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AN/SSQ-57A SONOBUOY MODIFICATIONS FOR REUSABLE OPERATION.(U)

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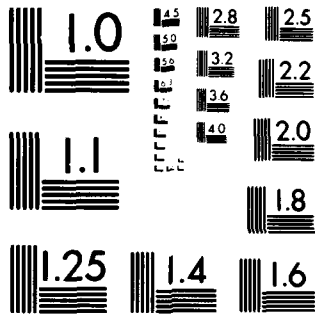
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AN/SSQ-57A SONOBUOY MODIFICATIONS FOR REUSABLE OPERATION

Lewis A. Thompson

OFFICE OF NAVAL RESEARCH
Contract N00014-75-C-0161



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TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION	1
SECTION I - GENERAL DESCRIPTION	3
SECTION II - DISASSEMBLY INSTRUCTIONS	5
SECTION III - MODIFICATIONS	7
SECTION IV - OPERATION	27
PARTS LIST	29

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INTRODUCTION

Several modifications have been made to the AN/SSQ-57A Sonobuoy for reusable operation from surface craft. Internal rechargeable batteries and a hydrophone cable reel allow the retrieval and reuse of the sonobuoy without the normal refurbishing procedures. The modifications can be accomplished with hand tools and off-the-shelf components. None of the modifications prevents the sonobuoy from being refurbished to standard air launch status.



SECTION I
GENERAL DESCRIPTION

1-1. Purpose of Letter

1-2. This letter describes the procedure for modifying the AN/SSQ-57A Sonobuoy for reusable operation without the standard refurbishing procedure.

1-3. Modified Operation

1-4. Launching. Because of the external cable reel, the sonobuoy cannot be air launched but is intended to be dropped from a surface vessel.

1-5. Operation. The modified sonobuoy is energized by removing the noval test plug cover, plugging in a phone jack, and replacing the plug cover. A pilot light in the end of the phone jack, observed through the transparent plug cover, is an indicator of the battery condition. To launch, the antenna is released, the hydrophone and cable are uncoiled into the water, and the sonobuoy body is thrown overboard.

1-6. Operating Life. The sonobuoy will operate for approximately 5 to 6 h on a fully charged battery pack. The life select switch is inoperative.

1-7. Retrieval. The sonobuoy is removed from the water and the hydrophone cable and compliant section (rubberband) are wound around the cable reel. When the hydrophone and cable are aboard, the antenna is retracted and the sonobuoy is deenergized by removal of the phone jack from the noval plug.

1-8. Changing Batteries. The sonobuoy batteries are charged through the noval test plug cover. A constant current power source of 150 mA (12 V) will fully charge the battery pack in approximately 14 h.

1-9. Flashlight Battery Operation. The sonobuoy's rechargeable C-size nickel cadmium batteries may be replaced by any C-size nonrechargeable battery if charging is not possible. The sonobuoy requires 300 mA at 12 V.

1-10. Scuttling. The seawater-soluble plug has been replaced to prevent the sonobuoy from scuttling.

SECTION II
DISASSEMBLY INSTRUCTIONS

- 2-1. General.
- 2-2. The sonobuoy is assumed to be in an air launch status.
- 2-3. Remove Rotochute Assembly.
 - a. Remove the paper tape marked "remove before launch".
 - b. Lift the blades of the rotochute and locate the retaining ring.
 - c. With a pair of needle-nose pliers pull up on the release rod until the retaining ring releases.
 - d. Remove the rotochute assembly and save.
 - e. Turn the sonobuoy upside down and allow the release rod to slide out of the case.
- 2-4. Remove Bottom Retaining Plate.
 - a. The bottom retaining plate is spring loaded and, once released, falls freely from the sonobuoy housing.
 - b. Remove the screw holding the retainer spring.
 - c. While holding a hand over the bottom plate, remove the retainer spring wire.
 - d. Remove bottom retaining plate and save.
 - e. Pull hydrophone and its wire spool out several feet.
- 2-5. Remove Sonobuoy Housing.
 - a. Remove scuttle plug and save.
 - b. Remove and save the four screws holding the lower casting to the sonobuoy housing.

- c. Remove and save the 12 screws holding the rotochute adapter ring.
- d. Remove and save the adapter ring.
- e. Pull sonobuoy housing off the sonobuoy assembly.

2-6. Remove Battery.

- a. Cut the green, black, and red battery wires. Leave a 2 in. length of wire extending from the lower side of the midseal casting.
- b. Remove and save the two Phillips head screws holding the upper portion of the battery bracket to the midseal casting.
- c. Remove and save the foam block.
- d. Remove and save the battery if it has not been used.
- e. Reattach the upper portion of the battery bracket to the midseal casting.

SECTION III
MODIFICATIONS

- 3-1. General.
- 3-2. A parts list for all modifications is included on the last page.
- 3-3. The following are the five modifications to be discussed.
 - a. Installation of internal battery pack.
 - b. Disabling of life select circuit.
 - c. Installation of phone jack for charging and power switching.
 - d. Potting of scuttle plug.
 - e. Construction of cable reel.
- 3-4. Battery Pack Installation.
 - a. The battery pack shown in Figs. 1 and 2 consists of an aluminum bracket to which five 2-cell battery holders have been attached.
 - b. Figure 3 shows all the necessary dimensions for construction of the battery support bracket.
 - c. The 2-cell C-size battery holders are mounted to the support bracket using 1/4 in. long No. 6 sheetmetal screws (two each). The holders must be offset from the bracket center line by 1/2 in. so that the mounting screws will not hit the antenna housing when the bracket is installed in the sonobuoy.
 - d. The battery support bracket is installed on the circuit board mounting frame by drilling and tapping the circuit board frame for 6-32 screws. The battery support bracket is positioned approximately 1 1/2 in. from the midseal casting. The center line of the bracket should touch the antenna housing.

