

## CHAPTER 8

# MECHANICAL MINESWEEPING

### LEARNING OBJECTIVES

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

1. State the principles and the objective of mechanical minesweeping.
2. Describe the operation of mechanical minesweeping equipment.
3. Recall the various types of mechanical minesweeping.

### INTRODUCTION

Minesweeping equipment can be subdivided into two basic types: mechanical and influence. Mechanical gear depends upon physical contact between the sweep and the mine or its attachments. Influence gear (acoustic/magnetic) is designed to actuate influence mines by simulating the influence signature of a ship (magnetic, acoustic, pressure, or a combination of two or more such influences).

The objective of mechanical minesweeping is to cut the mooring cable of the mine. This causes the mine to float to the surface, where it can be either exploited or neutralized.

The standard moored sweep, or OROPESA, is referred to as the "O"-type. Variations of the standard gear are designed to counter mines at very deep or very shallow depths. The basic principles of "O"-type gear are illustrated in figure 8-1.

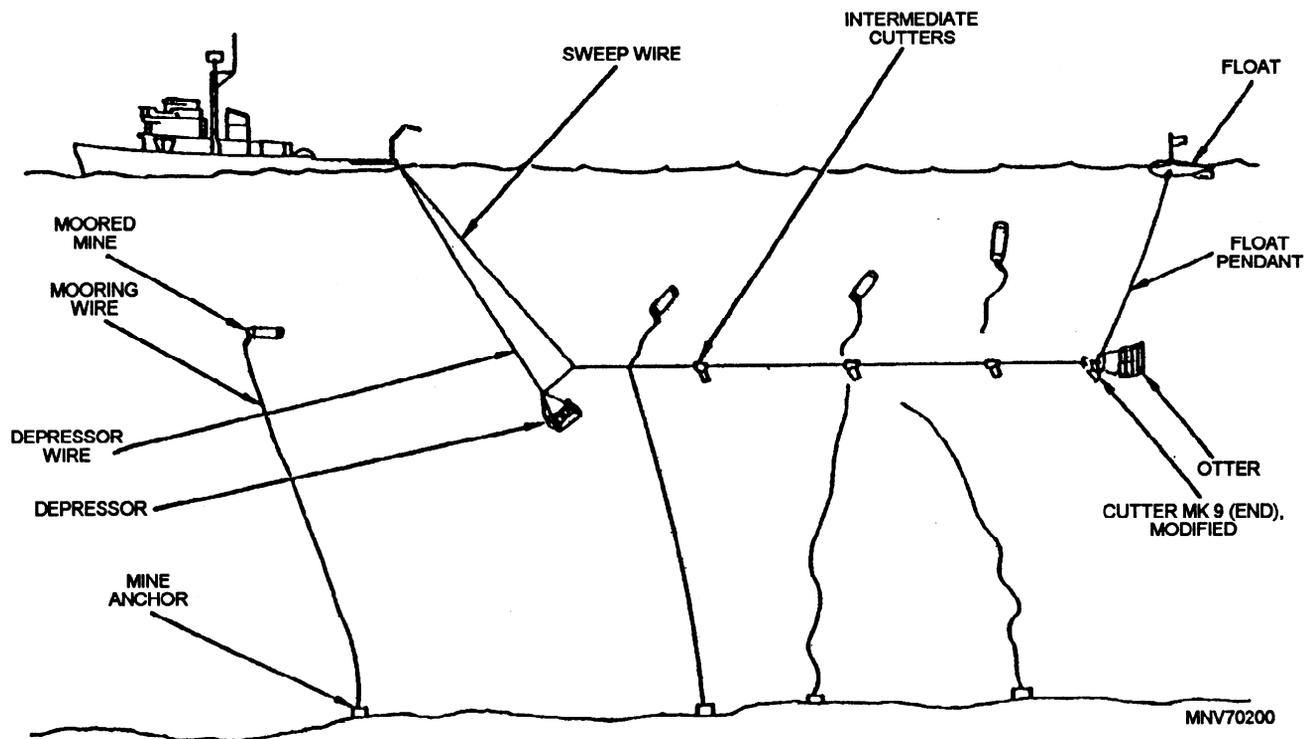


Figure 8-1.—Moored minesweeping.

Figure 8-2 shows the position of equipment on an MCM ship's fantail.

During a sweep, a sweepwire is towed from the stern of the minesweeper at a depth well below the depth at which mine cases are expected to be encountered. Sweepwires may be streamed from one or both sides of the ship. They are diverted, or spread away from the sides of the ship, by an *otter* attached to their outboard end and supported by a float attached with a float pendant.

The depth of the sweep is regulated by the length of the float pendant. To maintain the entire length of the sweepwire at approximately the same depth, a depressor is secured to the sweepwire near its inboard end. The depth of the sweepwire near the inboard end is determined by the length of the depressor tow wire.

