UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Sketches of a hammer-impact, spiked-base, shear-wave source

by

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Open-File Report 83-917

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards.

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1983

ABSTRACT

Generation of shear waves in shallow seismic investigations (those to depths usually less than 100 m) can be accomplished by horizontally striking with a hammer either the end of a wood plank or metal structure embedded at the ground surface. The dimensioned sketches of this report are of a steel, hammer-impact, spiked-base, shear-wave source. It has been used on outcrops and in a desert environment and for conducting experiments on the effect of rotating source direction.

DISCUSSION

The hammer-impact, spiked-base, shear-wave source is a modification of the Kirk shear-wave source (Hasbrouck, 1977) in which the vane of the Kirk source is replaced by two sets of spikes positioned at 30° intervals at a fixed radius from a central-location spike (fig. 3). When operating on hard surfaces and outcrops, it is difficult to chip out a narrow triangular trench to accept the keel of the Kirk source. In addition, better source coupling is obtained when the space between the vane and the trench wall is filled and then compacted--a time-consuming task. Use of the spiked-base source not only speeds field work but also appears to produce good source-to-ground coupling.

Precise orientation of the source is required in conducting field experiments on the effect of changing the orientation of the source. By positioning the source spikes at equal angular intervals along a circle, accurate source rotation can be achieved. When operating on hard surfaces the procedure is to remove the outer ring of spikes, drill a hole for the center spike, set the source on the ground at the selected orientation, use the outer ring of holes as a template to mark the position of two opposite holes, remove the source and drill these two holes, insert two spikes, replace the source on the ground, mark the position of the rest of the holes, remove the source, drill the remaining holes, reinsert all spikes, and reset the source. When operating on softer ground, the spikes are left attached to the source and a tapered punch (or engineer's wrench) is used to enlarge indicated spike holes before source emplacement. In sandy areas, these spike holes are better maintained if wetted.

The purpose of this report is to present dimensioned sketches of sufficient quality that a welder can fabricate the device. Drawings are dimensioned in inches.

Allowing 1/4 in. for torch cutting, the materials for construction of the source (in inches) are as follows:

1 steel plate, 0.25 x 15.5 x 33.5,
1 steel plate, 0.5 x 7.0 x 12.25,
1 angle iron, 1.5 x 1.5 x 90.0, and
1 steel block, 1.0 x 1.0 x 2.0.

Spikes for the source are machined from 5/8-in. diameter bolts. It is recommended that the spikes be cut with a taper. For operations on soft ground we use 6-in. long spikes; for operations on hard surfaces we use 3-in. long spikes.

The outer ring of spikes are bolted to the base plate using nuts on both sides of the plate and a lock washer under the upper nut. The short spike is screwed into the threaded hole in the 1-in. square block located at the center of the base plate.

An assembly drawing of the source is shown on figure 1. Details of the parts of the source are shown on figures 2 through 5.

REFERENCE

Hasbrouck, W. P., 1977, Working drawings of a Kirk shear wave source: U.S. Geological Survey Open-File Report 77-622, 6 p.

