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A PORTABLE STANDARD INSTRUMENT SHELTER

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A PORTABLE STANDARD INSTRUMENT SHELTER[1]

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This paper describes a portable double-louvered instrument shelter (Figure 1) designed to meet the specifications of the World Meteorological Organization (Anon. 1961). The shelter was developed primarily for seasonal hygrothermograph stations used for ecological studies in the Rocky Mountains. Important features of the instrument shelter are:

1. Data measured in the shelter can be compared directly with data from meteorological organizations of most countries in the world.
2. The shelter is large enough to house all common instruments including thermographs and hygrothermographs.
3. Recording instruments do not have to be removed from the shelter for periodic service, and a reduction in disturbance increases accuracy.
4. The shelter can be folded down to less than one-third of its size for transport and can be solidly erected on either a tree stump or post from 3 to 12 inches diameter.
5. The shelter is inexpensive and is constructed from common materials.

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Figure 1.

Three portable instrument shelters, two assembled and one packed.

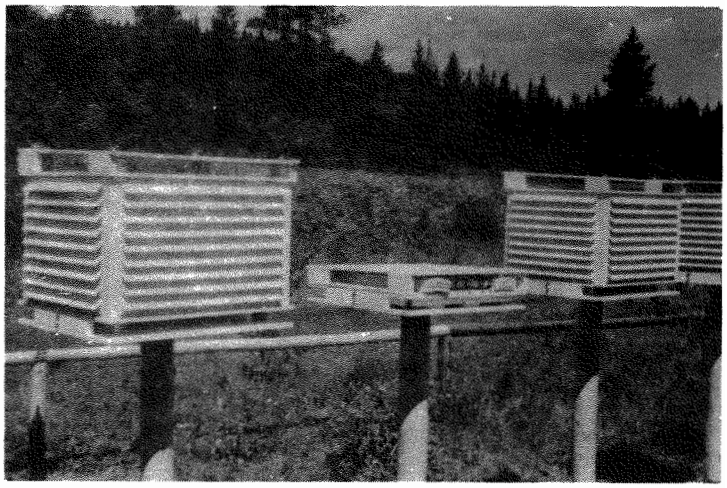
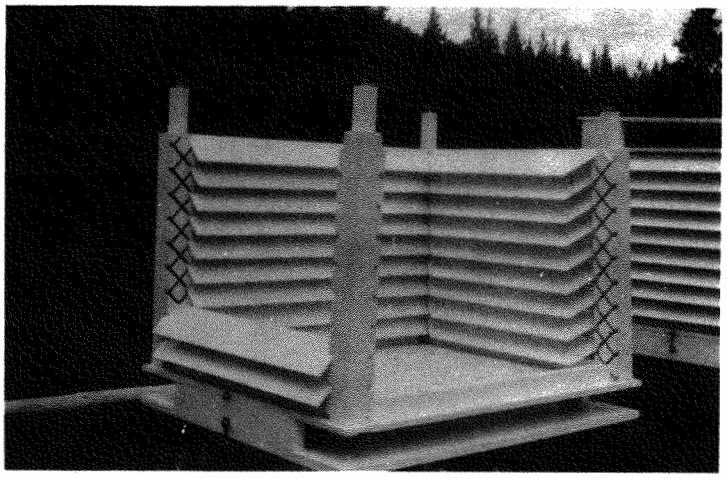


Figure 2.

To service the instruments the louvered section can be either lifted off as shown, or hinged up to one side.

Figure 3.

Method of setting up the louvers on the portable instrument shelter. Removeable springs keep tension on the corner posts until all are in place and the lower wing nuts are tightened.



There are several publications describing portable instrument shelters for field research that are not designed to standard specifications (Bauer and Buschner 1955, Hungerford 1957, Franssila 1961, Fraser 1961, Anon. 1963 and Van Arsdel 1963). MacHattie (1964) compared air temperatures measured in three portable instrument shelters of this type with those recorded in a standard Canadian Meteorological Service Stevenson screen. He showed that variations in design, particularly shielding, ventilation and insulation, cause differences in measured air temperature up to 3°F. Even when shelters of a similar design are used, the relative temperatures measured at dissimilar locations cannot be compared because of variation in radiation intensity and wind speed on each instrument site. Similarly it is not possible to calibrate portable instrument shelters that differ from the standard design with the standard.

The design and development of portable instrument shelters is stimulated by the need to find smaller and less expensive instrument shielding than the traditional Stevenson screen. Recent work has shown that the Stevenson screen is subject to lag and to over heating errors although it is the accepted standard (Bauer and Buschner 1955, MacHattie 1964). Research is needed to develop a new standard instrument shelter in modern materials that provides superior shielding, is inexpensive and is suited to most applications. Until such as shelter is accepted at the national or international level the Stevenson screen will be the standard.

