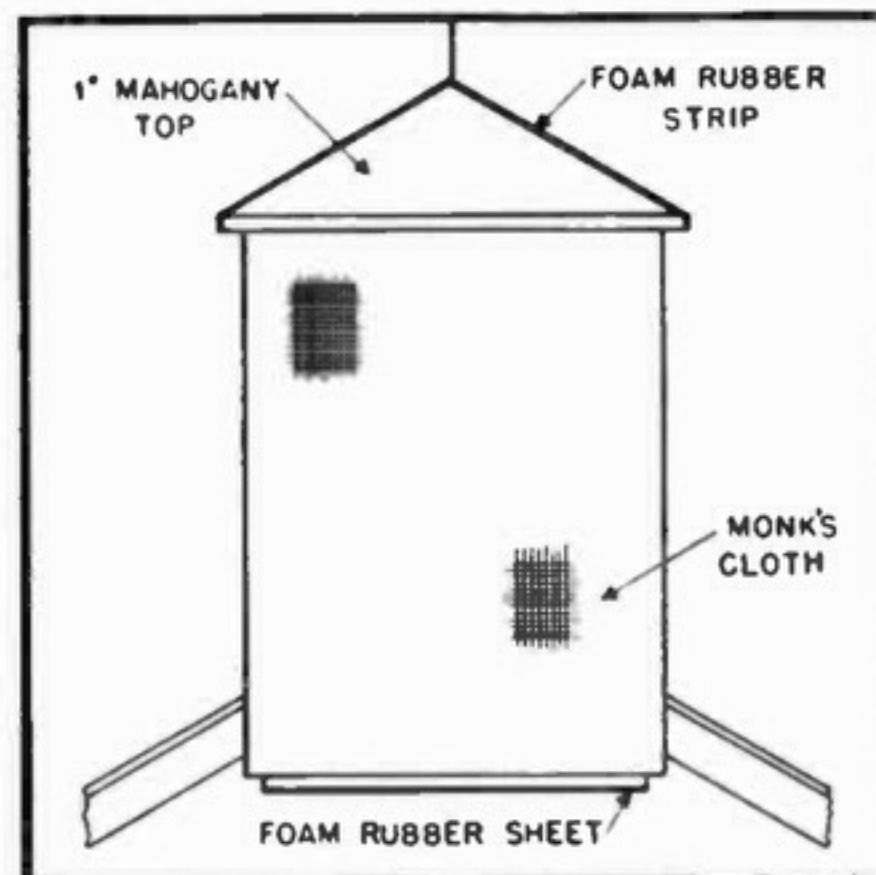
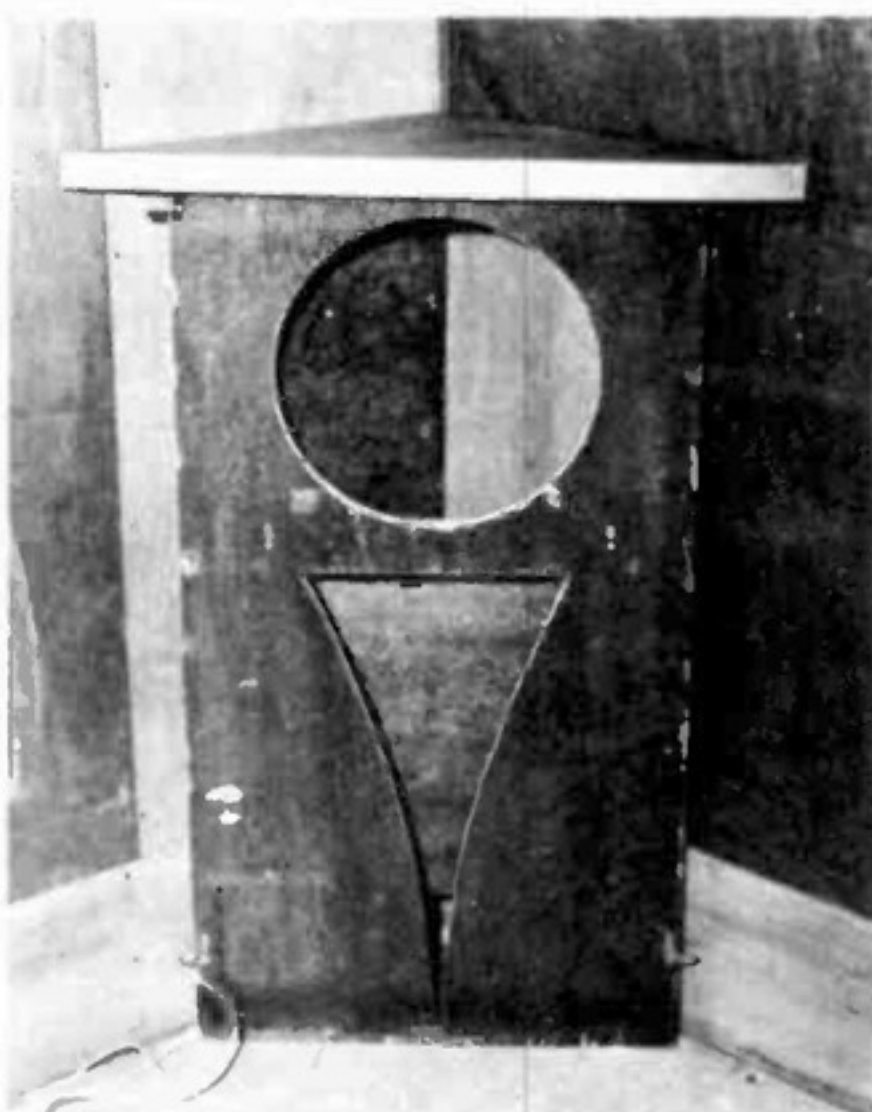
