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Technical Report No. LWL-CR-04B71

IMPROVED WASTE DISPOSAL UNIT

Final Report

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By
Harold H. Rosen
Biological Sciences Branch

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U. S. ARMY LAND WARFARE LABORATORY
Aberdeen Proving Ground, Maryland 21005

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ABSTRACT

A low-cost, disposable latrine system was developed as a substitute for honey-bucket, pit and burn-out type latrines. This system, weighing approximately 125 pounds, consists of a 4 ft x 2 ft x 2 ft fiberglass box and lid with plastic piping. It is field assembled without special tools and requires only the digging of a trench and the fabrication of a latrine box for its emplacement. The unit is available in the supply system as FSN 4540-762-9450.

FOREWORD

The development described herein was accomplished in-house; only the tanks were fabricated under contract. Corps of Engineers personnel at Fort Dix, New Jersey, are due thanks for their cooperation and assistance in testing the first prototypes.

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INTRODUCTION

In Vietnam the practice of using burn-out type latrines proved to be highly unsatisfactory for various reasons and was cited as a problem area in several reports. The purpose of this task was to find a solution to this problem. More recently, the requirements for ecological acceptability for systems accentuated the search for new developments in waste disposal.

CONCLUSIONS

A. The septic tank principle is an acceptable solution to the problem. The principle has been in effective use for a long time and as applied here, without the large quantities of flush water generally associated with home use, even soils with poor percolation are amenable to this system.

B. Using this principle, an inexpensive and therefore disposable unit, compact, lightweight, but capable of handling the waste of up to two hundred men per day is possible.

DEVELOPMENT CHRONOLOGY: TEST AND EVALUATION

This development was conducted in three phases. In the first phase the feasibility of using a septic tank principle was demonstrated; in the second phase a number of units based on this principle were fabricated and evaluated in the Republic of Vietnam. In the third phase the final and improved version, which contained the changes suggested by this evaluation, was fabricated. The report of Phase I and Phase II is contained in USALWL Technical Report No. 69-15, October 1969, and will be summarized here.

A. Construction and Assembly of First Prototype Unit. The first consideration was the determination of the desired size of the system. Since the organizational unit generally involved in setting up and operating latrines is a company, this was the basis for the computation. The average daily output in man is 1500 cc's (about 1½ quarts) of urine and about 150 grams (1/3 pound) of feces. The volume of the feces can be disregarded as negligible. For a company of two hundred men, we would then have 200 x 1½ quarts = 300 quarts or 75 gallons of liquid waste. The requirement for a septic tank is that the capacity should be large enough to hold at least 24 hours of sewage flow. Another requirement is that for a rectangular tank, the length be two or three times the width. From these data and requirements a 100 gallon capacity tank, 2 ft wide x 2 ft deep x 4 ft long was chosen. This tank provided one seat only. The tank for the

above was made of polyethylene. The piping was standard drain, waste and vent pipe, two-inch diameter for the outlet and four-inch (the largest commercially available size) for the inlet. The outlet pipe was cut into about three-feet sections so as to fit inside the tank for shipping. One section had a sanitary tee and a bulkhead fitting on it. Another section was perforated to allow the effluent to seep out. Five other sections were provided to give twenty feet of effluent line. The section with the tee, the first section, is passed through a hole in the tank wall and secured with the bulkhead fitting. The other sections are joined together using couplers and adhesive provided. The last pipe in the line is the perforated one. When the pipe has been assembled to the tank, the assembled unit is placed in the prepared ditch and hole. The lid is placed on the tank. The lid has a hole in one end of the top to which is bolted a standard toilet bowl flange to provide a seal around the inlet. The latrine box is moved over the tank and lined up with the hole in the tank lid, then the inlet tube is passed through the latrine box and into the tank. The inlet tube in this prototype was assembled from the four-inch pipe mentioned above and an eleven-inch diameter polyethylene funnel which formed the bowl. A toilet seat provided with the kit is fastened to the latrine box. About fifty gallons of water are added to the tank. The ditch is back-filled and the latrine is ready for use.

B. Field Evaluation of First Prototype Units. Two units were emplaced in a training area at Fort Dix, New Jersey. They were placed side by side to form a "two hole" latrine. The area chosen consisted of sandy soil surrounded by marshy terrain. The unit performed well for several months while in daily use by about a company of men. Eventually the latrine was abandoned because the water table in the area rose above the tank level.

Fifty systems were fabricated and shipped to RVN for test and evaluation. About one-half of these units were emplaced and tested by two Divisions, the Americal and the First Cavalry. In summary, the Americal Division experienced a good deal of trouble in the operation; the First Cavalry Division thought the units operated well. The Americal Division had clay and rock soil to contend with; the First Cavalry Division had a variety of soils. The following deficiencies were reported:

1. The polyethylene tank and lid were not rigid enough and had a tendency to deform and collapse when back-filled.

2. The inlet tube was too narrow and had a tendency to clog.

3. Two inlets should be provided per tank rather than one.

The general finding was that the principle has merit and is preferable to the standard burn-out technique in common use.

C. Final Prototype Fabrication and Evaluation. Since the concept of the system appeared to be acceptable, the third phase, the design and fabrication of a version incorporating the suggested changes, was initiated. In this prototype the tank size was doubled from 4 ft long x 2 ft wide x 2 ft deep to 4 ft long x 4 ft wide x 2 ft deep. The material of construction was changed to 1/4-inch fiberglass, the inlet tube diameter was increased to six inches and constructed of fiberglass, and two inlets per tank were provided. Appendix A fully describes the system.

