CHAPTER 9

ACOUSTIC MINESWEEPING

LEARNING OBJECTIVES

Upon completing this chapter, you should be able to do the following:

1. Describe the purpose of acoustic minesweeping.
2. Recall the different types of sound frequencies a ship will produce.
3. Recall the purpose and function of acoustic devices and their associated equipment.

INTRODUCTION

Ships under way produce varying amounts of sound (acoustics). Over the years, mines that detonate in response to some of these sounds have been developed. Some of the mines detonate as soon as they detect a certain sound. Others register a count each time they detect the sound and detonate when they reach a specific count. Acoustic minesweeping is used to either detonate these mines or to cause their detecting devices to register a ship count. Table 9-1 lists the types of sounds that may be used to trigger acoustic mines.

Acoustic minesweeping equipment is designed to simulate the acoustic signature of a ship and to detonate the mines a safe distance from the minesweeper.

ACOUSTIC MINESWEEPING EQUIPMENT

Acoustic minesweeping equipment consists of power-driven devices, which are normally towed astern, and waterflow-operated devices that are operated by the flow of water as they are towed.

Table 9-1.—Frequency Ranges and Sources

Frequencies	Sound Sources
Low	Main propulsion machinery, hull vibrations, and propeller cavitation
Medium	Auxiliary and main machinery
High	Hull vibrations and propeller cavitation

ACOUSTIC DEVICE A MK 2(g)

The Acoustic Device A Mk 2(g) (commonly known as *rattle bars)* (figure 9-1) is a mechanical device that produces a chattering sound for countering acoustic influence mines.

The A Mk 2(g) consists of a frame made of three 34-inch parallel bars and two end plates and two 30-inch, movable parallel bars. The two 30-inch bars are mounted at each end to swing arms that allow them to oscillate in the center of the frame. As the A Mk 2(g) is towed through the water, the flow of water between its parallel pipes and bars causes them to hit each other with great force, producing sound. The sound output depends on ship's speed. Higher speed increases the output; lower speed decreases it. During turns, the device has a tendency to stop chattering unless its speed through the water can be maintained.

The A Mk 2(g) is made of corrosion-resistant steel and weighs approximately 135 pounds. It has a relatively short life because of the mechanical stress placed on its parts. This stress increases in proportion to the speed of tow. The device also is subject to fouling by weeds and debris.

AUXILIARY DEPRESSOR

The auxiliary depressor (figure 9-1) is used to prevent excessive hogging (or arching) of the sweep wire at high-speed sweeping operations. It is a roof-shaped device, 23-1/2 inches long, 11 inches wide, and 4 inches high, made of stainless steel, and weighs 15 pounds.