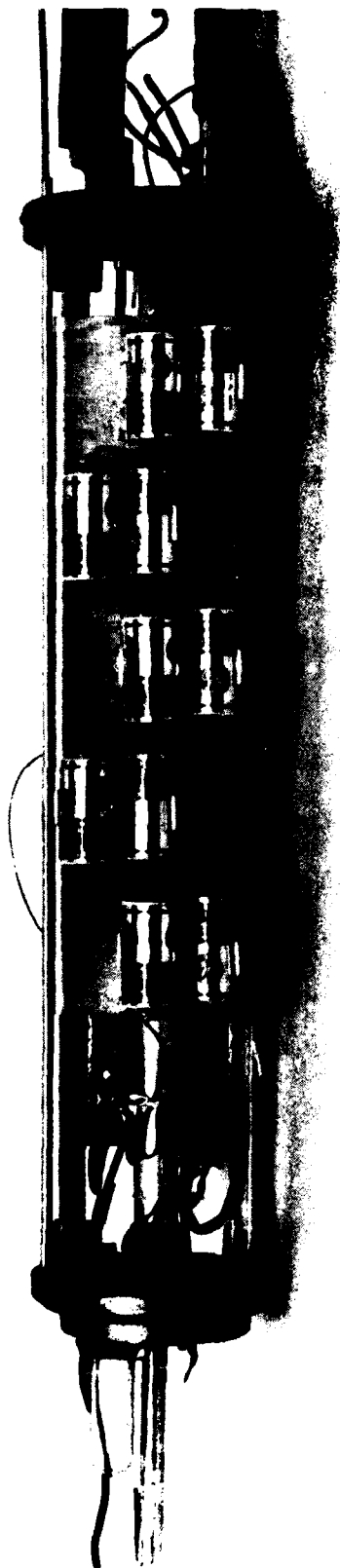


FIGURE 1
TOP VIEW OF INTERNAL BATTERY PACK

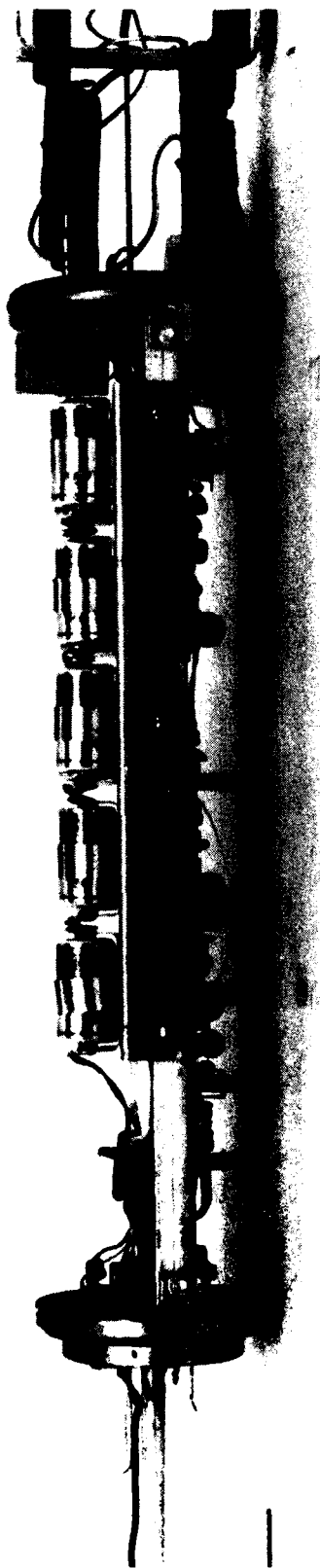


FIGURE 2
SIDE VIEW OF BATTERY PACK

0161-2

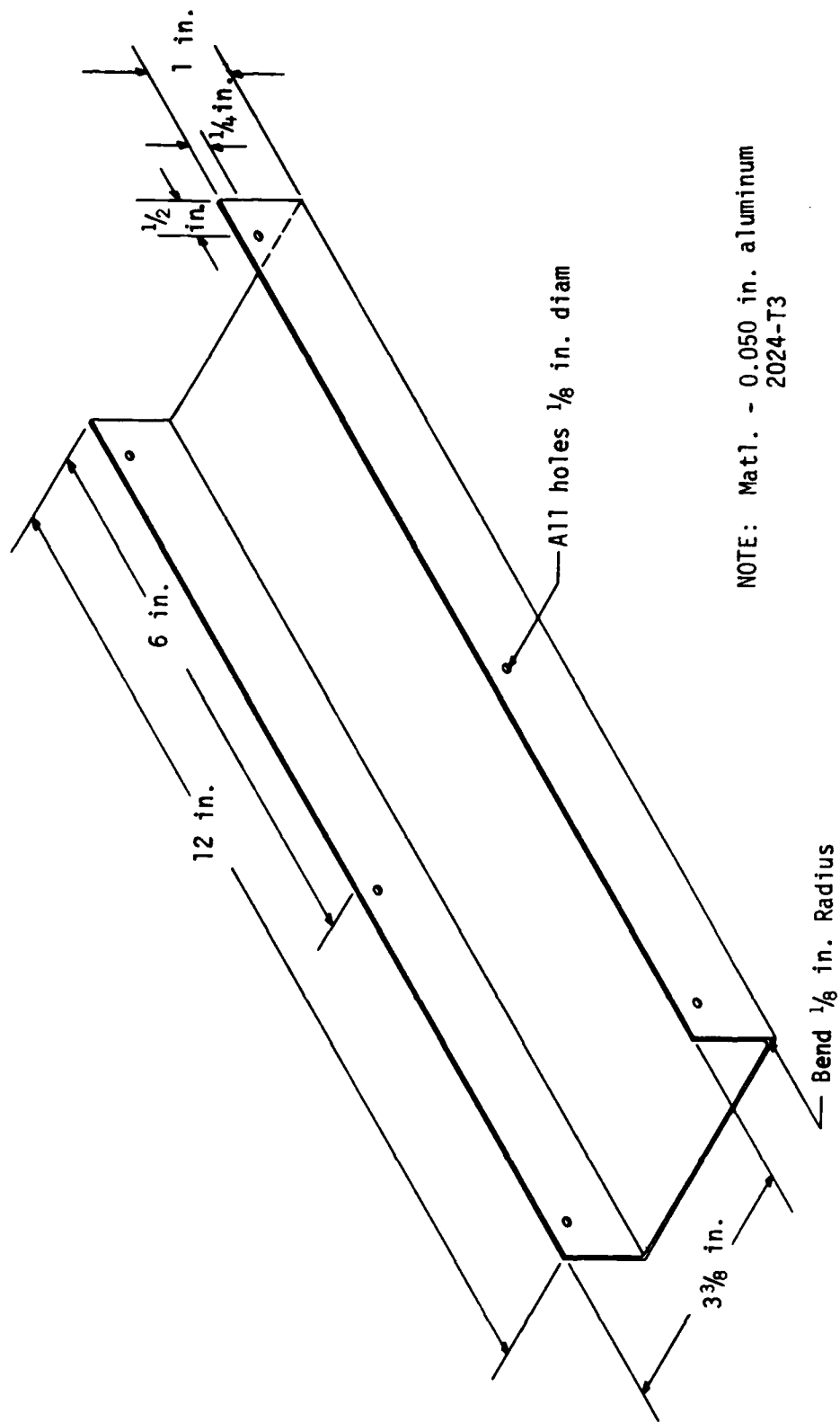


FIGURE 3
BATTERY SUPPORT BRACKET

3-5. Disabling of Life Select Circuit.

- a. The life select circuit must be disabled so that the sonobuoy can operate without the need for a 1.5 V battery.
- b. Rotate the small potentiometer shown in Fig. 4 clockwise until its mechanical stop is reached.

3-6. Phone Jack Installation and Wiring.

- a. A stereo phone jack is mounted on an aluminum bracket and installed in the noval test plug hole. This jack provides for power switching and battery charging.
- b. Remove noval test plug cover and save.
- c. Remove the two hex head screws holding the noval test plug and save.