One system was taken to Fort Dix, New Jersey, and installed in a training area where it functioned well. Forty additional systems were fabricated. Seventeen of these units were sent to Fort Dix, of which six have been installed, and to date no report has been received. Three systems were sent to Fort McClellan, Alabama, where they were used through the summer of 1972 in a National Guard Training area. The three units were set up separately and each served 97 to 100 men per weekend. The report received on these was very favorable. To quote: "The latrines are ideal in our situation. No problems encountered. I believe you have found the answer to our problem."

DISCUSSION

The results to date indicate that this latrine system can function as a substitute for the pit and "honey bucket" type of latrine and is much simpler to operate and maintain. This system can be manufactured cheaply enough to make it disposable and applicable for short-term use.

As this development was drawing to a close, it was learned that the Office of the Chief of Engineers had been directed to find a system more acceptable in terms of ecological constraints than the present temporary latrine systems (honey bucket, straddle trench, pit latrine). A data package covering the LWL Improved Waste Disposal System was provided to OCE and from this OCE determined that the system fulfills their present requirements. This system, therefore, was included in the appropriate supply catalog. The system was subsequently assigned FSN 4540-762-9450.

APPENDIX A
INSTALLATION AND OPERATION OF THE USALWL WASTE DISPOSAL UNIT

1. Introduction:

The USALWL waste disposal unit is essentially a small septic tank, designed to replace the "honey bucket" and pit type latrines. Once installed it should require little or no attention beyond the cleaning of the latrine and bowl. It does not require or use chemicals.

2. Description:

The parts of a complete unit are shown in Figure 1. Each unit consists of the following parts:

a. Tank, 1 each, 200 gallons, 4 ft x 4 ft x 2 ft, fiberglass.

b. Tank Lid, 1 each.

c. Inlet Assembly, 2 each.

d. Effluent Assembly, 1 bundle, contains 1 each 2" pipe with tee and fitting attached, 4 each 2" pipe with connectors attached, 1 each 2" perforated pipe with connector attached.

e. Toilet seat, 2 each.

f. Adhesive, 1 can and brush.

As many as three units may be shipped nested together. The inner unit will contain enough items (c through f) to make as many complete units as there are tanks and lids.

3. Installation:

Installation will require the digging of the proper size hole, construction of the latrine box and assembly of the tank and piping. The latrine box and inclosure design and construction is up to the user; FM 21-10 is a good guide. It may be possible to adapt an available latrine box and inclosure. Sites for latrines should be chosen in accordance with the recommendations in FM 21-10.

Detailed instructions for the installation and assembly are given and shown in the photographs that follow.

4. Maintenance:

Latrine and bowl area should be cleaned daily. Flush bowl with about one gallon of water; do not pour large quantities of concentrated germicide or detergent into tank. If paper or other matter plugs inlet pipe, it can be cleared by poking a long stick down into the pipe. No chemicals are required or provided.

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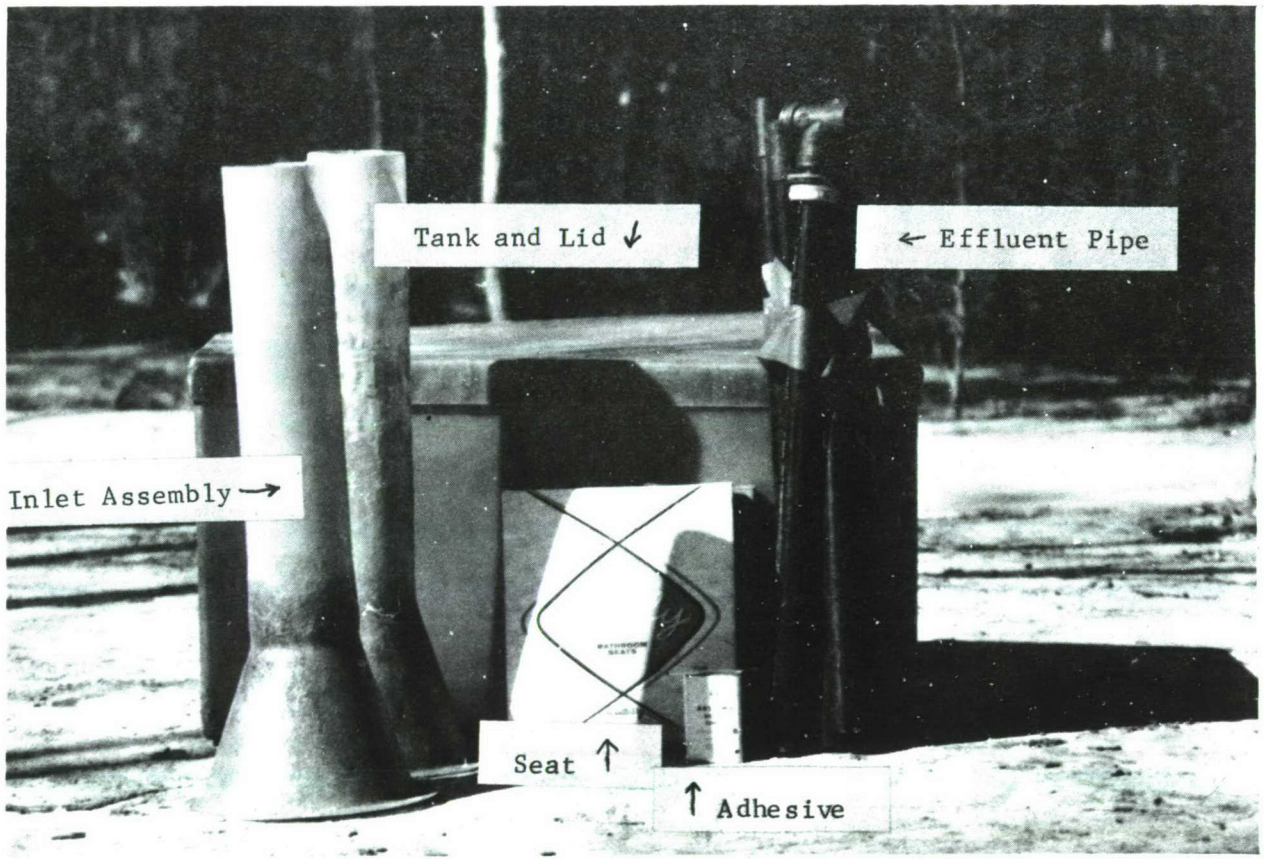