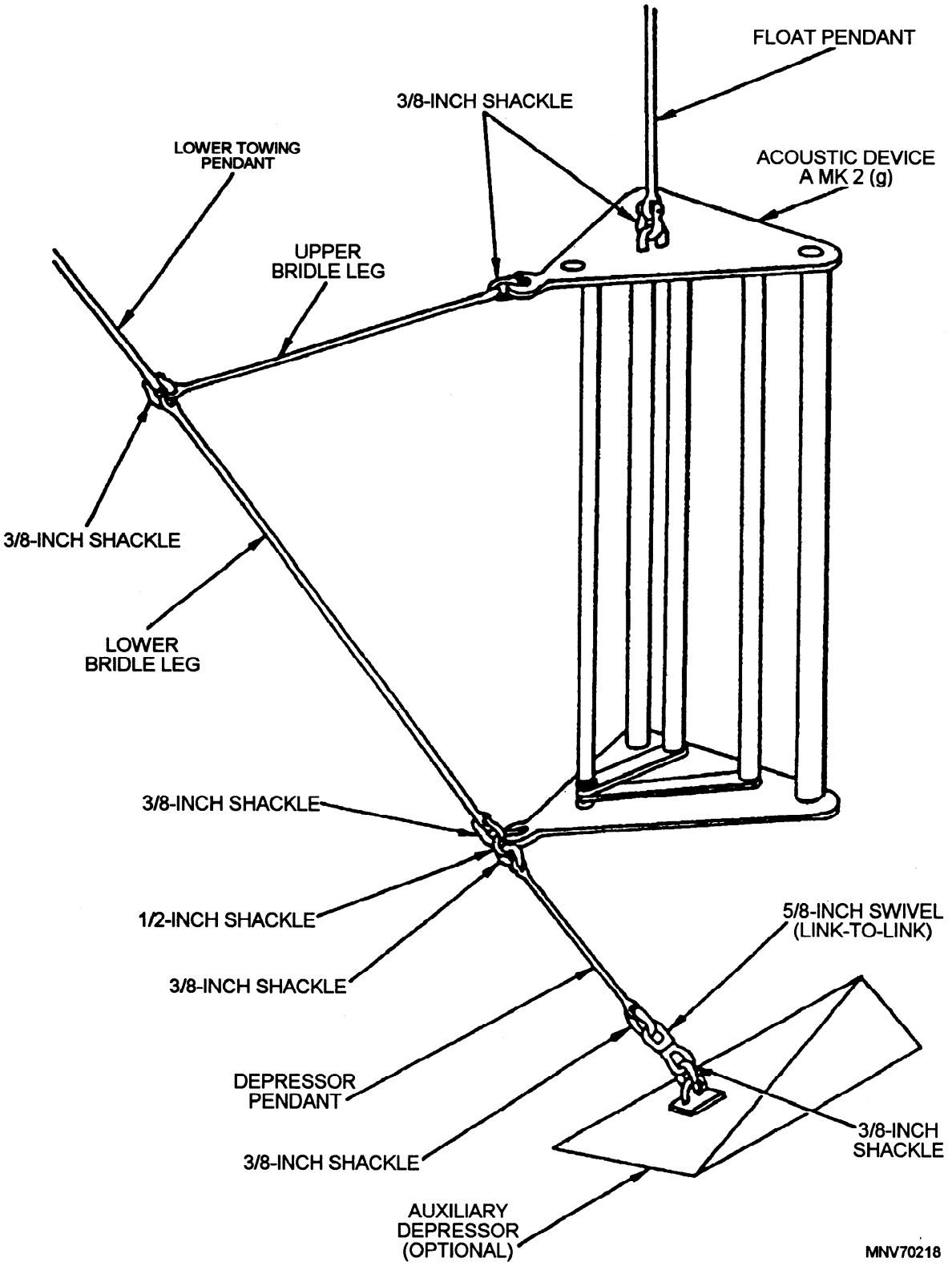

Figure 9-1.—Acoustic Device A Mk 2(g) rigged with an auxiliary depressor.

ACOUSTIC DEVICE, TB-26/A Mk 6(b)

The Acoustic Device TB-26/A Mk 6(b) (figure 9-2) is an electric-motor-driven mechanical oscillator that provides a controlled source of low-frequency acoustic signals for use in sweeping acoustic mines.

It is towed behind the ship by a buoyant acoustic power cable (APC) and provides varying ranges of low-frequency output through the use of selective eccentrics. The assembly uses a motor-driven mechanical oscillator containing two opposing piston