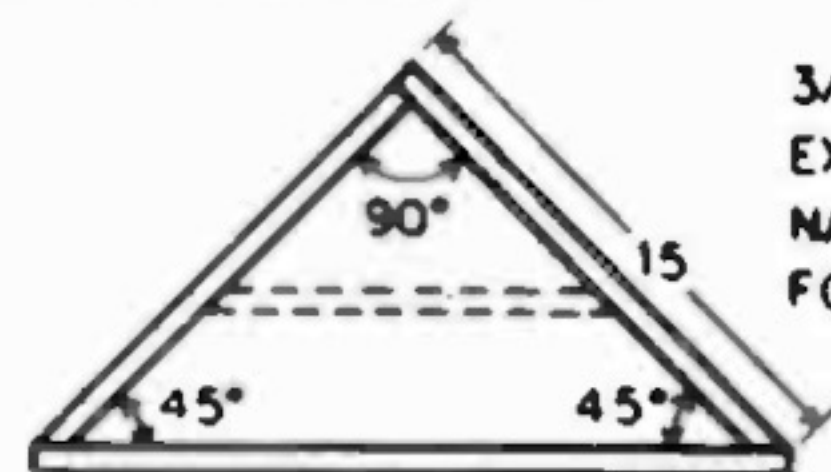