- d. Pull noval test plug clear of mounting area.
- e. On a small sheet of aluminum trace the outline and mounting hole positions of the noval plug as shown in Fig. 5.
- f. Drill holes as shown in Fig. 5 and then cut out the traced shape using metal shears or scissors.
- g. Mount jack on bracket.
- h. Remove the wire from pin 3 of the noval plug and solder to the ring contact of the phone jack as shown in Fig. 6.
- i. Solder a piece of hookup wire from the tip contact of the phone jack to the first battery holder terminal. Series connect all the battery holders as shown in Fig. 6 using short pieces of hookup wire.
- j. Solder a hookup wire from the last battery holder contact to the sleeve contact of the phone jack.

POTENTIOMETER

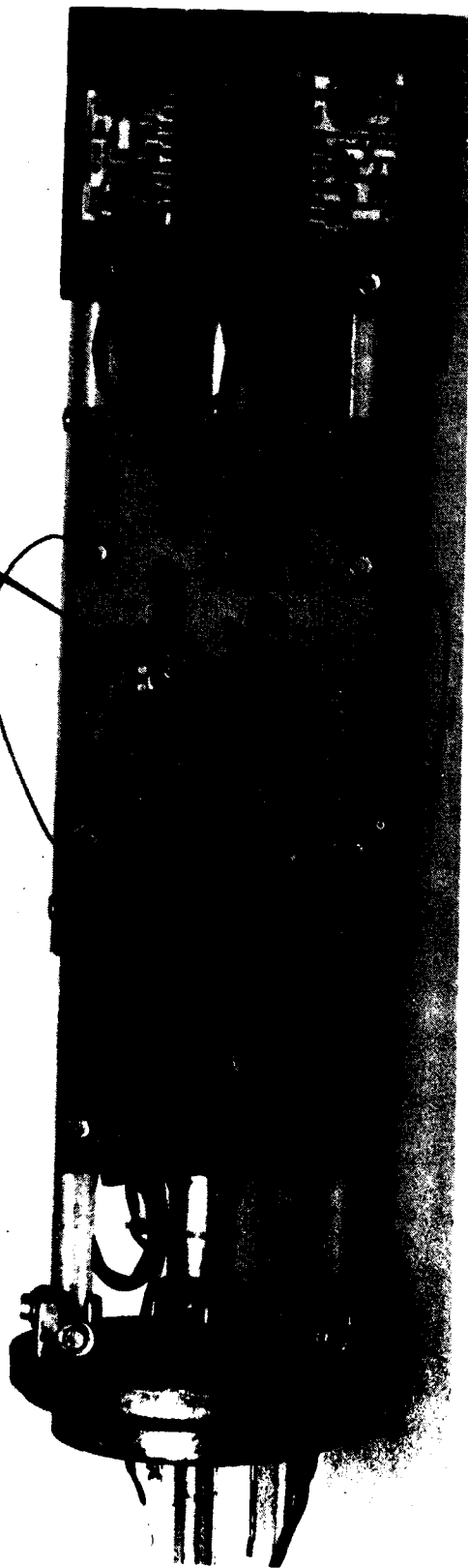
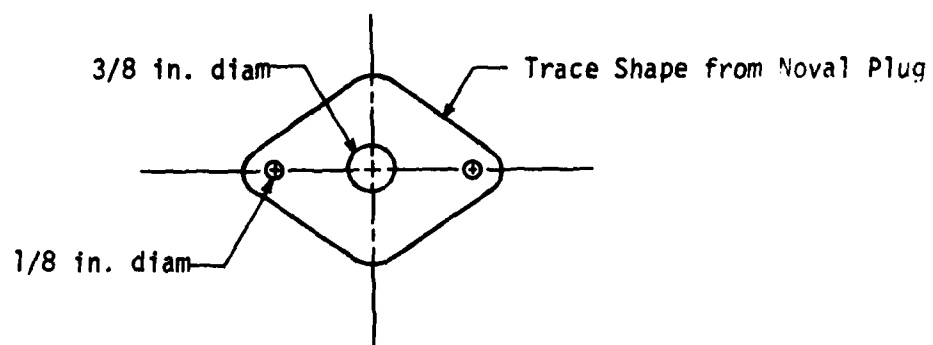