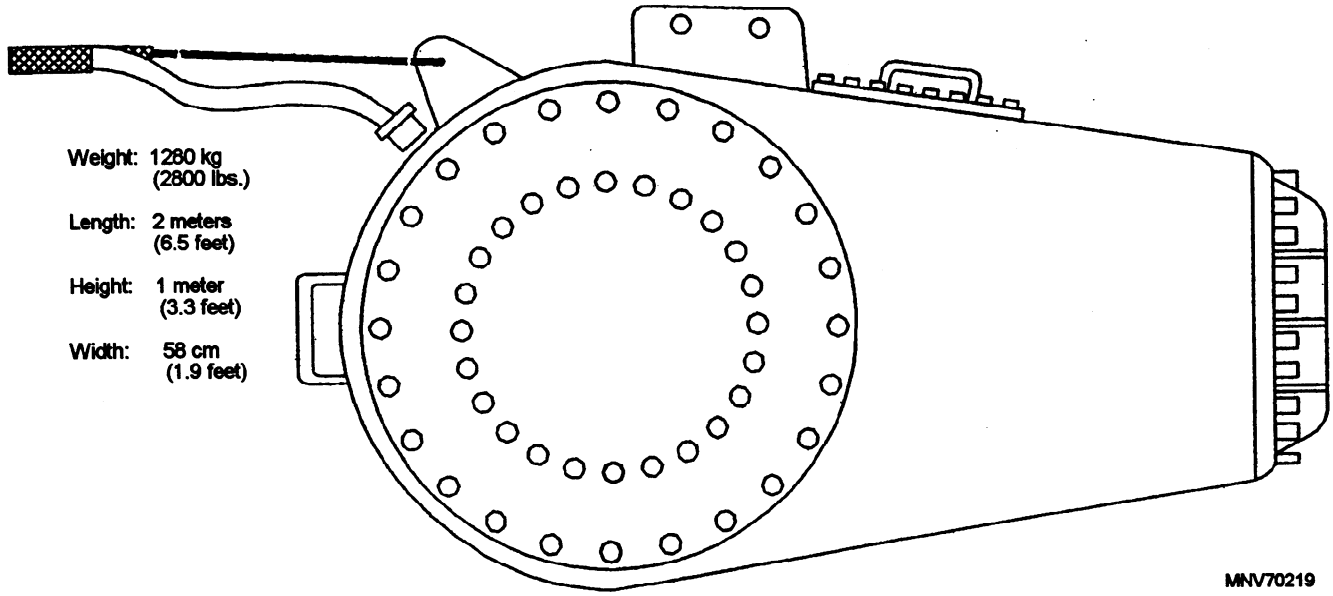

Figure 9-2.—Acoustic Device TB-26/A Mk 6(b).

diaphragms vibrated by the eccentrics. The frequency of the vibration is controlled by the speed of the electric motor within the apparatus.

ACOUSTIC DEVICE TB-27/A Mk 4(v)

The Acoustic Device TB-27/A Mk 4(v) (figure 9-3) is a motor-driven mechanical device that produces controlled sound output for sweeping acoustic mines.

This device is also towed through the minefield by an acoustic power cable. An acoustic controller on board the ship sends voltage through the APC to operate a motor within the TB-27. The motor drives a hammer into a steel diaphragm, causing it to vibrate. By varying the motor speed, the controller can select a sound intensity and frequency appropriate for sweeping mines.

The functioning components of the acoustic device are the diaphragm, the striker assembly, the eccentric

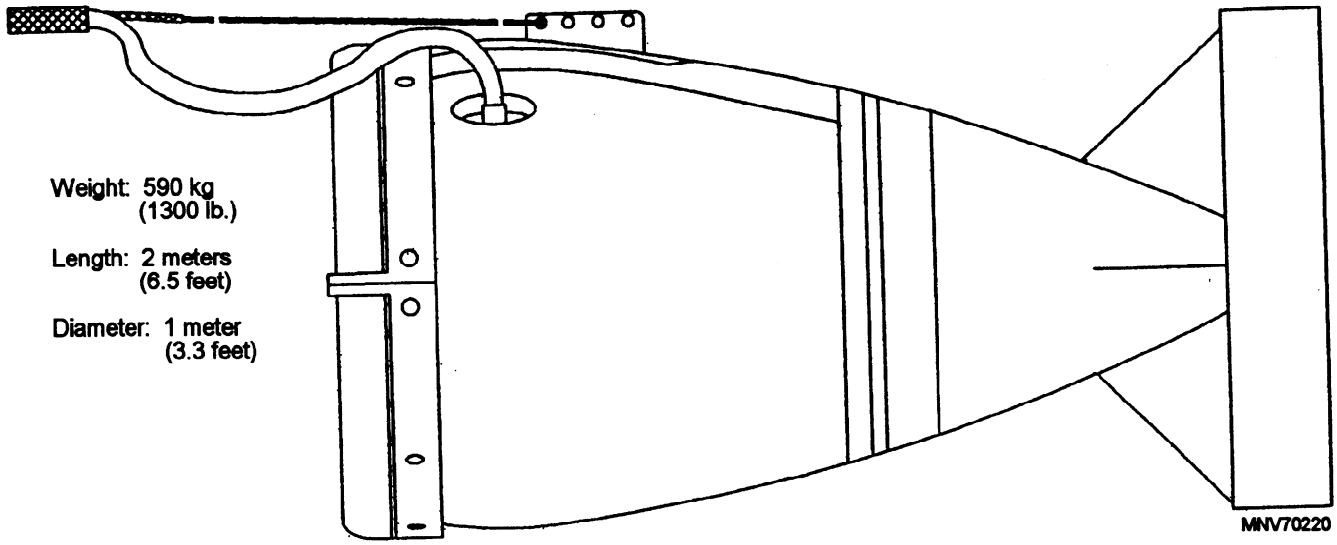

Figure 9-3.—Acoustic Device TB-27/A Mk 4(v).