Fig. 8 (above). Sketch of finished appearance. Fig. 7 (left). Cabinet in stage of construction before mounting loudspeaker panel.

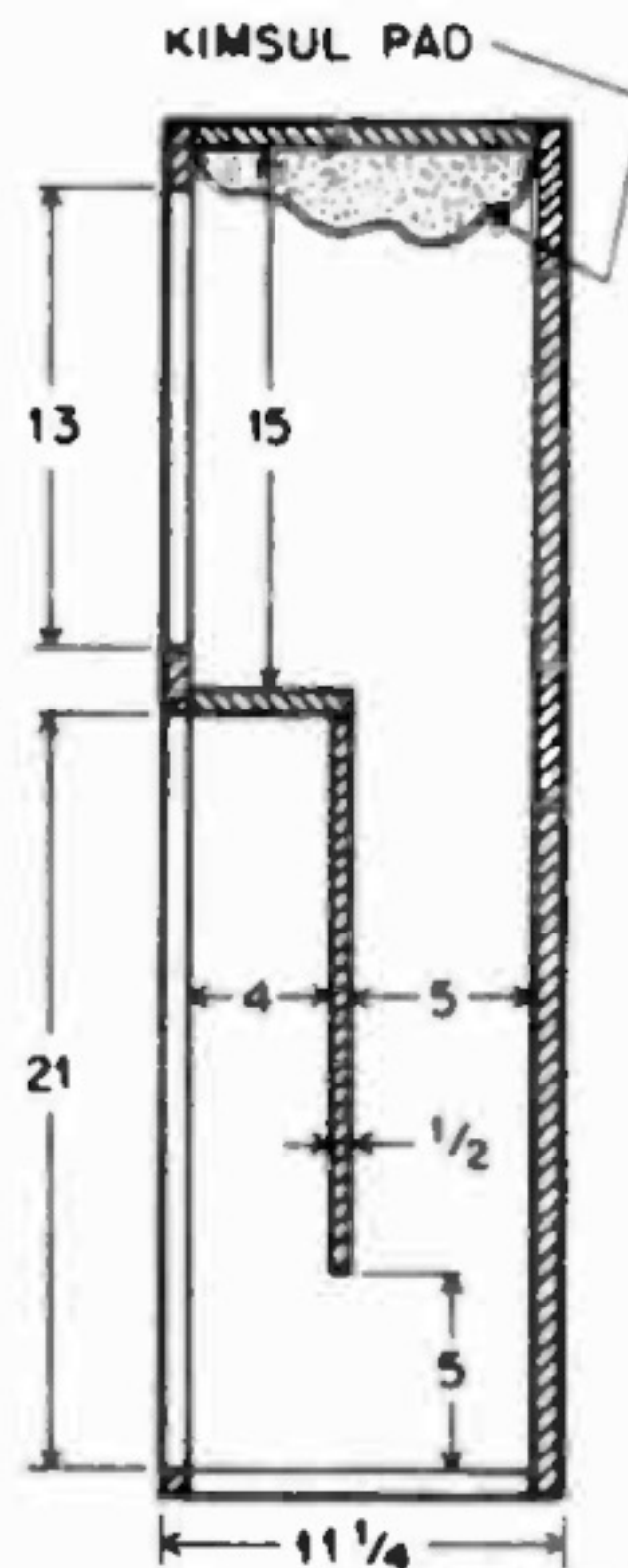
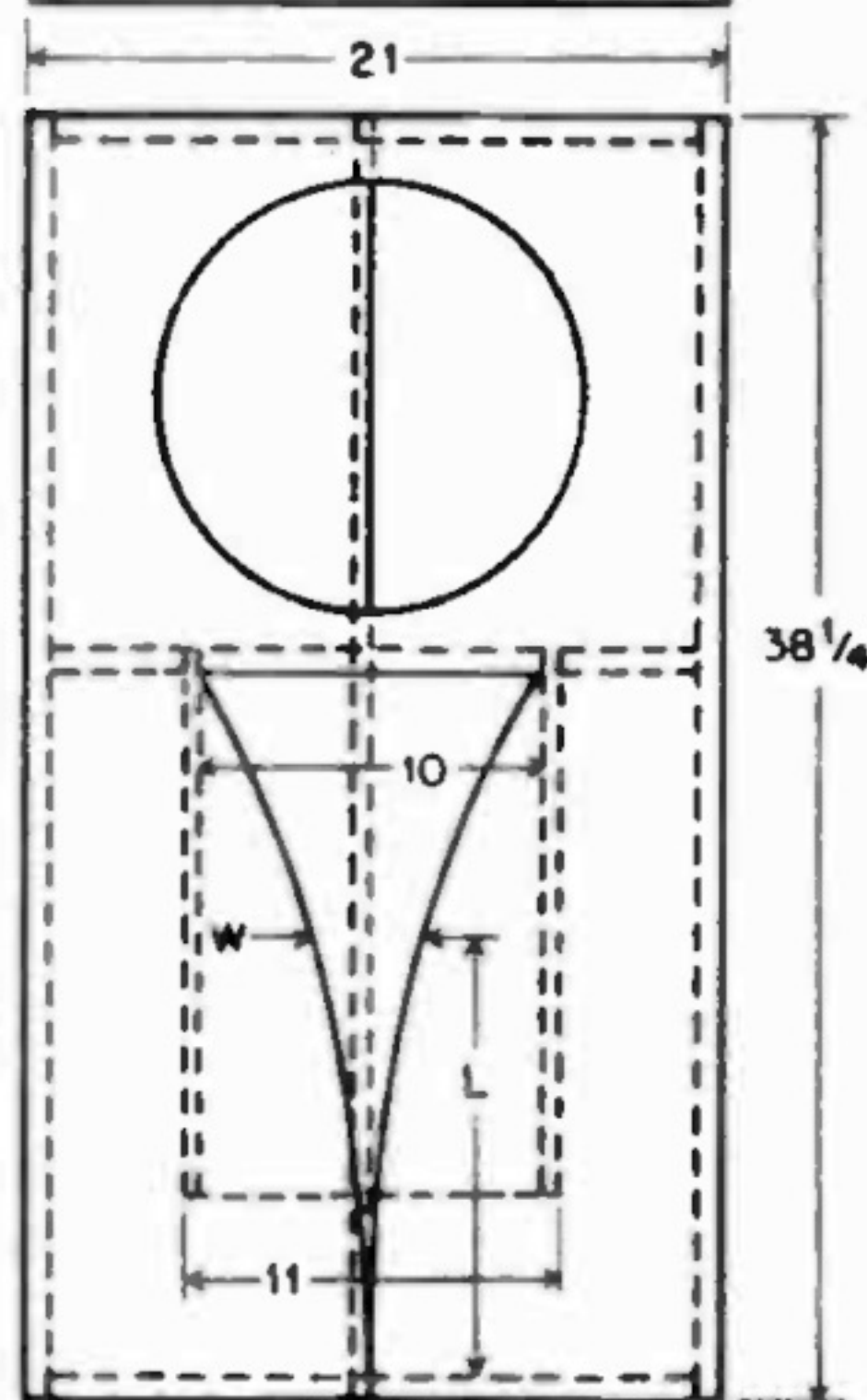