FIGURE 1. Component Parts of Unit

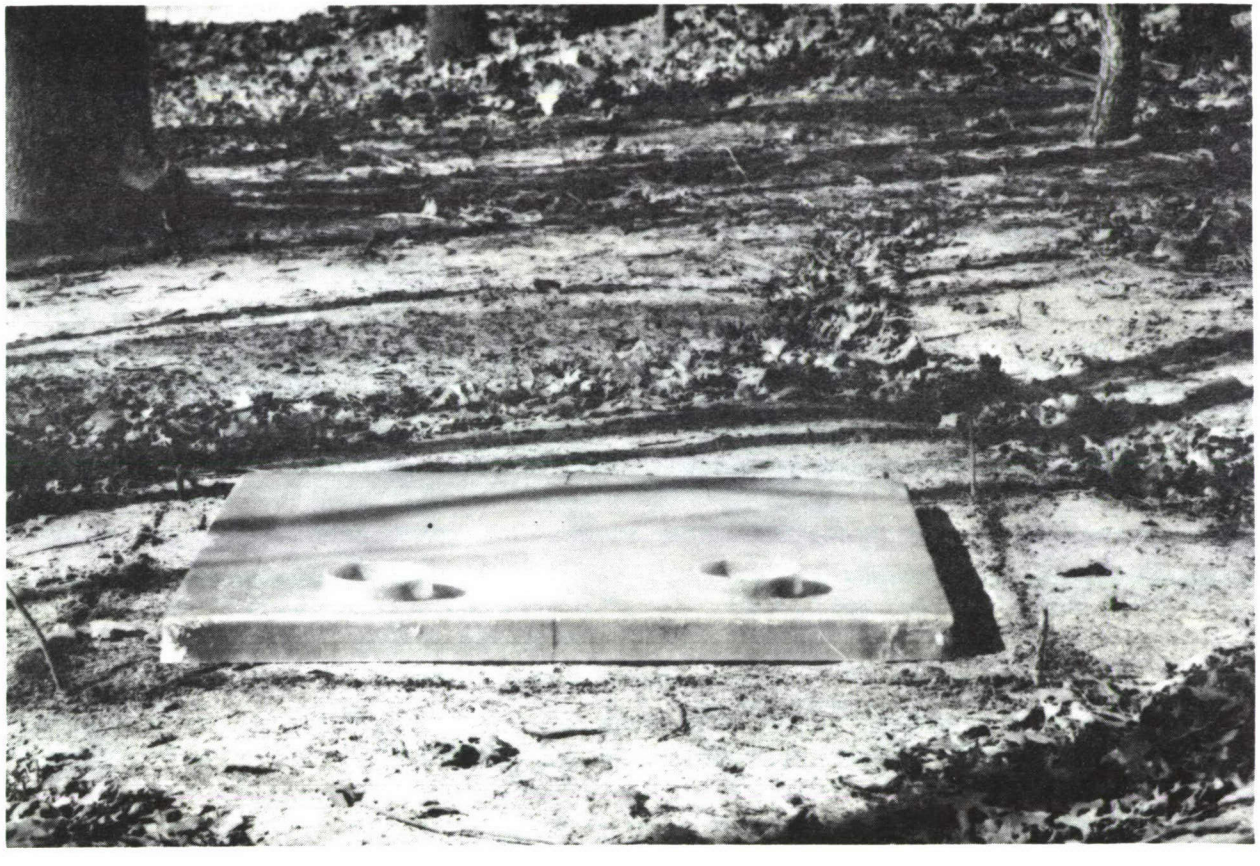

FIGURE 2. Using the tank cover, mark out the hole to be dug for the tank. The hole should be 3 to 6 inches larger than the cover. The hole should be about 3 ft. deep. Remove sharp rocks, roots, etc. from hole to prevent damage to tank.