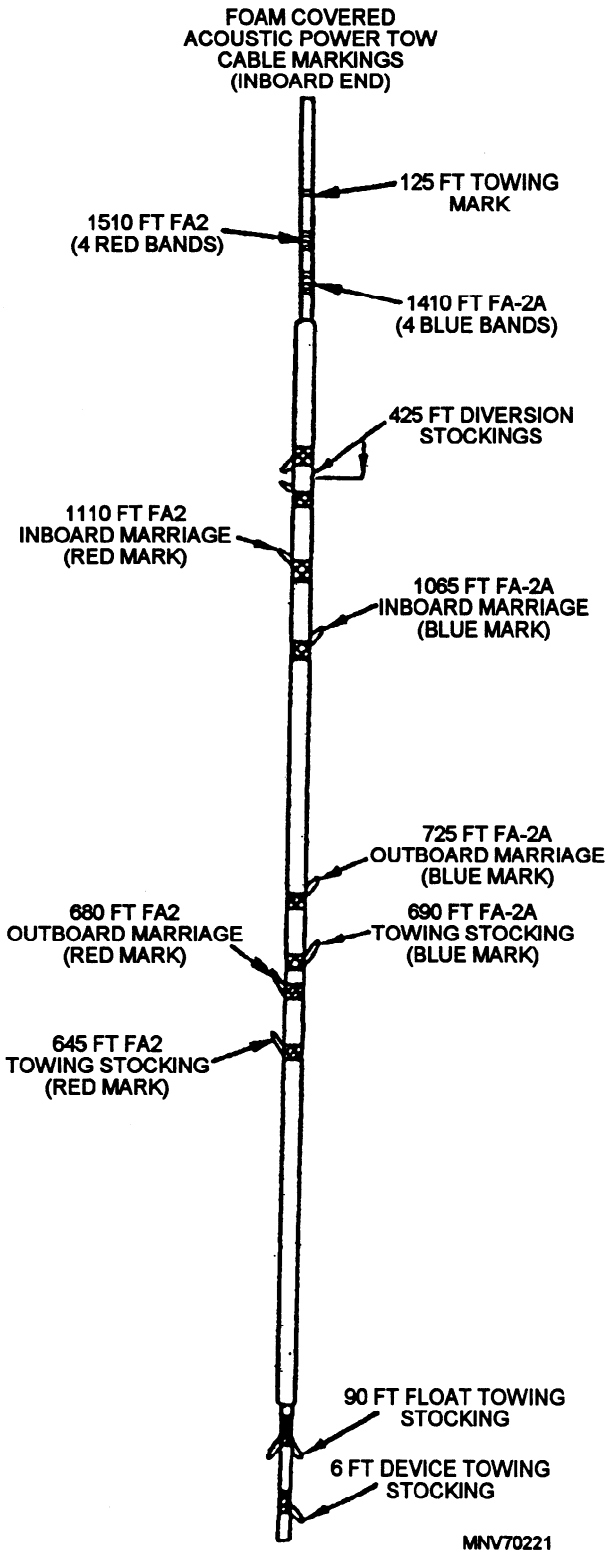

Figure 9-4.—Acoustic power cable.

shaft assembly, and the motor. Within the striker assembly, an eccentric controls the movements of a spring-driven hammer. The striker operates as a piston and strikes the diaphragm at a frequency governed by motor speed. The eccentric shaft assembly is a bearing-mounted shaft connected through an eccentric and ball-and-socket arrangement to the striker assembly. The eccentric shaft is rotated by a V-belt driven by the 1-1/2 horsepower, 240 Vdc motor. The motor receives its controlling voltage from the power converter unit (PCU) on board the ship.

ACOUSTIC POWER CABLE (BUOYANT)

The acoustic power cable (APC) (figure 9-4) provides electrical power to operate acoustic devices at an extended distance from the ship, contributing to the ship's safety during minesweeping operations. It contains four conductors, and is 1,650 feet long and 1-1/2 inches in diameter. It has two nonbuoyant sections, 125 feet on the outboard end and 250 feet on the inboard end. The buoyant section is 1,275 feet long and 3 inches in diameter. Polyethylene foam wrapped around the power cable provides the necessary buoyancy.

AUTOMATIC CONTROLUNIT SG-1224A/SLQ-37(V)

The automatic control unit (ACU) (figure 9-5) provides the waveforms used for acoustic and magnetic mine countermeasures.