FIGURE 4
LIFE SELECT POTENTIOMETER ADJUSTMENT



NOTE: Matl. - 0.050 in. aluminum
2024-T3

FIGURE 5
PHONE JACK MOUNTING BRACKET

AS-75-1881
LAT - 0161

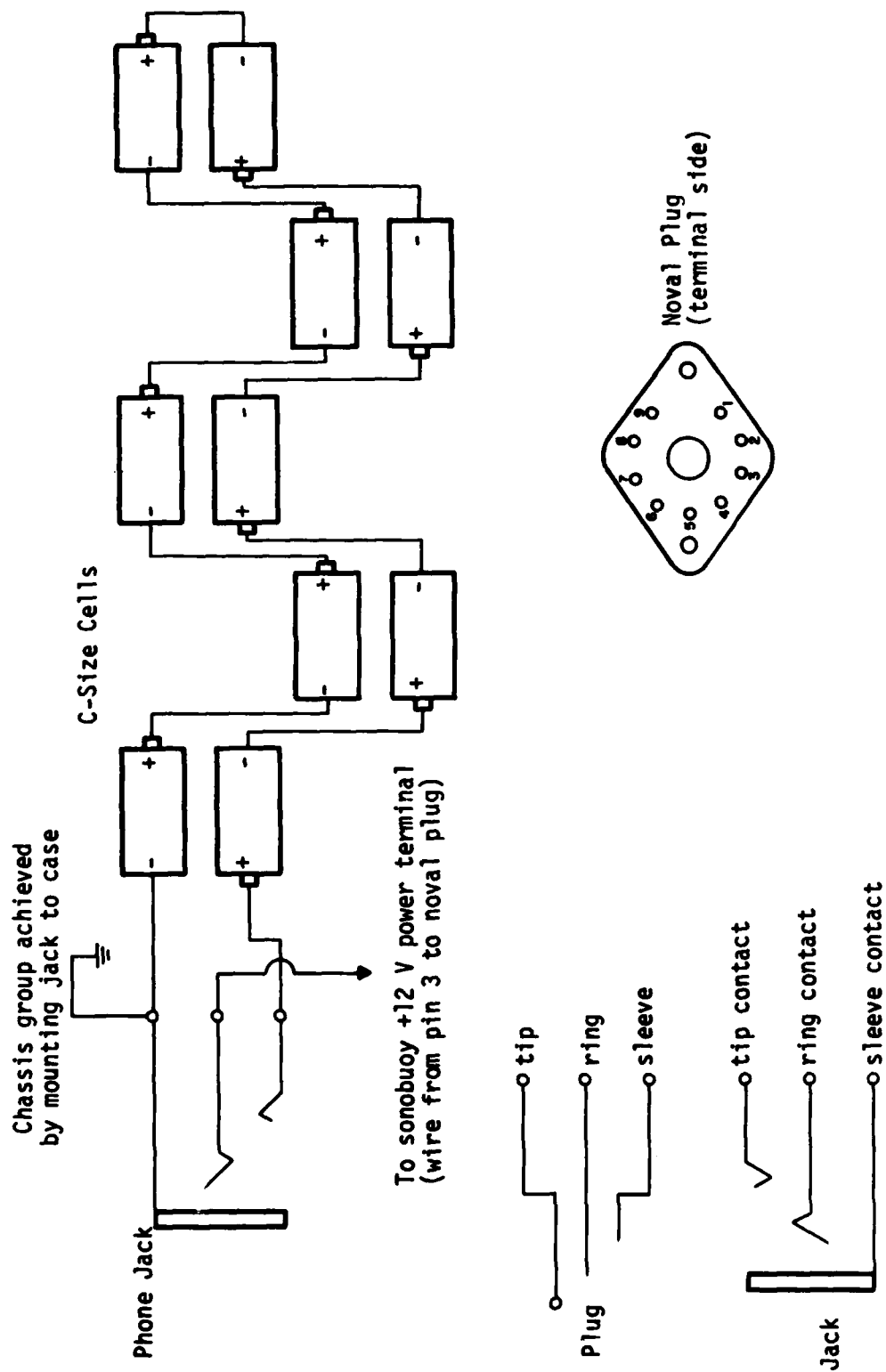


FIGURE 6
PHONE JACK WIRING DIAGRAM

- k. Mount the phone jack and bracket in the noval plug hole using two hex screws.
- l. Wrap electrical tape around the terminals of the noval plug and then strap it down against the antenna housing as shown in Fig. 7.
- m. Install batteries as shown in Fig. 6. Each 2-cell holder will have one battery facing each way.
- n. Disconnect the positive saltwater battery lead (red) from the power terminal strip inside the sonobuoy (near midseal casting). This will eliminate a saltwater discharge path that would reduce battery life.

3-7. Pot Scuttle Plug

- a. Drill out the material in the center of the scuttle plug using a 1/4 in. diam drill bit.
- b. Clean inside surface of hole with fine sandpaper and solvent.
- c. Tape one end of the scuttle plug and fill the hole with epoxy glue.