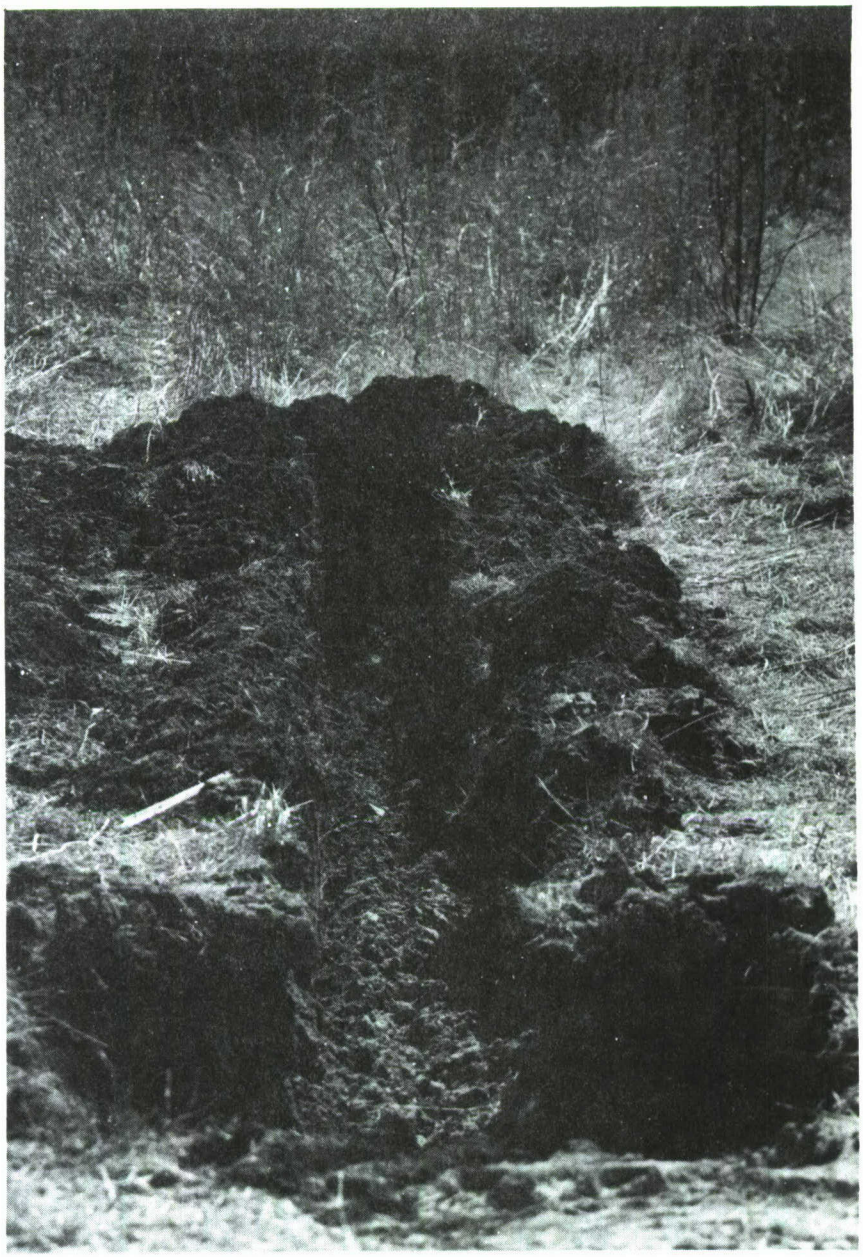

FIGURE 3. The trench for the effluent pipe is extended from the tank hole - 20 ft. long - at least 3 inches wide. It should be about 1 ft. deep at the tank end - deepening to about 2 ft. at the far end.

FIGURE 4. Dig down at least an extra 2 ft. in the last 6 ft. of ditch and prepare a porous bed of small rocks, gravel or sand to aid drainage. This is especially necessary in nonporous (clay) type soil.