Fig. 9. Semi-finished cabinet with loudspeaker in place on its mounting panel. Note brackets on edges of front panel for mounting the trimming frame.

Fig. 5. (right). Sectional drawings of the simplified corner enclosure. Fig. 6 (below). Details for cutting plywood pieces for the cabinet. 15×15 in. speaker mounting panel.



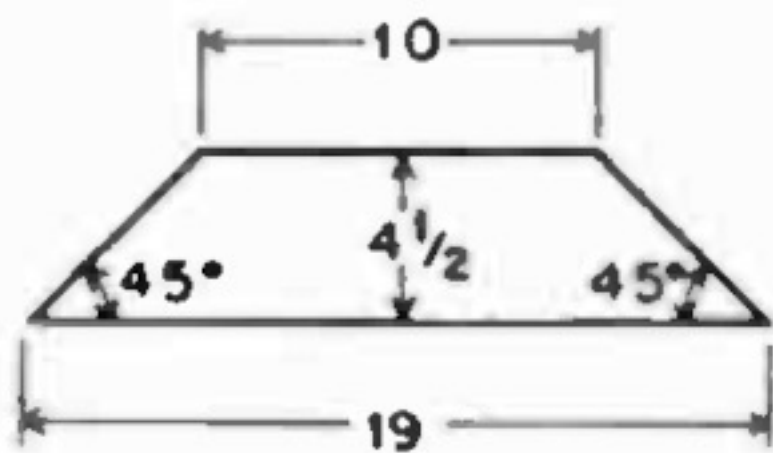
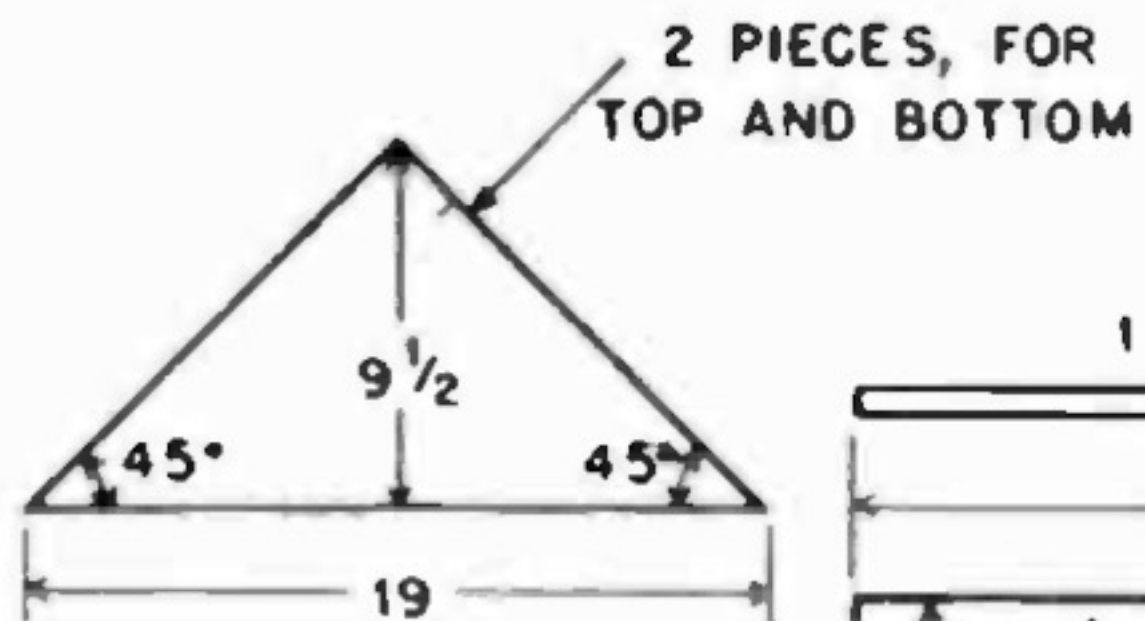
3/4" PLYWOOD THROUGHOUT EXCEPT AS INDICATED. SCREW, NAIL, AND GLUE ALL JOINTS FOR AIR-TIGHT SEAL



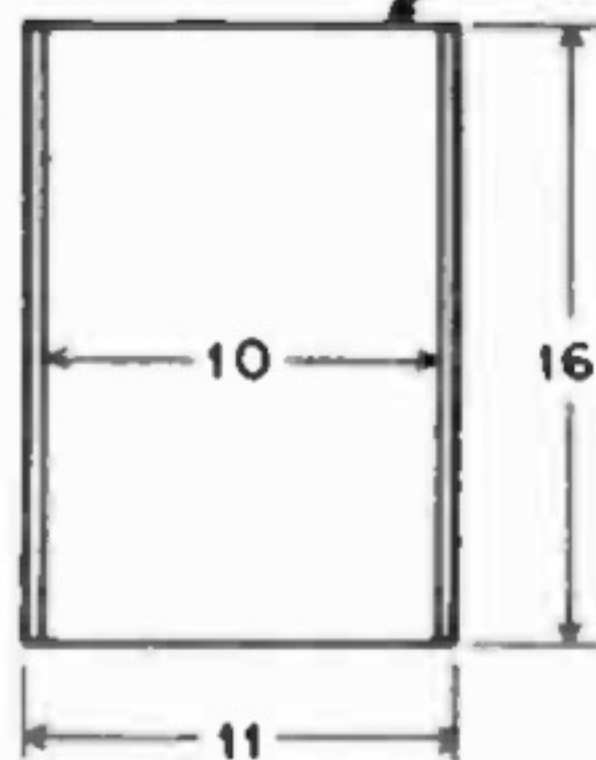
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DIMENSIONS  
IN INCHES

EXPONENTIAL SLOT DIMENSIONS	
L"	W"
1	.46
2	.52
3	.64
4	.80
5	1.00
6	1.24
7	1.52
8	1.88
9	2.22
10	2.64
11	3.12
12	3.62
13	4.18
14	4.76
15	5.42
16	6.10
17	6.82
18	7.60
19	8.42
20	9.30
21	10.34