Acoustic voltage waveforms provided by the ACU are converted to direct current by the power converter unit (PCU) and applied through the APC to run the motors in the TB-26 and the TB-27. Magnetic voltage waveforms provided by the ACU are sent to the ship's magnetic minesweeping generators, converted to high-amperage current, and applied to the ship's magnetic tail.

FLOATS

Minesweeping floats (figure 9-6) are used to support either minesweeping otters or acoustic devices

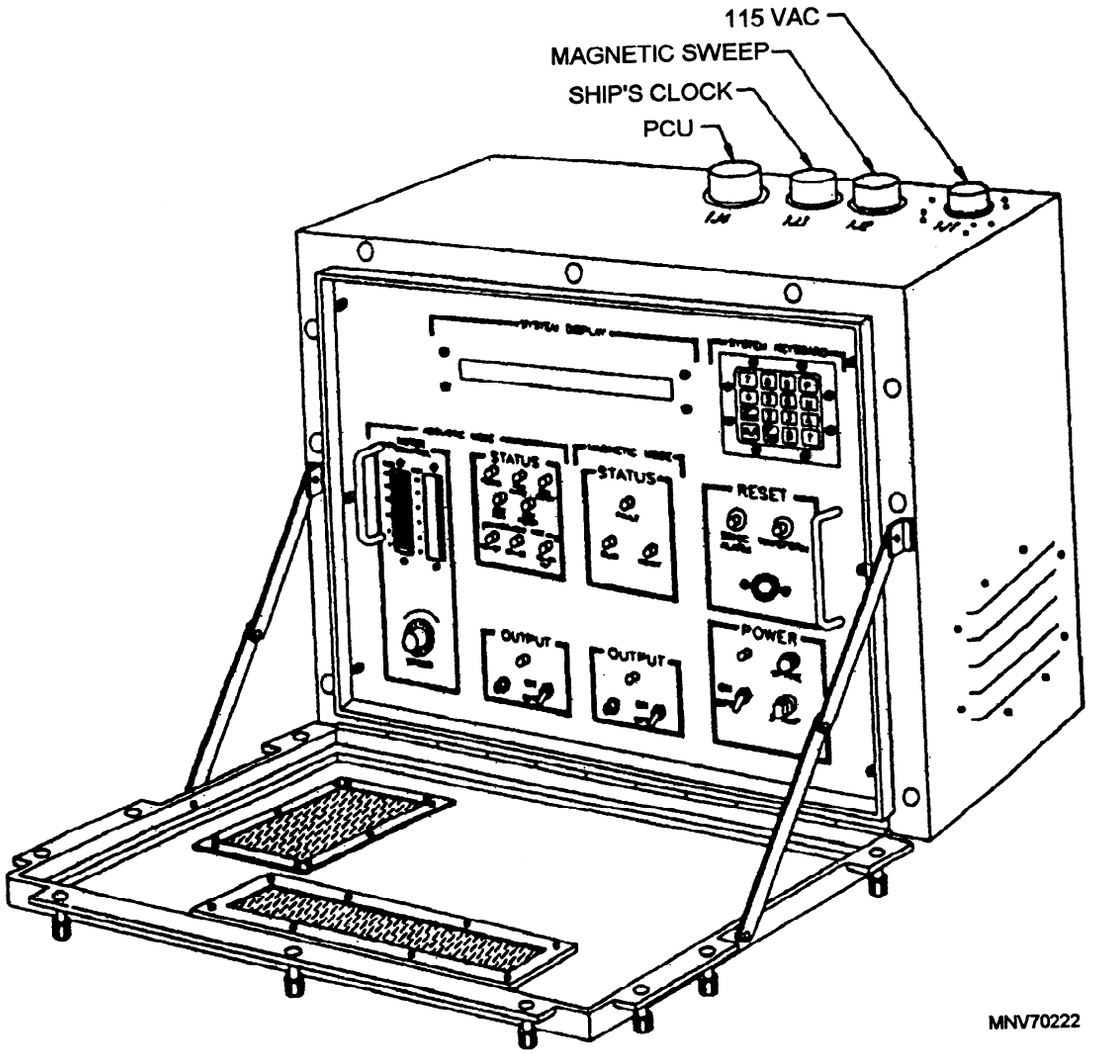

Figure 9-5.—Automatic Control Unit SG-1224A/SLQ-37(V).