3-8. Buoyancy Compensation

- a. Cut a piece of styrofoam 3 in. x 5 in. x 3 1/2 in.
- b. Place this piece of styrofoam in the area where the saltwater battery is clamped.
- c. If floating or stability problems are encountered, clamp a small styrofoam ring around the upper part of the sonobuoy case. Placing additional styrofoam in the battery compartment will only cause the sonobuoy to float horizontally.

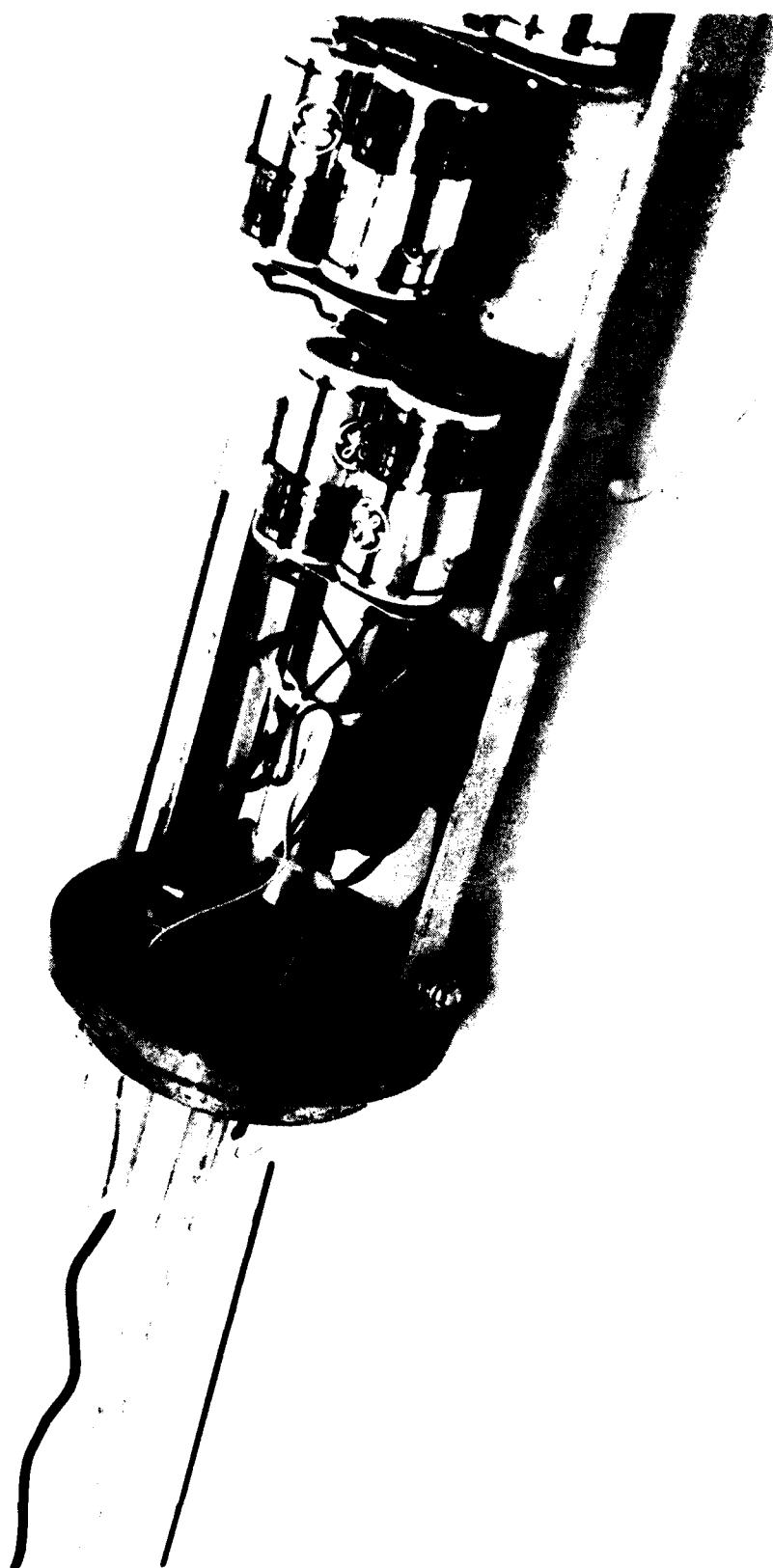


FIGURE 7
PHONE JACK AND NOVAL PLUG

3-9. Encase Sonobuoy Assembly

- a. Clean the inside of the sonobuoy case.
- b. Remove and clean midseal O-ring and groove.
- c. Grease the midseal O-ring groove with silicone compound.
- d. Place the O-ring into the groove and apply silicone compound grease to the outside of the O-ring.
- e. Grease the O-ring bevel on the upper casting and grease the smaller O-ring. Insert the O-ring into the sonobuoy case and push it up against the shoulder of the case.
- f. Apply grease around the inside of the sonobuoy case about 3 in. up from the lower end.
- g. Carefully place the case over the sonobuoy assembly. Make sure that the release rod hole in the case lines up with the release rod hole in the upper casting as shown in Fig. 8.
- h. Secure the lower casting to the sonobuoy case with four screws.
- i. Replace and secure the rotochute adapter with 12 screws.
- j. Grease the scuttle plug and its gasket and put the plug in the scuttle plug hole.
- k. Tie down the antenna by placing a heavy wire through the large hole in the top of the sonobuoy case, through the loop in the radiating element of the antenna, and out through the hole in the opposite side of the case. Twist the wire to secure the antenna.
- l. Cut the small bare wire which holds down the antenna.