The instrument shelter described in this paper was specifically developed to fit the specifications for a standard instrument shelter.

Air temperature and humidity data measured in it can be compared with confidence to meteorological service data.

The shelter was field tested in 1964 and was found to be entirely satisfactory. Three to four shelters can be carried in the trunk of a standard sedan automobile. A shelter can be completely erected in thirty minutes and repacked in less than fifteen. The shelter is not suited for use on stations at which frequent readings are taken because the louvered section must be hinged up or removed. It is ideal for intermittant stations where daily or weekly measurements are made.

Description

The portable shelter is built of wood painted white. It weighs 35 pounds (without carrying box) and measures 25 by 20 by 19½ inches when erected and 25 by 20 by 5½ inches when packed for transport. The shelter has a double roof, double ventilated floor and double louvering so that all radiation is excluded. Sufficient space is provided to accommodate all common meteorological instruments including the largest hygrothermographs. The shelter features removeable corner posts and cloth-hinged double louvers that can be flattened. These are all packed between the roof and floor boards for transport (Figure 1). Access to the instrument is obtained hinging the entire upper louvered section or by removing it from the instrument platform (Figure 2). Recording instruments can be serviced without disturbance; an advantage not found in equivalent sized Stevenson screens. When packed the instrument shelter kit includes the

following components:

1- double roof
1- instrument platform
1- screen base
2- 19 1/2" corner posts
2- 18 1/4" corner posts
18- short louvers
18- long louvers
4- 3" angle brackets
4- 1/8" wing nuts
16- washers
8- 3/16" wing nuts
4- springs

1- carrying box (optional)

Cost and Construction

The materials for each shelter cost $20 in 1964. One and one-half man-days are needed to saw out, assemble and spray paint each shelter. A list of the materials required to build a single instrument shelter follow:

Roof

21" x 25" x 3/8" fir ply
20" x 25" x 3/8" fir ply
1'4" lin. 3/4" x 4" clear pine

Floor

20" x 25" x 3/8" fir ply
20" x 25" x 1/2" fir ply
4' lin. 3/4" x 1 5/8" clear pine
7' lin. 3/4" x 1" clear pine

Corner Posts

7' lin. 1 5/8" square clear pine

Louvers

4' x 8' x 1/8" mahogany ply

Miscellaneous

25 yds. 1" twill tape
1'4" x 3/16" threaded brass rod
16 - 3/16" brass wing nuts
16 - 3/4" plated steel washers
16 - 1 1/4" plated steel washers
4 - 3" steel angle brackets
4 - 3/4" x 1/8" plated bolts
4 - 1/8" plated hex. nuts
4 - 1/8" brass wing nuts
4 - 14" screen door springs(paint, nails, screws, glue, staples and wire)

Carrying Box (optional)

22" x 26" x 1/4" fir ply
8' lin. 3/4" x 5 1/2" common spruce
4 - brass hooks
1 - carrying handle

(net measurements)