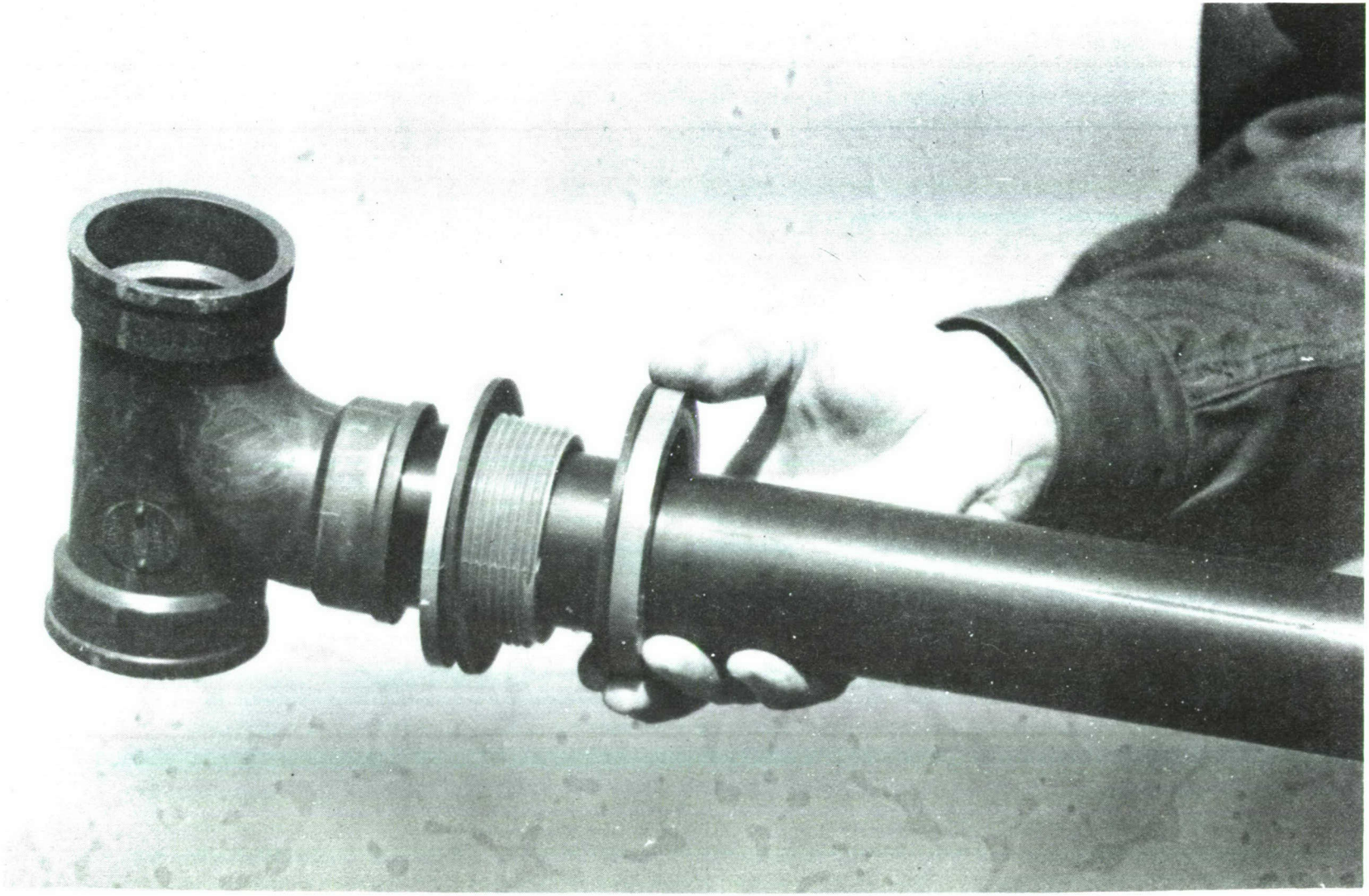

FIGURE 5. Start assembly of unit - Remove nut and 1 gasket from flange on 2" pipe with tee.

FIGURE 6. Pass pipe through hole in side of tank - tee is placed inside tank with curved part of tee down.

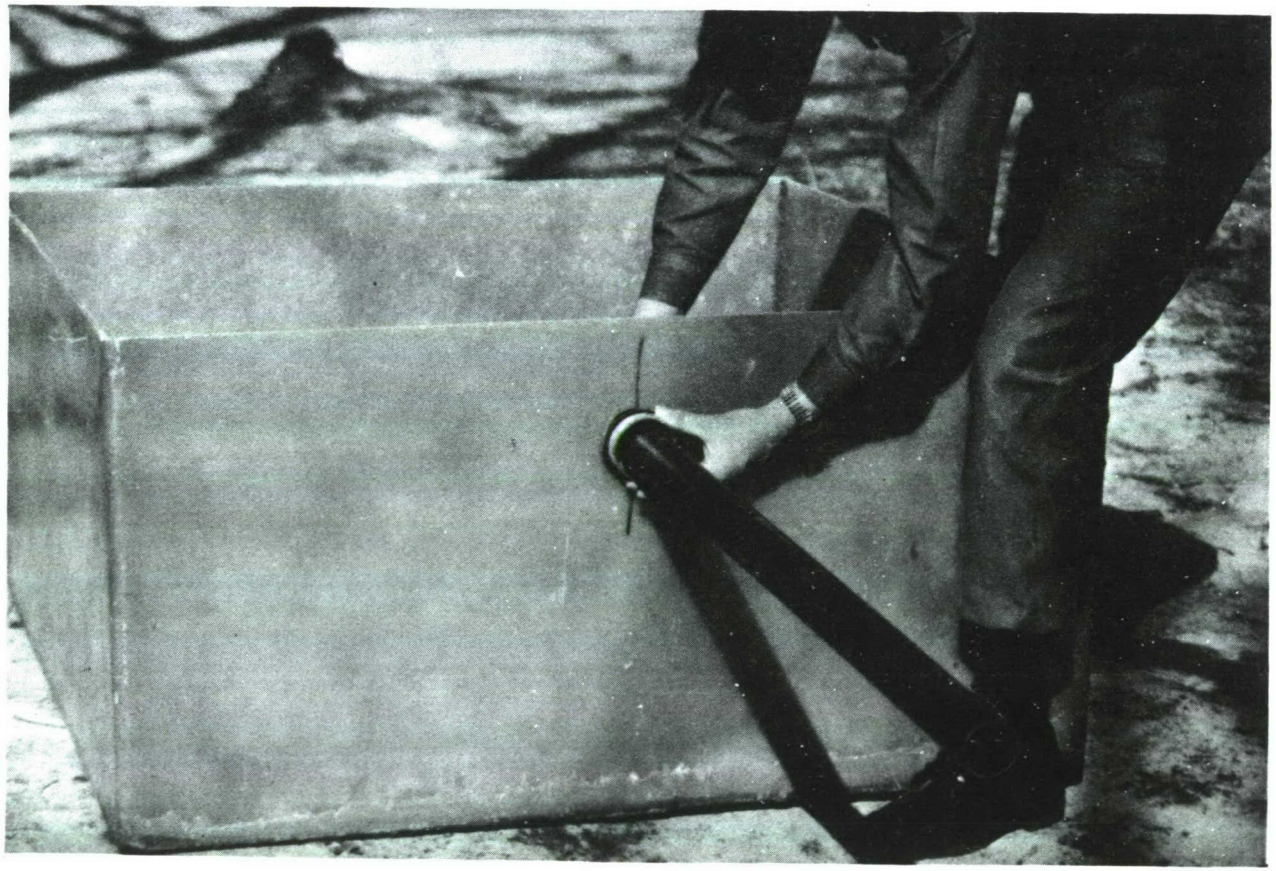

FIGURE 7. Slide gasket and nut over pipe - draw up tight - tee in tank should point up and down.