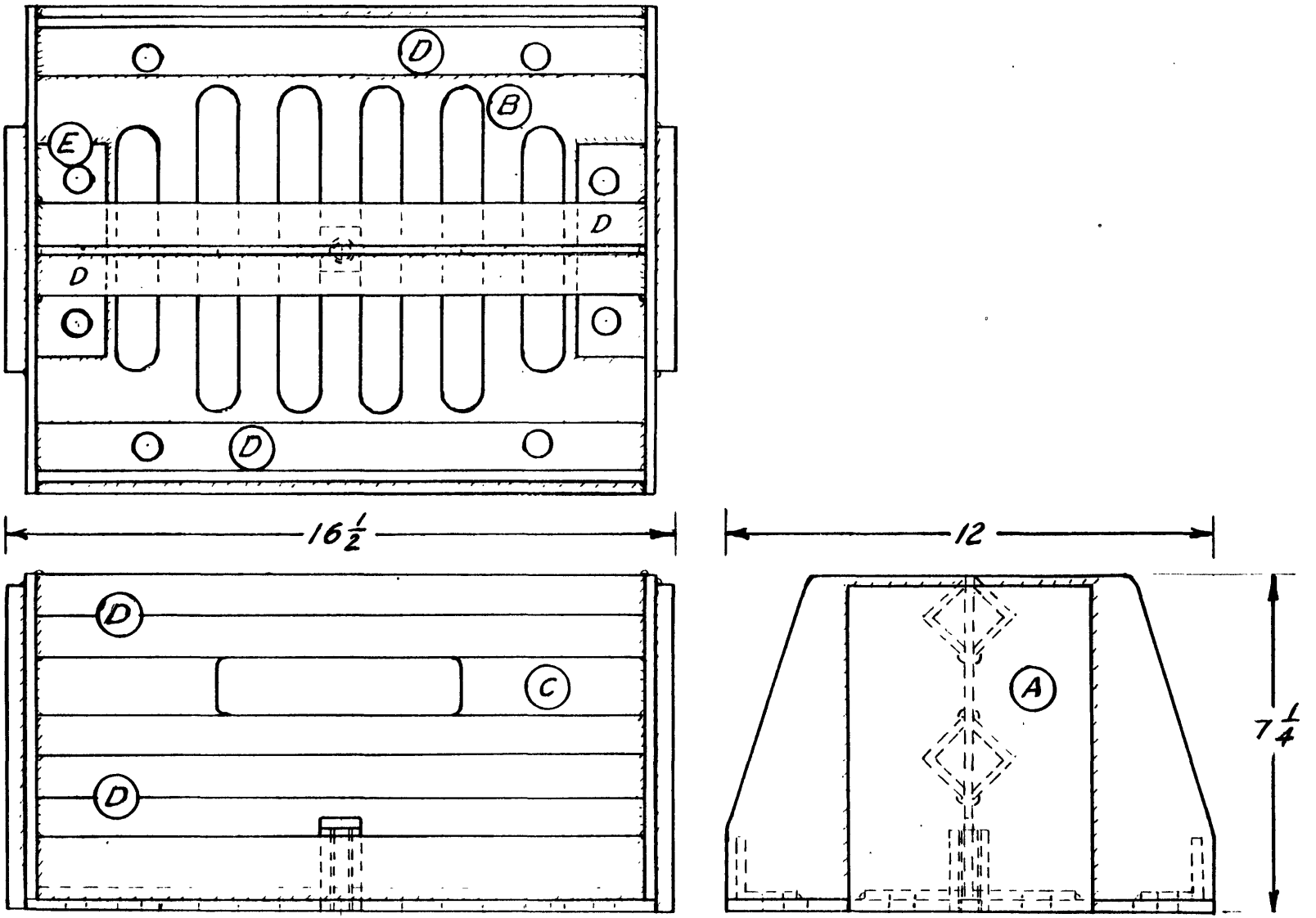


Figure 1. Assembly drawing of spiked-base, shear-wave source. All dimensions in inches.