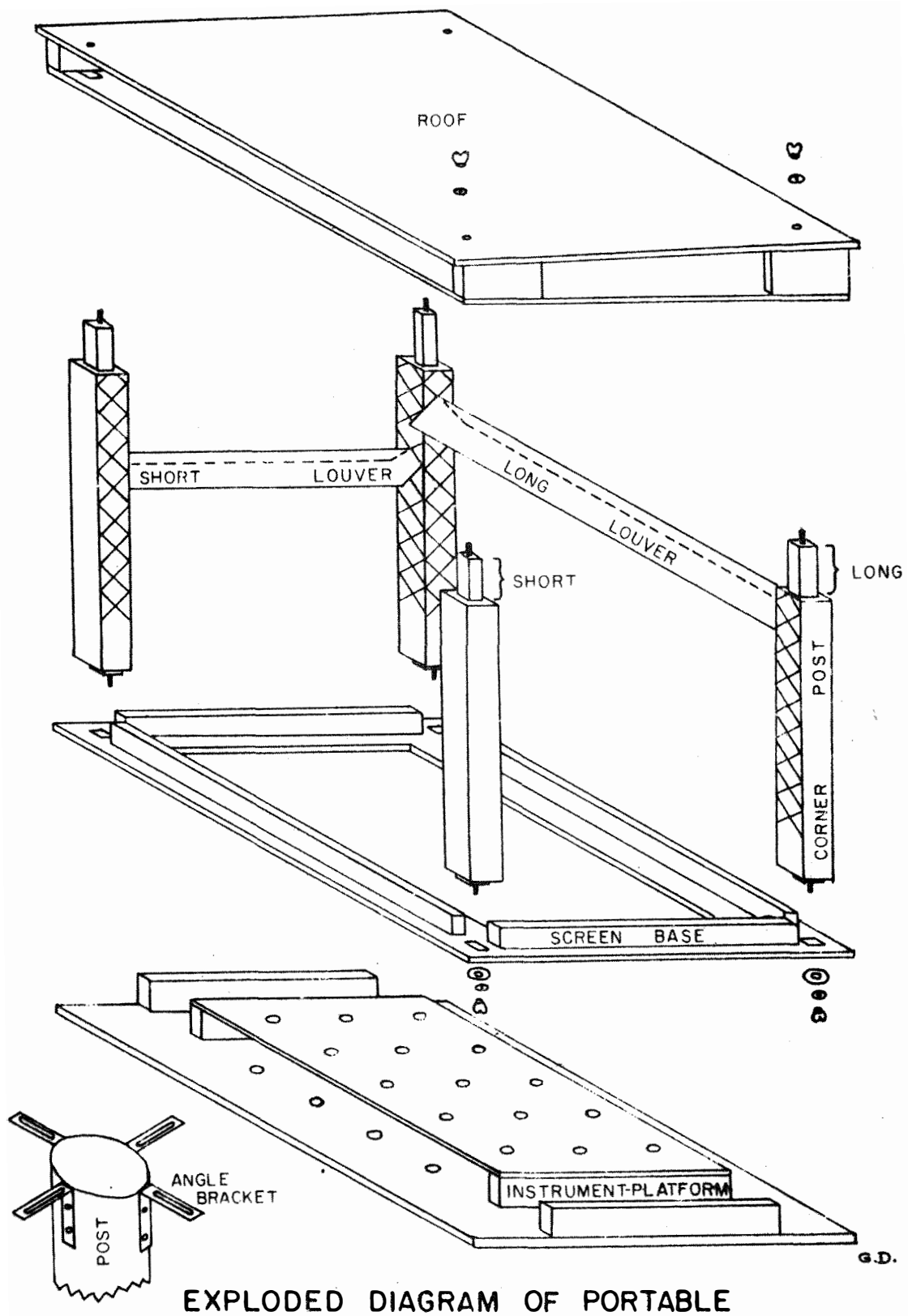
A construction plan is attached. The 3/16" slots in the corner posts are cut with a radial arm circular saw set at 45°, and the stock is moved along a fence marked at 1 1/2" intervals between each cut. The louvers are cut on a simple jig to ensure an exact length. They are hinged with twill tape glued on and stapled. The roof and floor are assembled with white glue and finishing nails.

Erection Instructions

1. Attach the slotted arms of the four 3-inch steel angle brackets to the bolts projecting from the underside of the instrument platform with wing nuts (plan and Figure 4). Space the brackets to fit the four sides of the stump or post prepared for mounting the shelter, tighten the wing nuts and secure the brackets with screws.

2. Place the screen base with its reinforcing bars uppermost on the instrument platform (Figure 4). Insert the small ends of the corner posts in the square holes in the screen base. Loosely fit washers and wing nuts to the projecting threaded rod, ensuring that the incised sides of the corner posts face each other and that the long and short corner posts are paired on the long side of the screen base as in Figure 4.

3. Hook the long springs between the threaded rods projecting from the top of the cornerposts so that they are parallel to the long sides of the screen base. Similarly hook the short springs parallel to the short sides (Figure 3). Fit the long louvers, one at a time, in each side, starting at the screen base and working to the top. Similarly fit the



EXPLODED DIAGRAM OF PORTABLE

DOUBLE LOUVERED STEPHENSON'S SCREEN

short louvers. The springs allow the corner posts to be separated enough at the top to snap the louvers into position and hold them after insertion. Tighten the wing nuts at the base of the corner posts and remove the springs.

4. Fit the roof with the higher side corresponding with the long corner posts. Fit the washers and wing nuts retaining the roof and tighten.

To dismantle, reverse the procedure omitting the use of the springs. To pack for transport, invert the screen base and store the corner posts, louvers (folded flat), and metal parts between the double roof and floor boards.