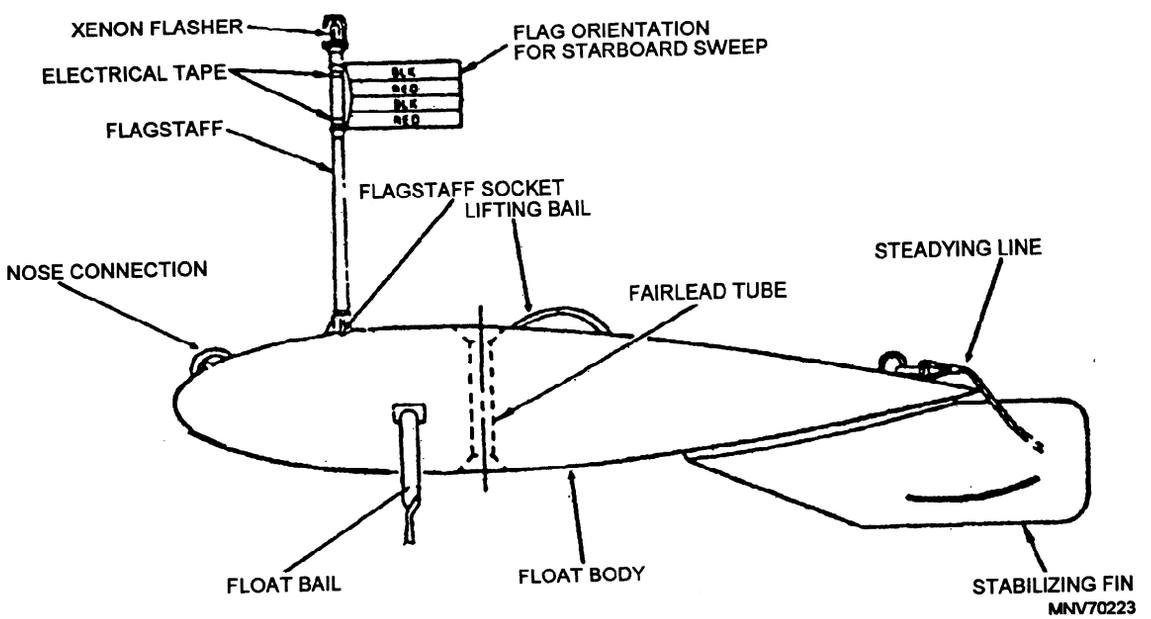

Figure 9-6.—Typical "O"-type float

during minesweeping operations. Floats generally come in three sizes: size 0, size 1, and size 5. Size 0 is the largest; size 5 is the smallest. (See table 9-2.)

Table 9-2.—Floats, Type "O" - Data

Nomenclature	Length (ft-in)	Weight (lb)	Buoyancy (lb)
Float, size 0	17-7	950	3300
Float, size 1	14-3	900	1500
Float, size 5	5-4 3/4	96	202

The size 0 float is used solely to support the acoustic device TB-26. The size 1 float is designed to support either an otter or the acoustic device TB-27. The size 5 float is used only with the A Mk 2(g) (rattle bars). All floats serve as a marker for the approximate outboard end of the sweep, allowing the sweep width to be checked by observation from the ship.

Recall, from chapter 8, that the float's flag, with black and red horizontal strips, indicates whether a port sweep or a starboard sweep is being conducted. A black stripe on top indicates a starboard sweep; a red stripe on top indicates a port sweep.

Acoustic sweep configurations using the rattle bars, the TB-26, and the TB-27 are illustrated in figures 9-7 through 9-9.