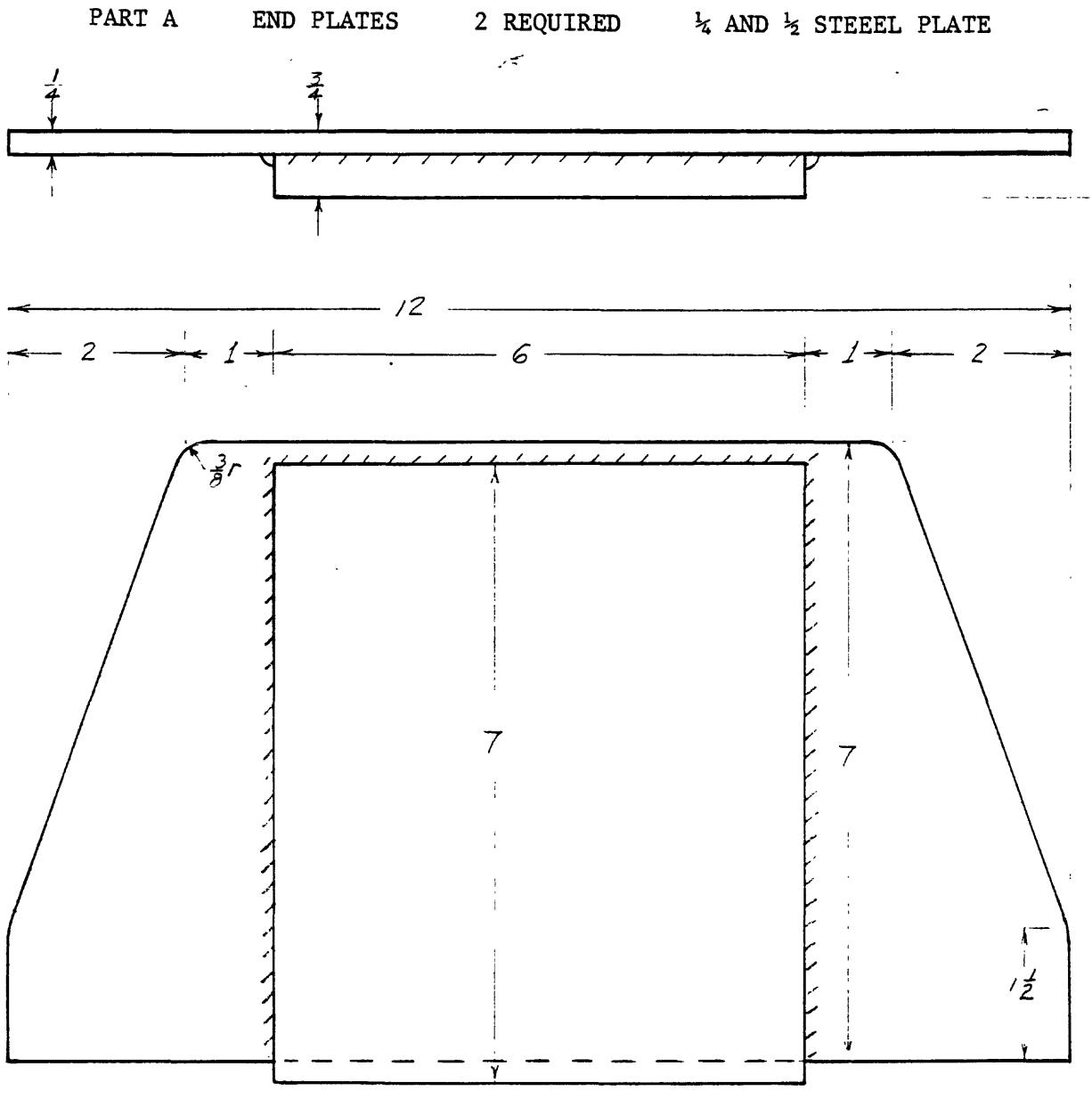
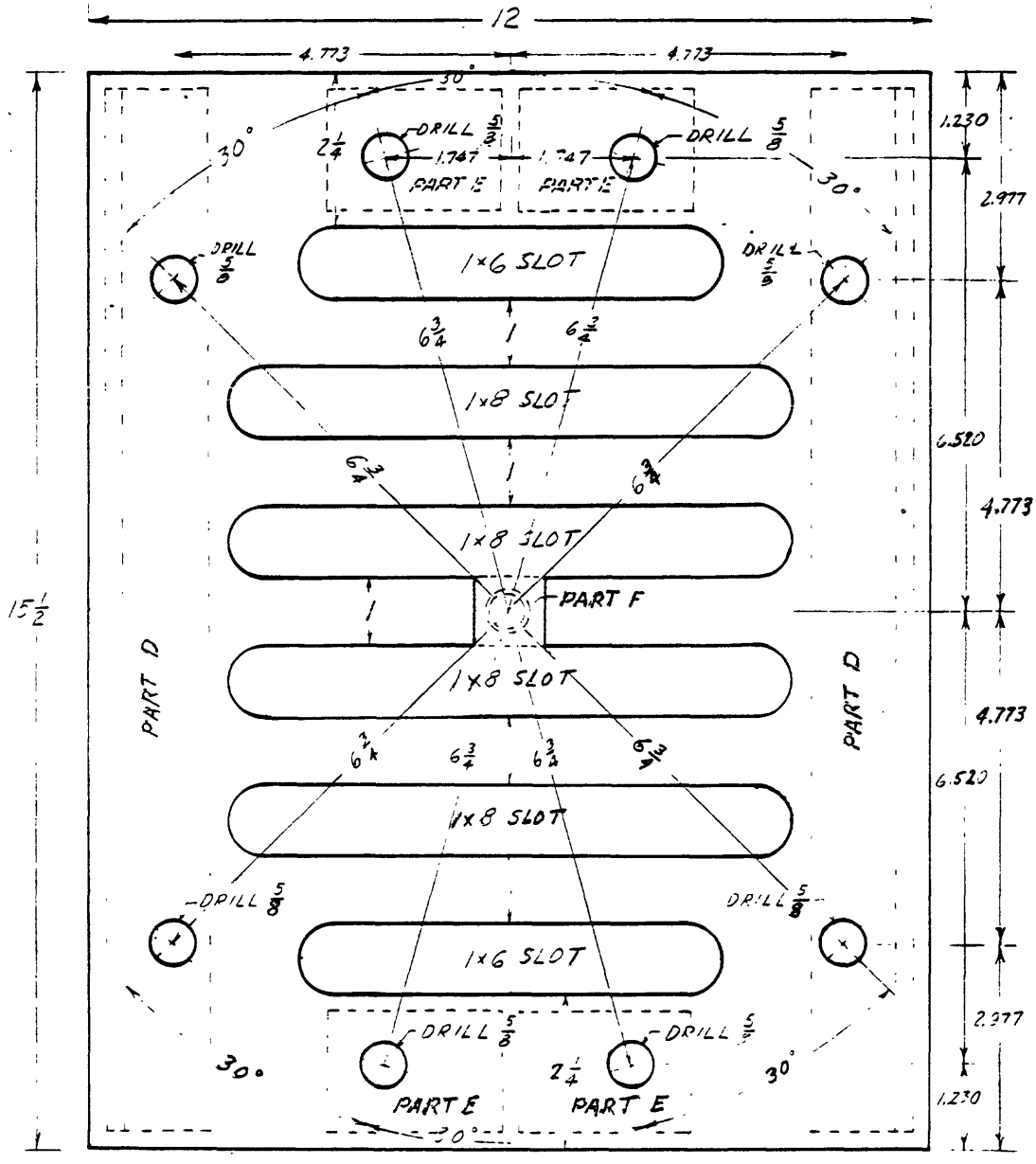