FIGURE 8. Assemble rest of 2" pipe - adhesive is applied to pipe end then coupling end of next piece of pipe is slid on. Do this fast - adhesive sets up rapidly.

FIGURE 9. Put perforated pipe on last.

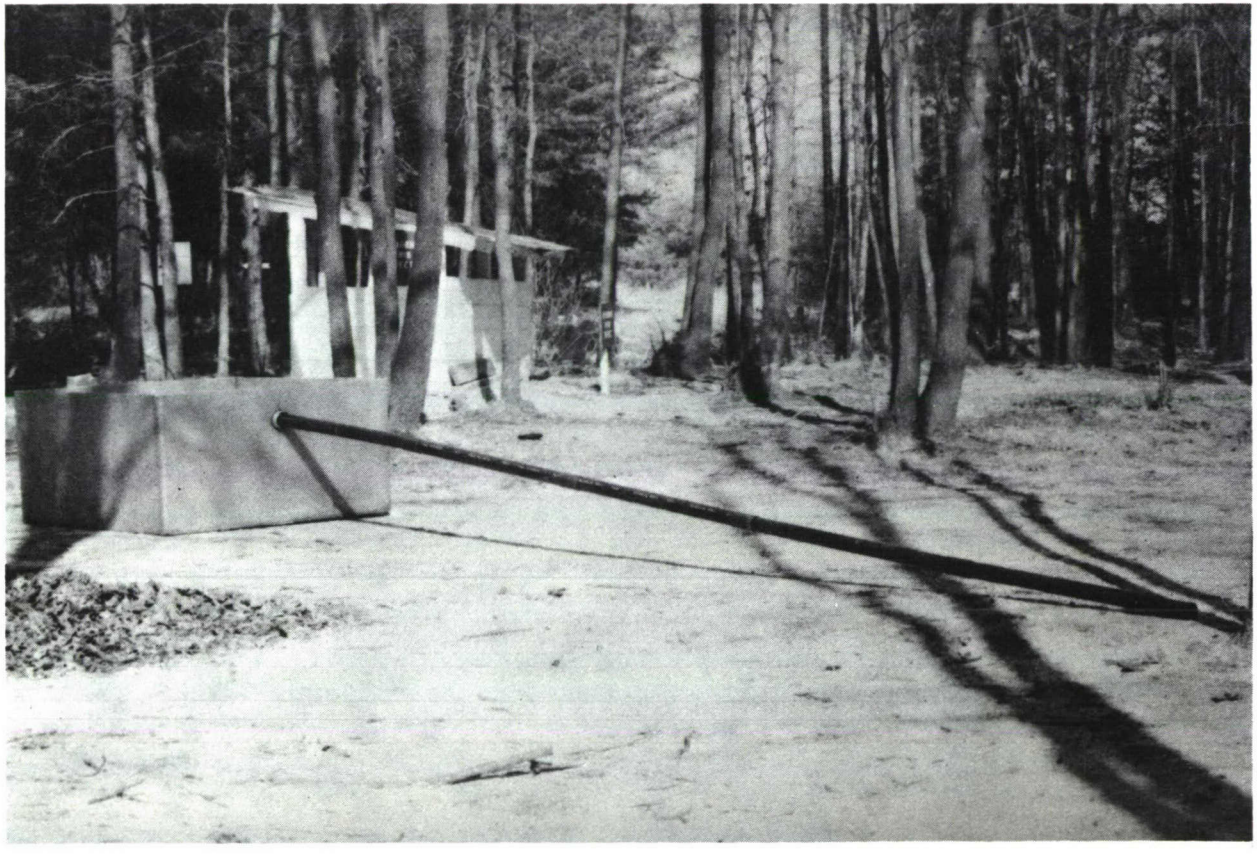

FIGURE 10. Assembled pipe should look like this.

FIGURE 11. Place tank with lid on into hole and pipe into ditch. Tank should be from 6 to 12 inches below ground level; pipe should slope down from tank to end of ditch to allow run off. Holes in lid must be on side away from effluent pipe.