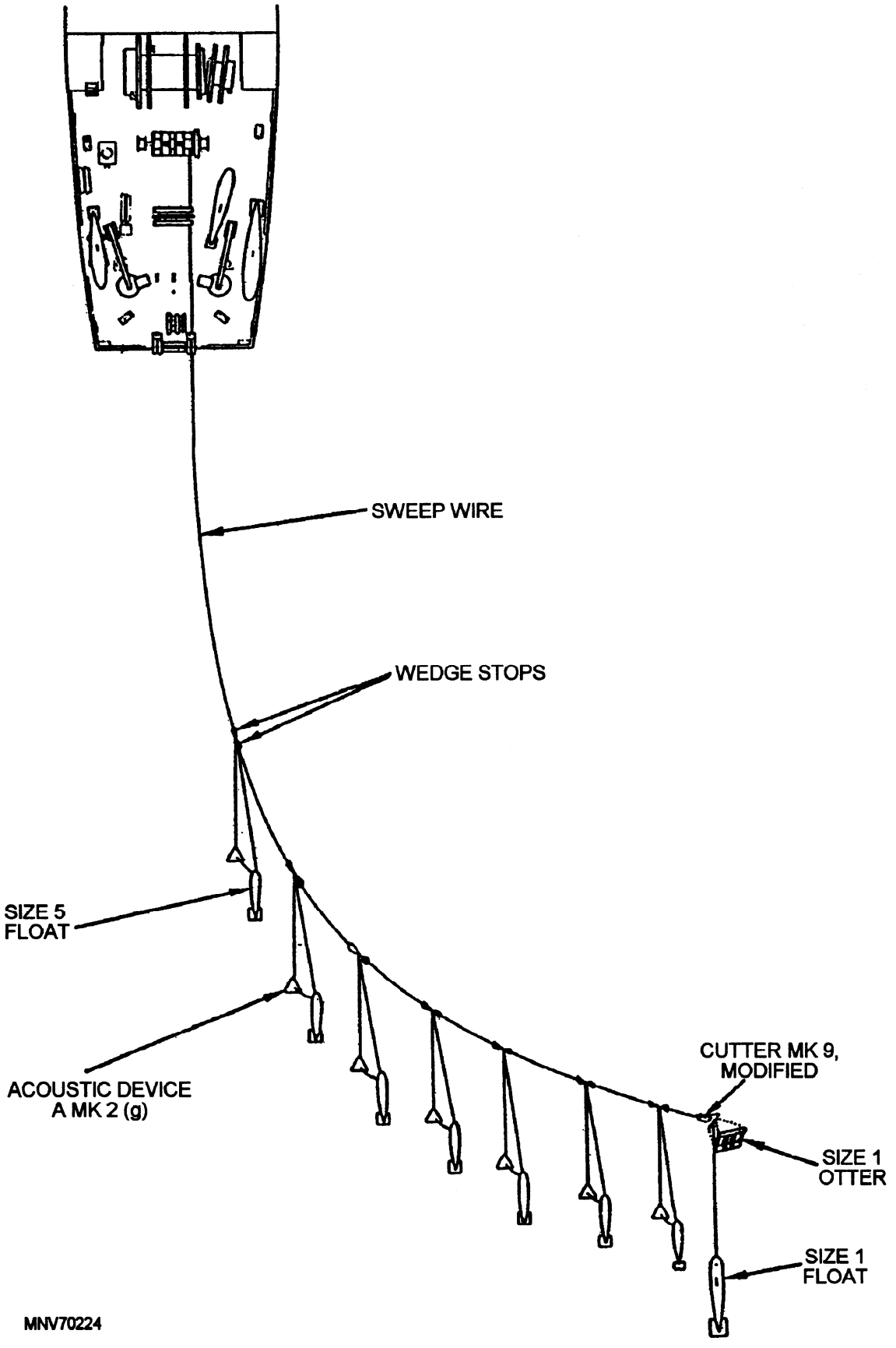

Figure 9-7.—Acoustic sweep configuration A Mk 2(g).