Figure 2. Details of end plates of spiked-base, shear-wave source.

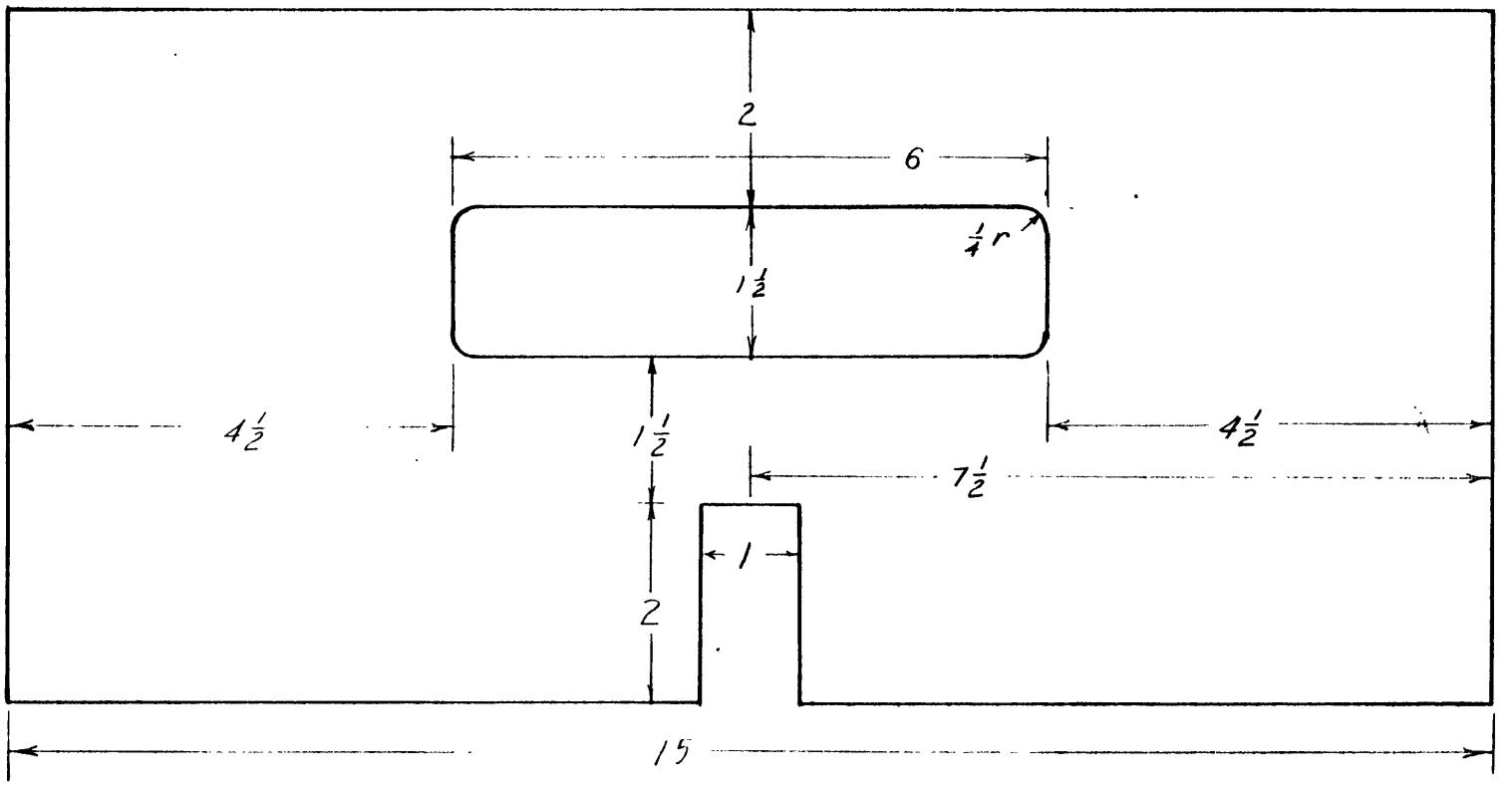
PART B BASE PLATE 1 REQUIRED ¼ STEEL PLATE