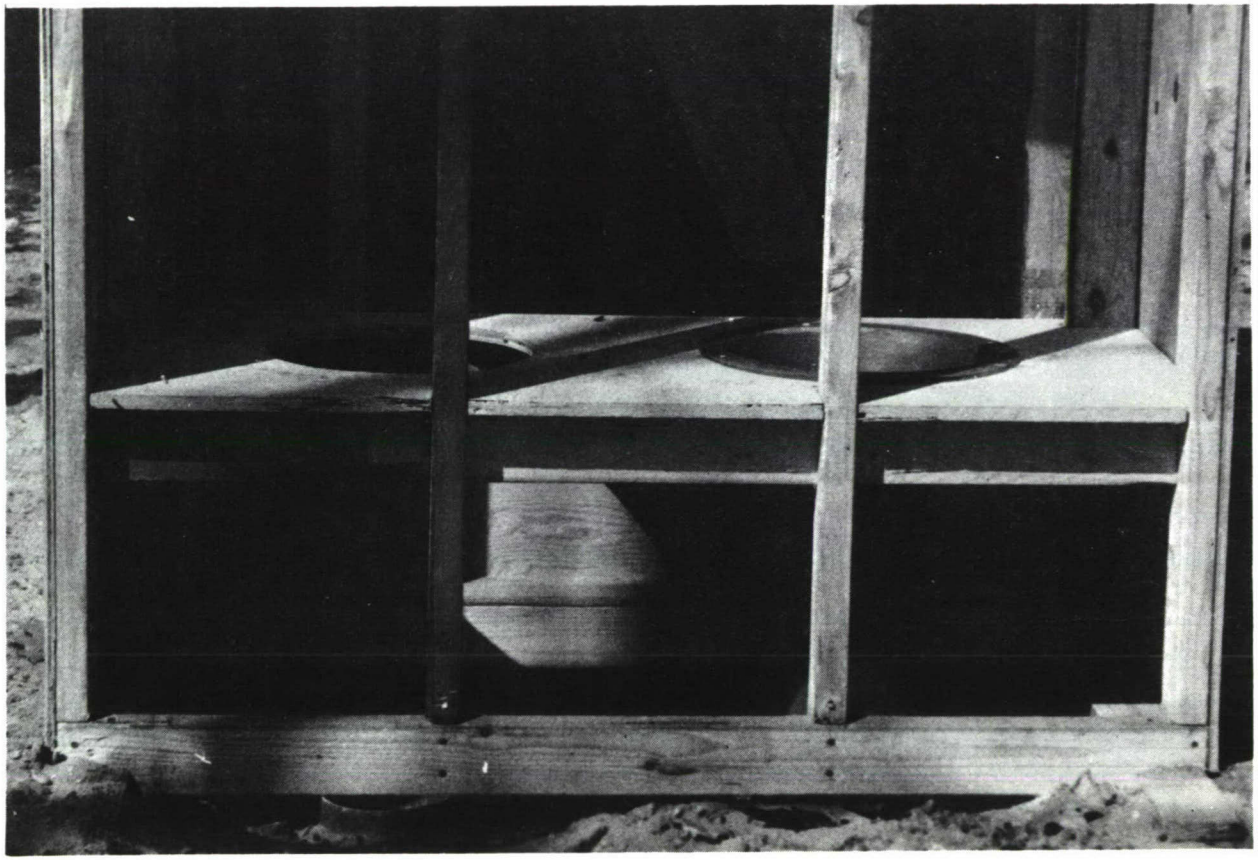

FIGURE 12. Place latrine box over tank - holes in seat should be lined up with center of holes in tank lid. Hole in seat is approximately 13½" in diameter - bowl can be used as a template.