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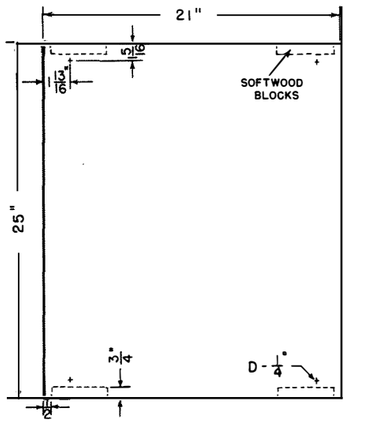
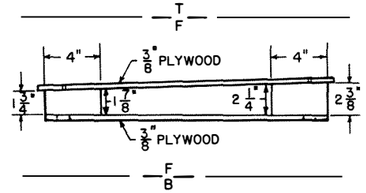
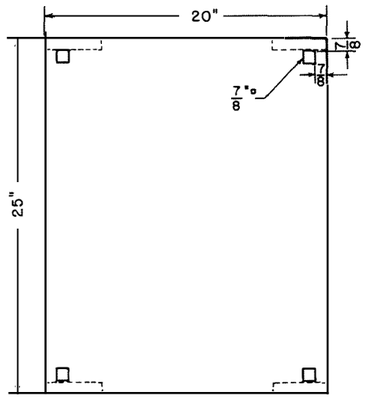
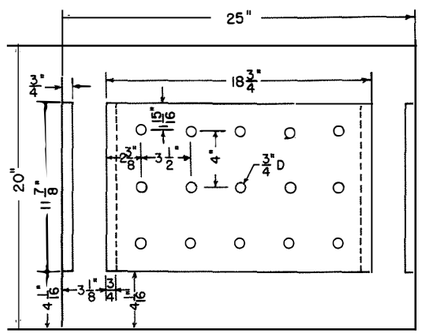
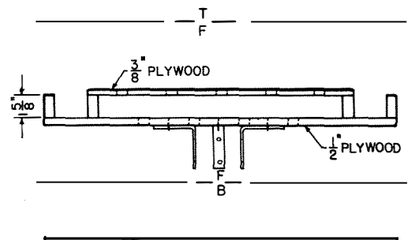


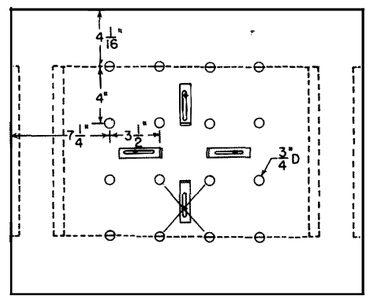




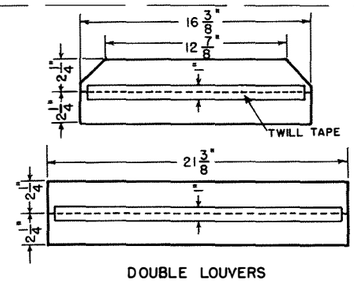
ONE PIECE DOUBLE ROOF



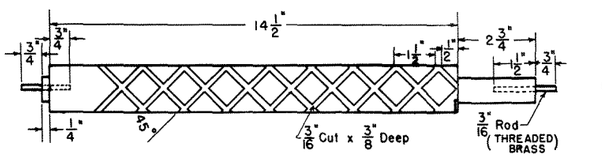




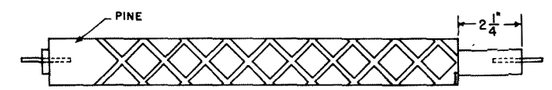
SCREEN STAND AND RAISED INSTRUMENT PLATFORM



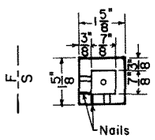
DOUBLE LOUVERS

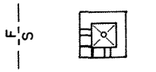


TWO OF EACH POST NEEDED

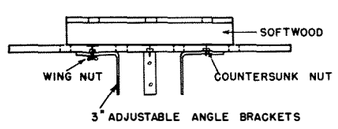


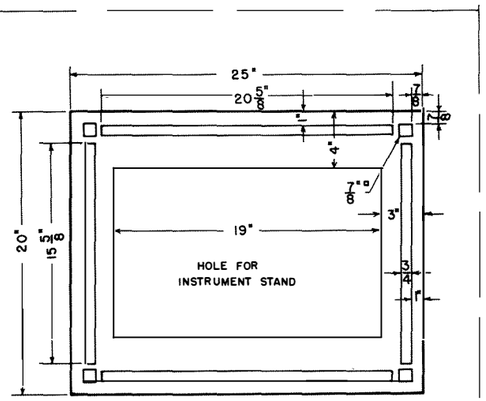
CORNER POSTS

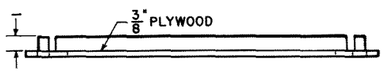




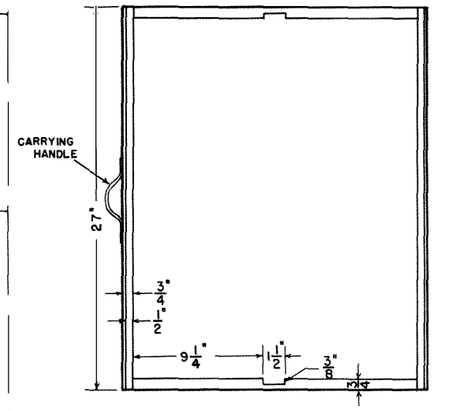
ANGLED CUTS ON TWO SIDES







SCREEN BASE



SCREEN TRANSPORT BOX

PLAN OF PORTABLE DOUBLE LOUVERED INSTRUMENT SHELTER

W.M.O. SPECIFICATIONS