ALL DIMENSIONS IN INCHES

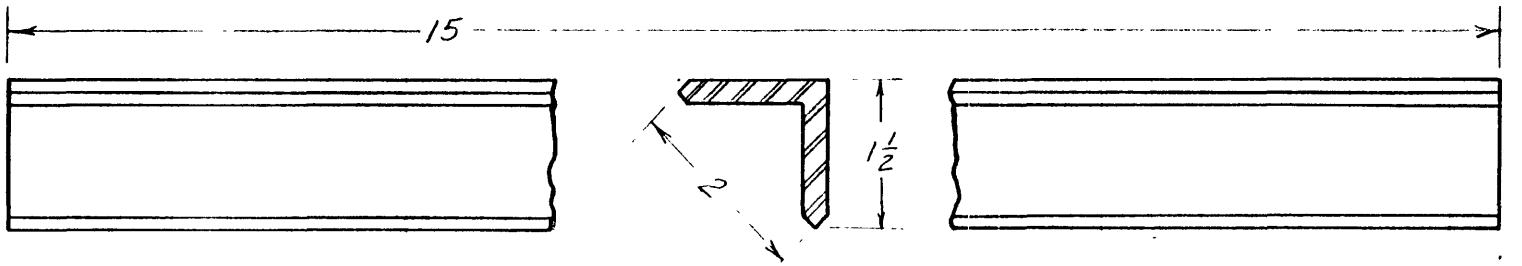
Figure 3. Details of base plate of spiked-base, shear-wave source.

PART C CENTER BRACE 1 REQUIRED ¼ STEEL PLATE



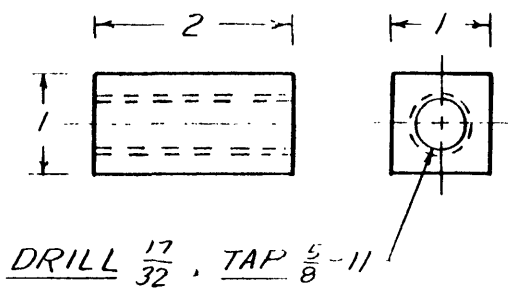
ALL DIMENSIONS IN INCHES

Figure 4. Details of center brace of spiked-base, shear-wave source.

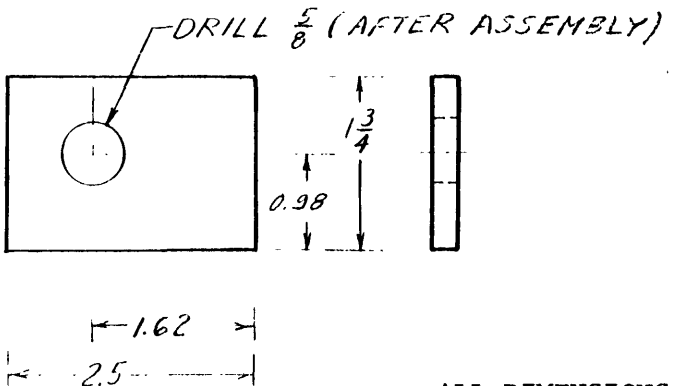


PART D ANGLE-IRON BRACES 6 REQUIRED (2 WITHOUT CHAMFERED EDGES)

PART F CENTER BLOCK 1 REQUIRED



PART E BOSSES 4 REQUIRED ¼ STEEL PLATE



ALL DIMENSIONS IN INCHES

Figure 5. Details of angle-iron braces, bosses, and center block of spiked-base, shear-wave source.