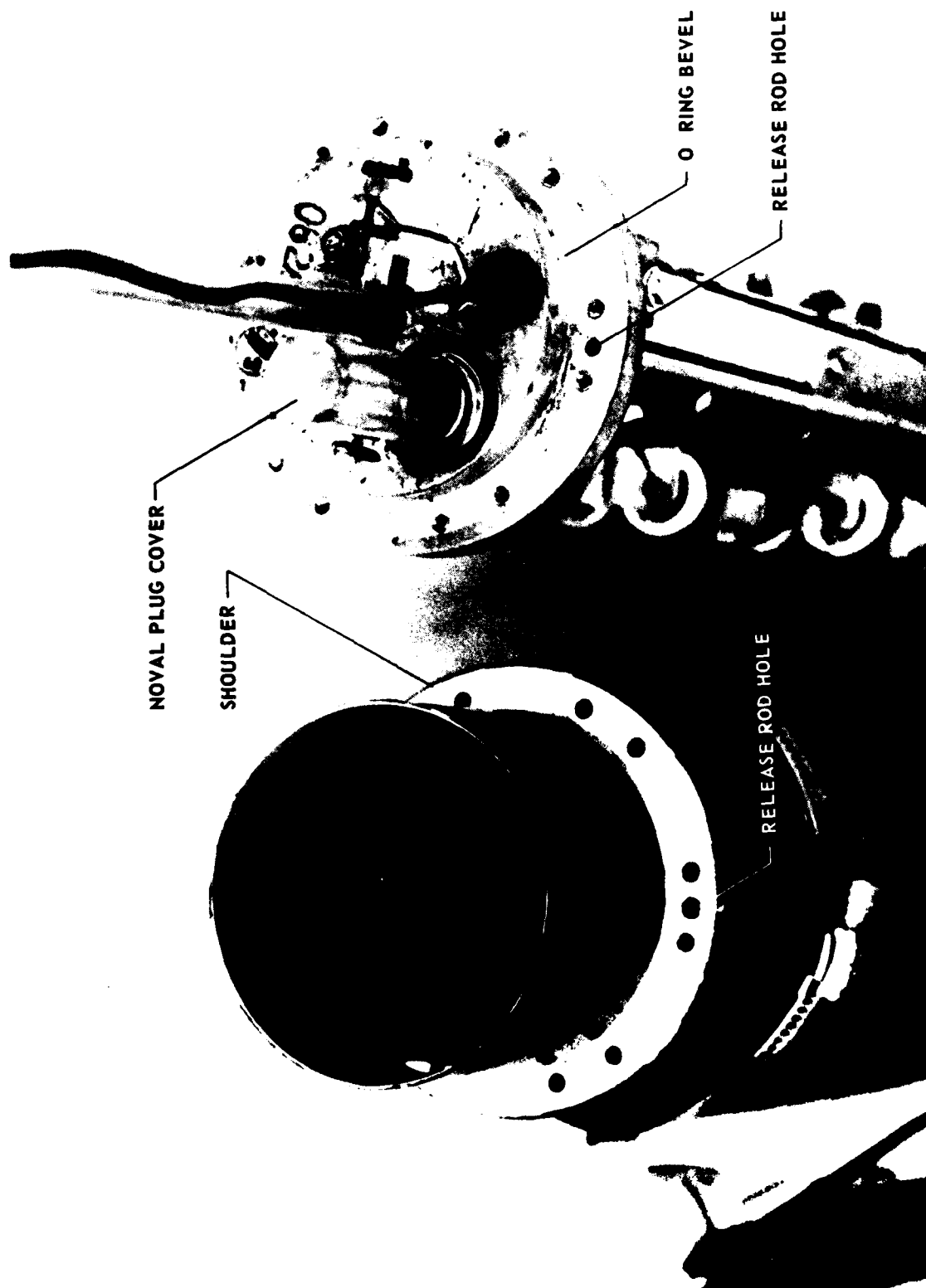


FIGURE 8
RELEASE ROD HOLE LOCATION

3-10. Construct Cable Reel.

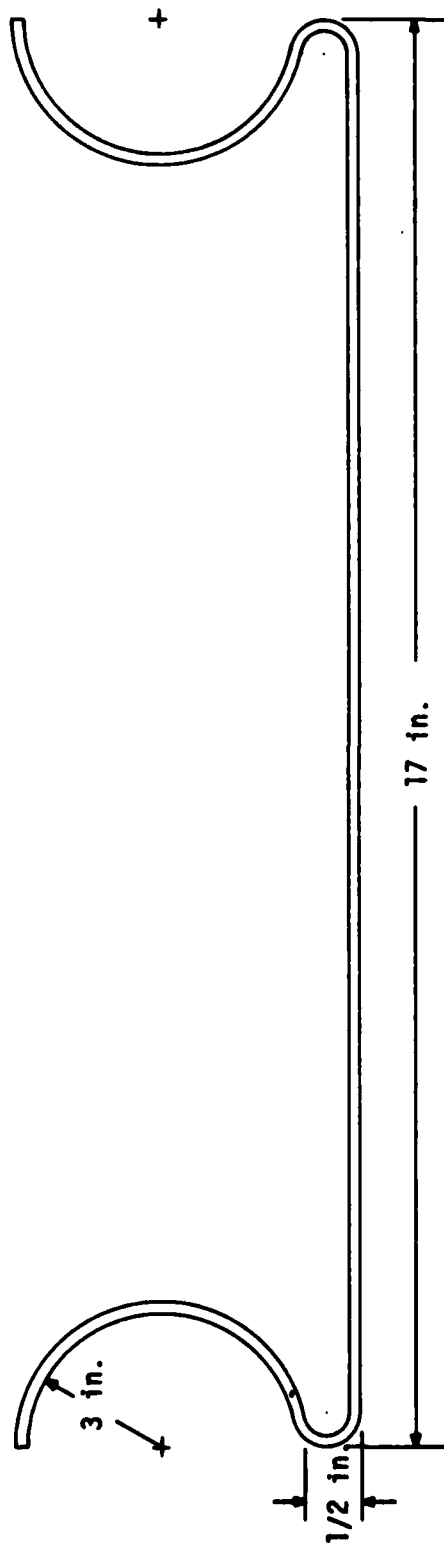
- a. Construct the cable reel as shown in Fig. 9.
- b. Tape the 3 in. diam areas of reel to protect the hydrophone line when wrapped on it.
- c. Attach the reel to the sonobuoy case by using two 5 in. diam stainless steel hose clamps as shown in Fig. 10. Place the lower hose clamp around the case in the same position as the midcasting seal. This will prevent distorting the case and causing a leak. Do not overtighten the clamps because the sonobuoy case is not very strong.
- d. The hydrophone cable and compliant section may be coiled up on the reel to either the 60 ft or 300 ft length depending upon which is needed.