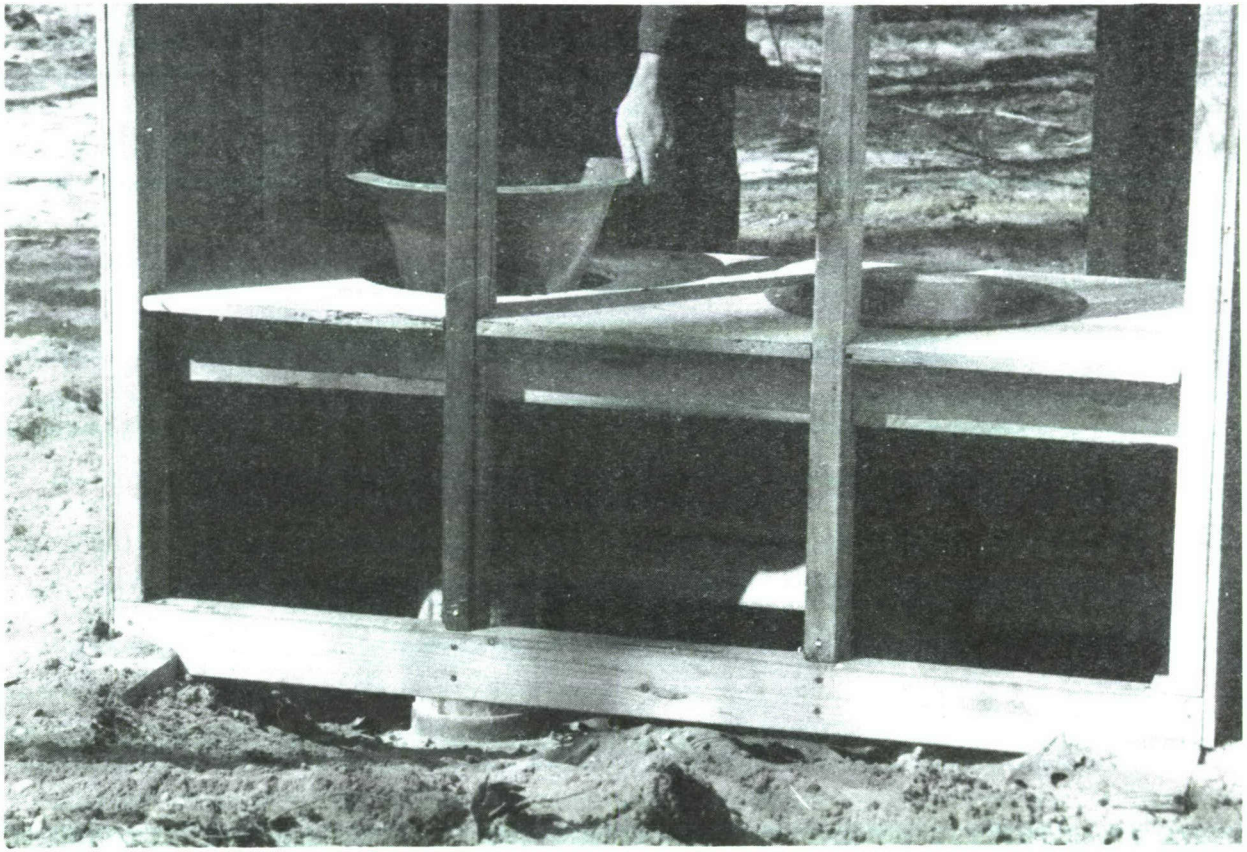

FIGURE 13. Pass pipe through seat hole, and through hole in the lid. Pipe should extend at least 12" into tank when the bowl is seated.

FIGURE 14. Bowl flange is pressed onto latrine box and screwed down - screws are provided.

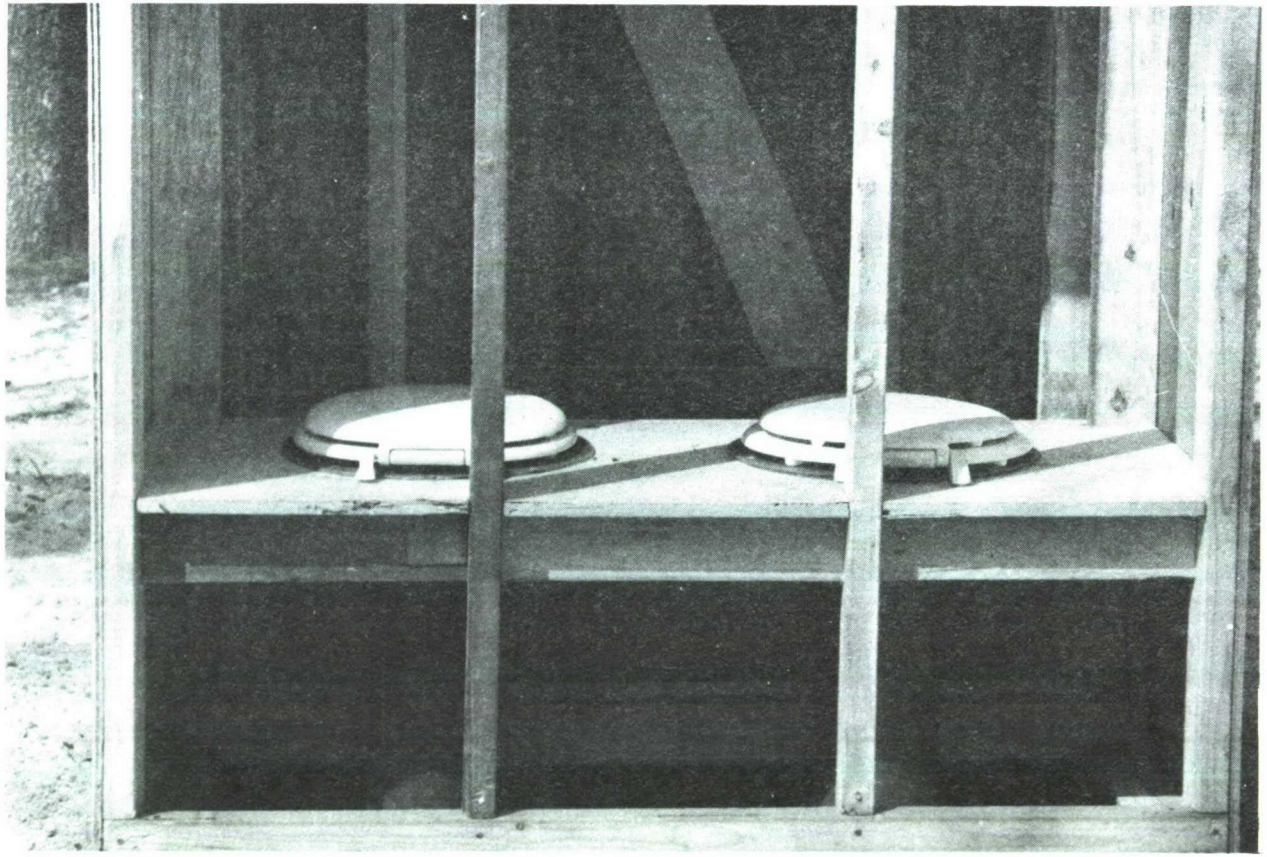

FIGURE 15. Toilet seats are mounted to latrine box.

FIGURE 16. Place a board, cardboard or plastic over (not around) perforated pipe to keep earth from packing and blocking drain holes. Backfill ditch and tank hole. Pour about 100 gallons of water (non-potable is all right) into tank and then pour about 1 quart of motor oil (used oil is satisfactory) down each inlet. This will form a seal to keep down odors and flies. Unit is now ready for use.

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13. ABSTRACT

A low-cost, disposable latrine system was developed as a substitute for honey-bucket, pit and burnout type latrines. This system, weighing approximately 125 pounds, consists of a 4 ft x 2 ft x 2 ft fiberglass box and lid with plastic piping. It is field assembled without special tools and requires only the digging of a trench and the fabrication of a latrine box for its emplacement. The unit is available in the supply system as FSN 4540-762-9450.

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