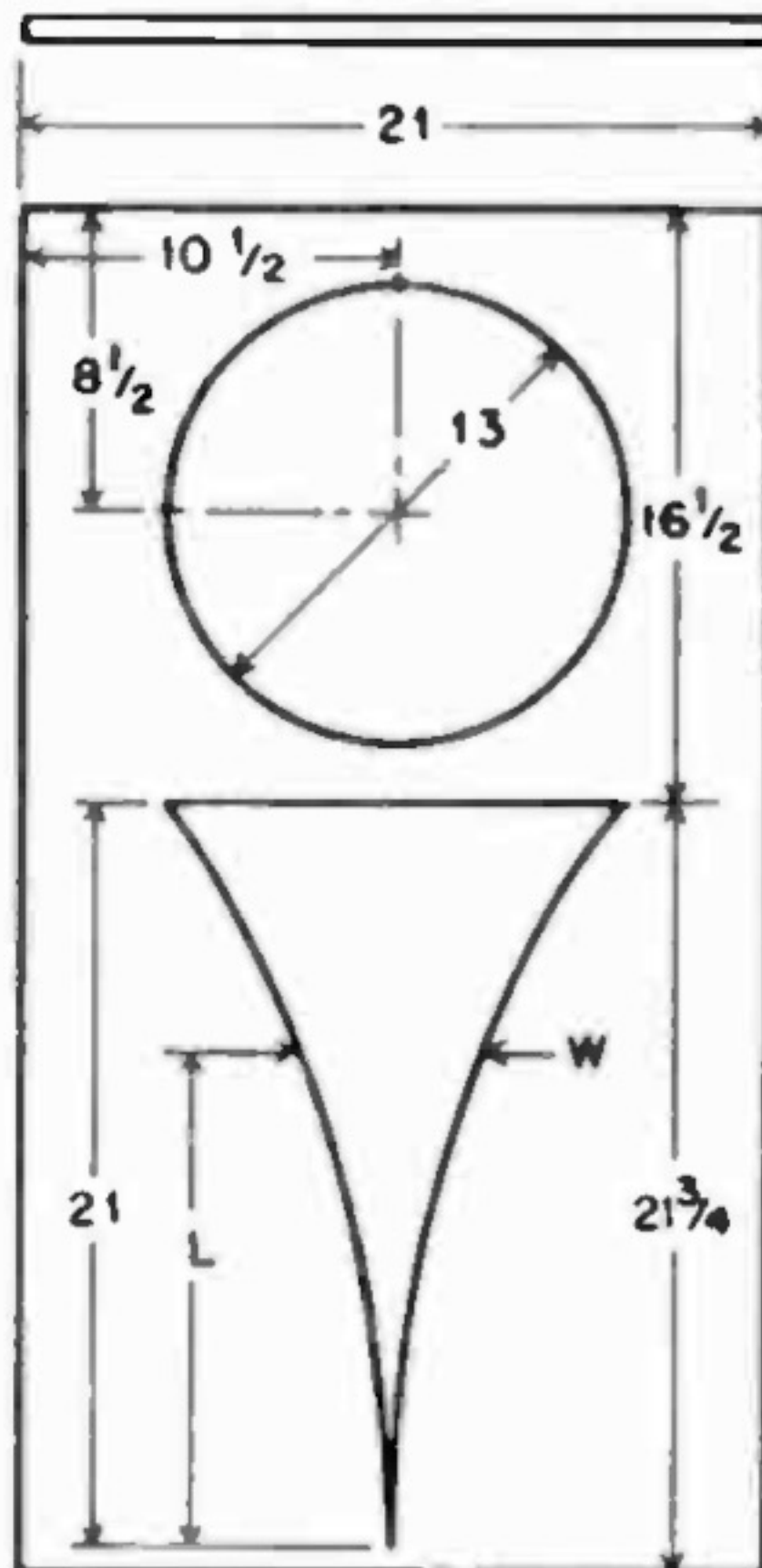


$\frac{1}{2}$ " PLYWOOD



SCALE: 1" = 18"  
DIMENSIONS IN  
INCHES

1 FRONT



1 SIDE



1 SIDE