3-11. Charging Batteries.

- a. The battery charging plug schematic is shown in Fig. 11.
- b. The batteries require 150 mA of current for approximately 14 h to be fully charged from a discharged state. The batteries may be charged for longer periods of time but not to exceed the 150 mA current limit.
- c. A dc bench supply with an adjustable current limit can be used for battery charging.
- d. Figure 12 shows a schematic diagram of a simple battery charger.

3-12. Power Switch.

- a. The sonobuoy is energized by plugging a specially wired phone plug into the phone jack. The noval test plug cover is then replaced to provide a waterproof seal.



NOTE: 1/2 in. of 1/8 in. aluminum
Bar stock 6061-T3

FIGURE 9
CABLE REEL

AS-75-1883
LAT - 0161

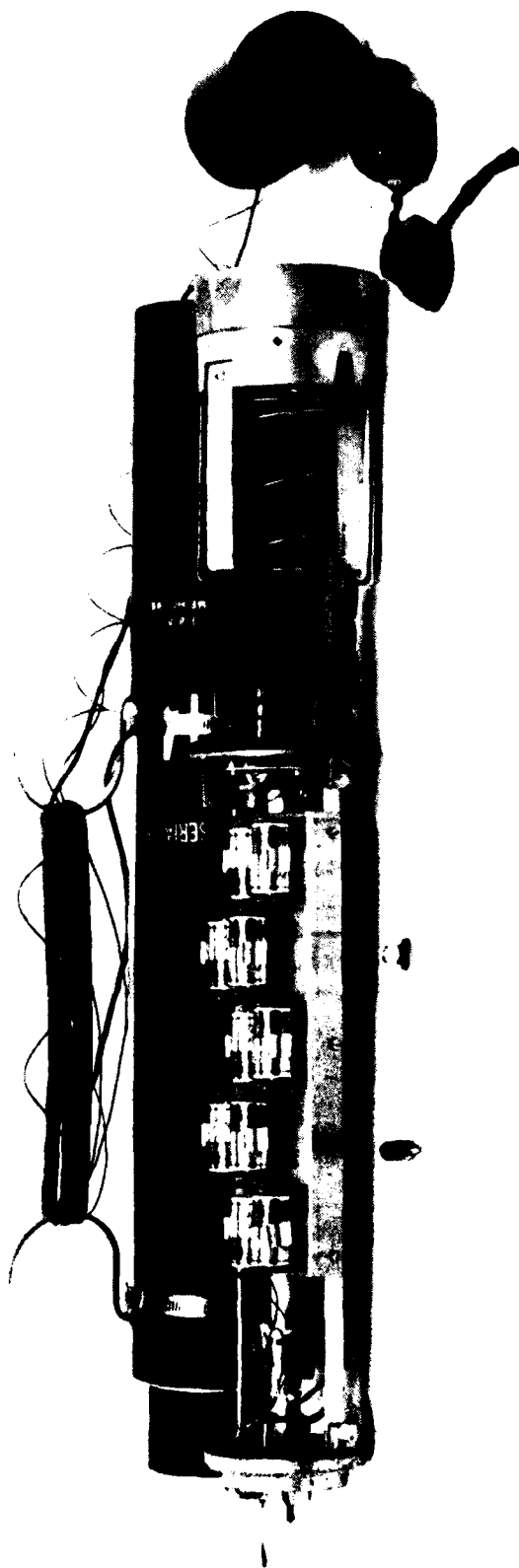


FIGURE 10
MODIFIED SONOBUOY

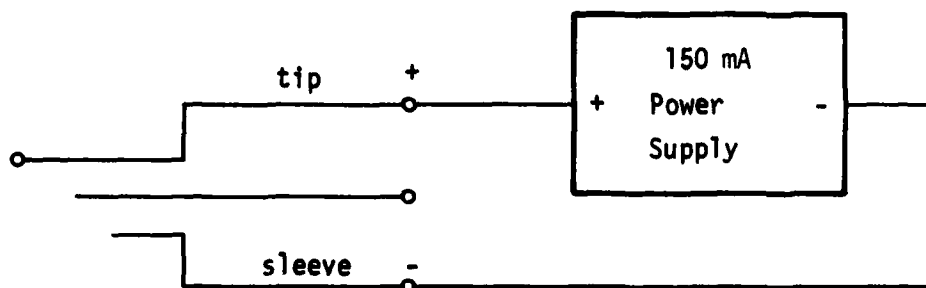


FIGURE 11
SONOBUOY CHARGING CIRCUIT

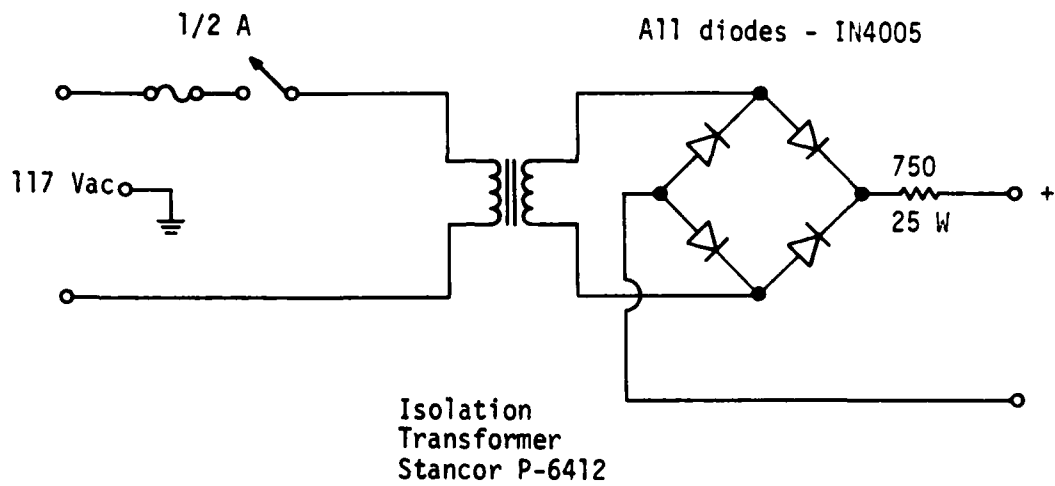
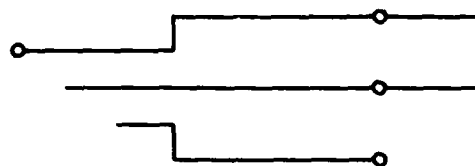


FIGURE 12
SONOBUOY CONSTANT CURRENT CHARGER

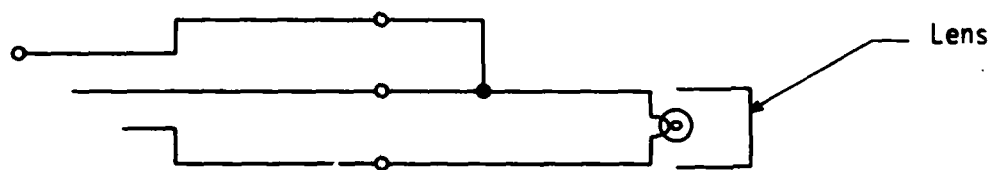
- b. A small pilot light may be included to monitor battery life.
- c. Figure 13 shows the energizing plug with and without the pilot light.
- d. If the pilot light is included, it can be mounted with the lens cap in the end of the phone plug cover.

3-13. Buoyancy Check.

- a. The sonobuoy should be placed in the water for a buoyancy and stability test.
- b. Deploy the antenna and hydrophone. The hydrophone should be hung from the bottom casting or deployment spring.
- c. The sonobuoy should float vertically with several inches of freeboard. If buoyancy or stability problems are encountered see section 3-8.



Energizing Plug only



Energizing Plug with Pilot Light

FIGURE 13
ENERGIZING PLUGS

AS-75-1886
LAT - 0161

SECTION IV

OPERATION

4-1. Launching.

- a. Energize the sonobuoy by removing the noval test plug cover, plugging in the power plug, and replacing the plug cover.
- b. Unreel the hydrophone into the water.
- c. While holding the sonobuoy horizontal with the antenna end pointed away, remove the antenna hold-down wire and allow the antenna to deploy.
- d. Throw the sonobuoy into the water.

4-2. Operating Time.