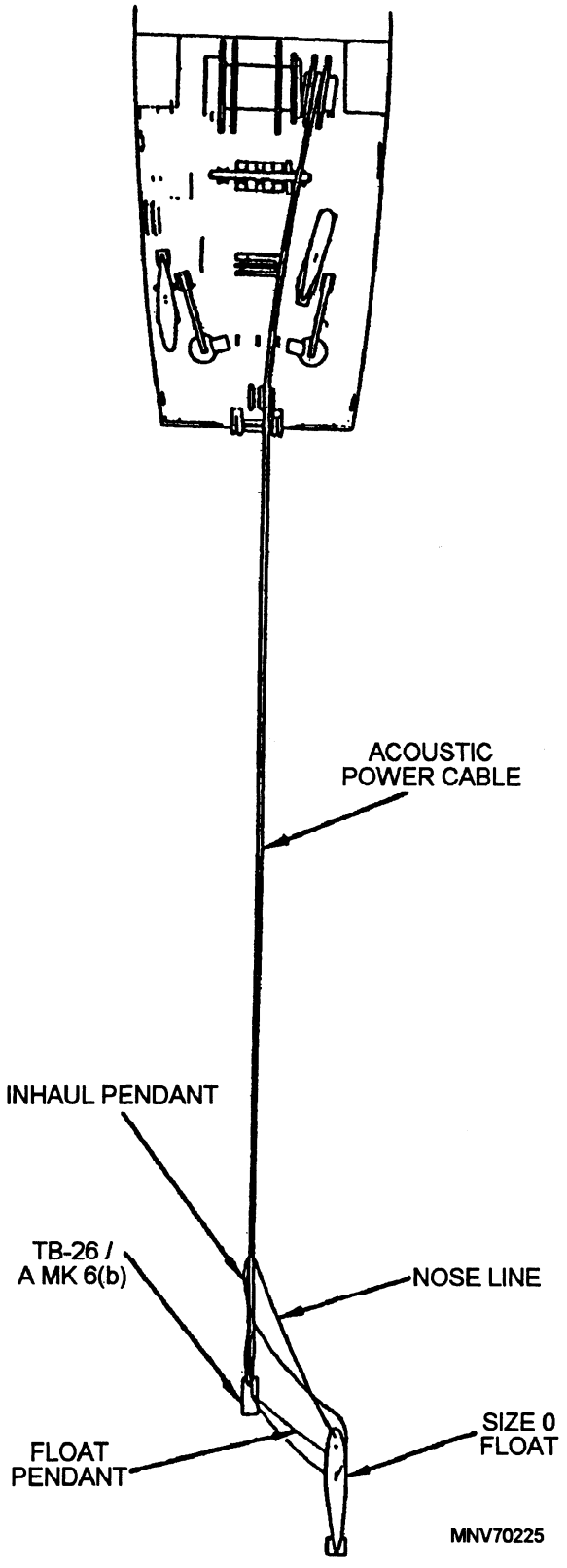

Figure 9-8.—Acoustic sweep configuration TB-26/A Mk 6(b) astern.

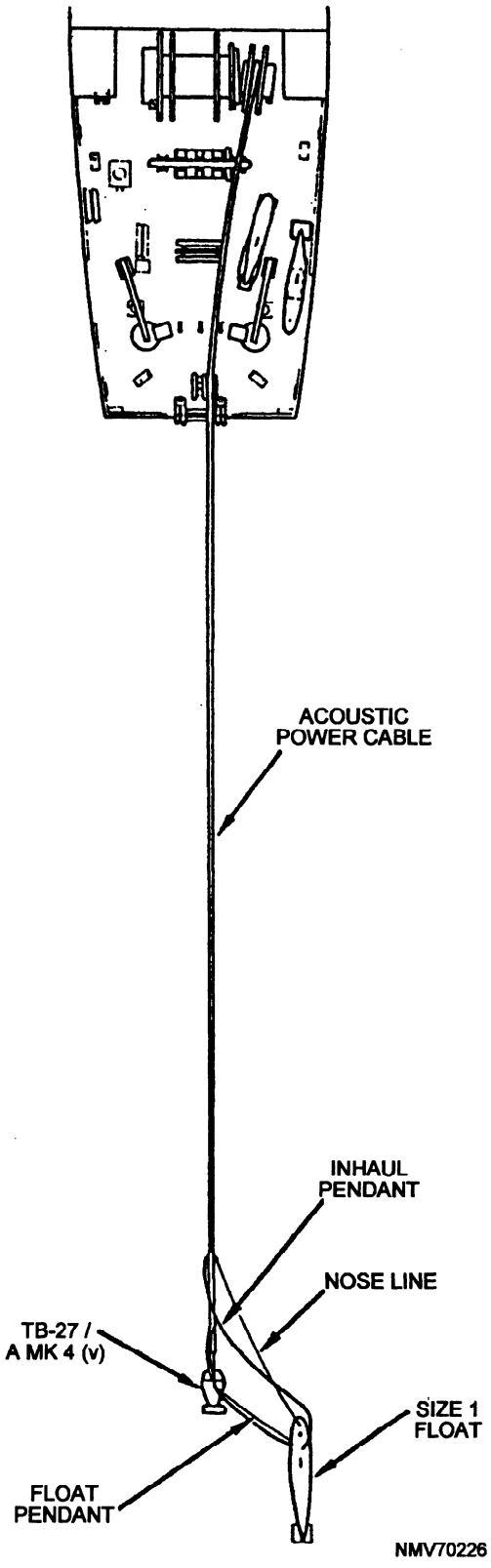

Figure 9-9.—Acoustic sweep configuration TB-27/A Mk astern.