- a. The nickel-cadmium batteries will provide approximately 5 h of operation (calculated).
- b. Carbon-zinc batteries will provide approximately 4 h of operation (calculated).

4-3. Retrieval.

- a. Grasp the antenna mast to lift the sonobuoy from the water. Lift the sonobuoy straight up to prevent bending the antenna mast.
- b. Wind the hydrophone cable and the compliant section around the cable reel.
- c. Wash the sonobuoy with fresh water.
- d. Unscrew the noval plug cover and deenergize the sonobuoy by unplugging the energizing plug. Replace the noval plug cover.

- e. Fold down the radiating (top section) element of the antenna so that it lies next to the antenna mast.
- f. Fold the ground plane elements inward so that they lie next to the antenna mast.
- g. Push the antenna mast and elements into the antenna housing. It may be necessary to lightly tap on the top of the antenna mast with a hammer to loosen it. Make sure the antenna elements are in the proper guide slots on the upper casting.
- h. Tie down the antenna by placing a heavy wire through the large hole in the top of the sonobuoy case, through the loop in the radiating element of the antenna, and out through the hole in the opposite side of the case. Twist the wire to secure the antenna.

4-4. Charging Batteries.

- a. The batteries should be charged for approximately 14 h at 150 mA of current.
- b. The charger is connected to the sonobuoy battery pack through the noval test plug phone jack (see section 3-11).

PARTS LIST

1. Aluminum sheet - 0.050 thickness (approximately 6 in. x 12 in.)
2. Aluminum bar stock - 1/2 in. x 1/8 in. (approximately 20 in. long)
3. 5 in. diam stainless steel hose clamps (2)
4. No. 6 x 1/4 in. sheet metal screws (10)
5. 6-32 x 1/4 in. machine screws (6)
6. Silicone grease
7. 2-part epoxy glue
8. 2-cell C-size battery holders (5) Keystone No. 174 or equivalent
9. C-size rechargeable sealed nickel-cadmium cells (10) General Electric type GCT1.55B
10. Stereo phone jack (chassis mount) Switchcraft No. 12-B
11. Stereo phone plug General Cement No. 33-646
12. Light bulb - Mura Corp. - Violet lead
13. Light bulb lens for above
14. 2 ft of No. 22 hookup wire

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