Sweepwires are armed with special cutting devices attached to their outboard end (end cutter) and at intervals along their length (intermediate cutters).

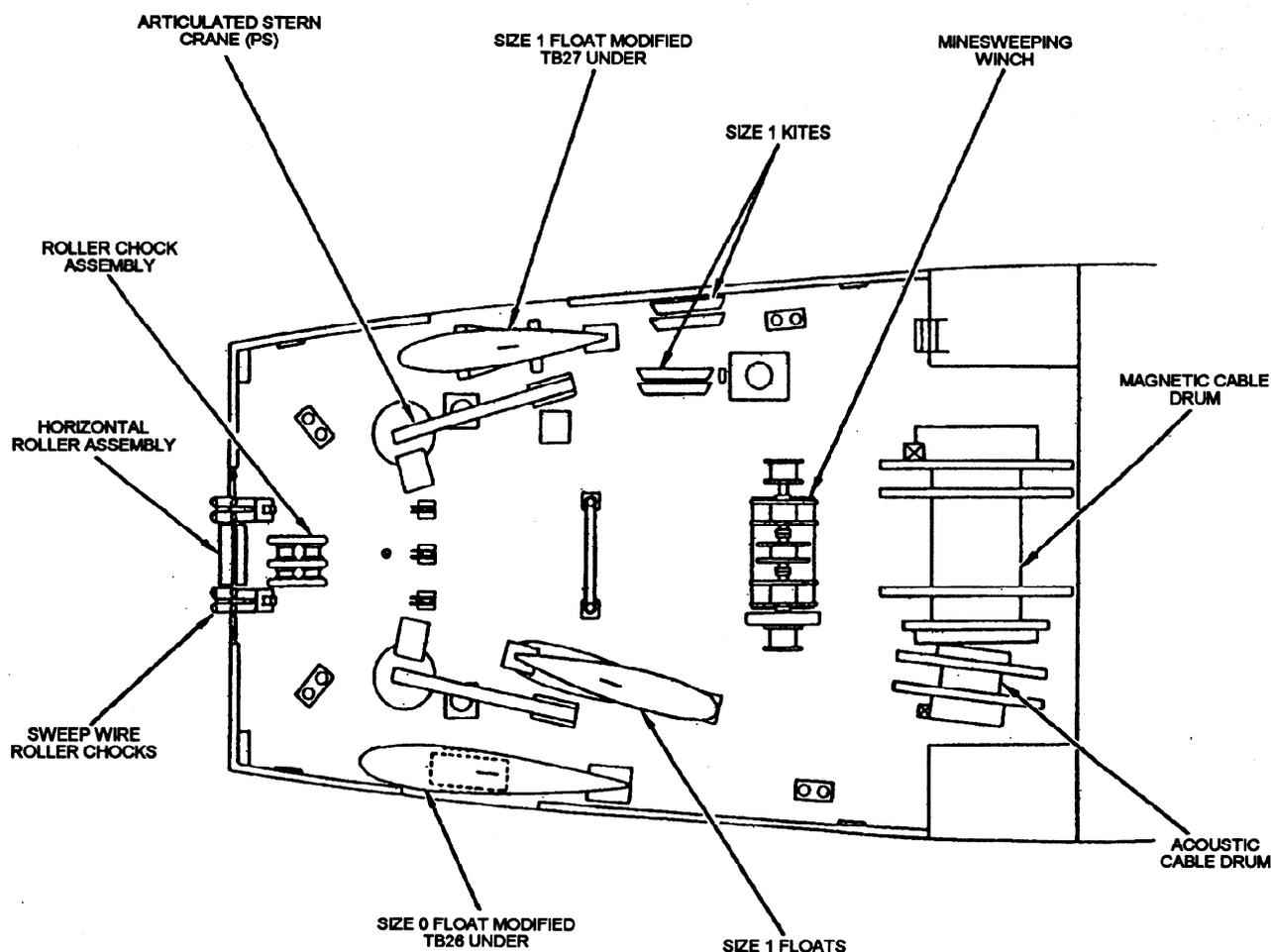
When the sweepwire contacts a mine mooring cable, the mooring is cut by one of the cutters or, in some cases, by the sweepwire itself, allowing the buoyant mine case to rise to the surface, where it can be exploited or neutralized.

## MECHANICAL MINESWEEPING EQUIPMENT

To this point, we have provided an overview of the mechanical minesweeping operation. The following paragraphs describe the major individual components of a typical mechanical system, such as the sweep and depressor wires, cutters, floats, kites, and bridles.

### SWEEP WIRE

A nonmagnetic 5/8-inch, 4,000-foot wire rope with a breaking strength of 32,000 pounds is used as a sweep wire for general minesweeping operations.



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Figure 8-2.—Equipment on an MCM ship's fantail.

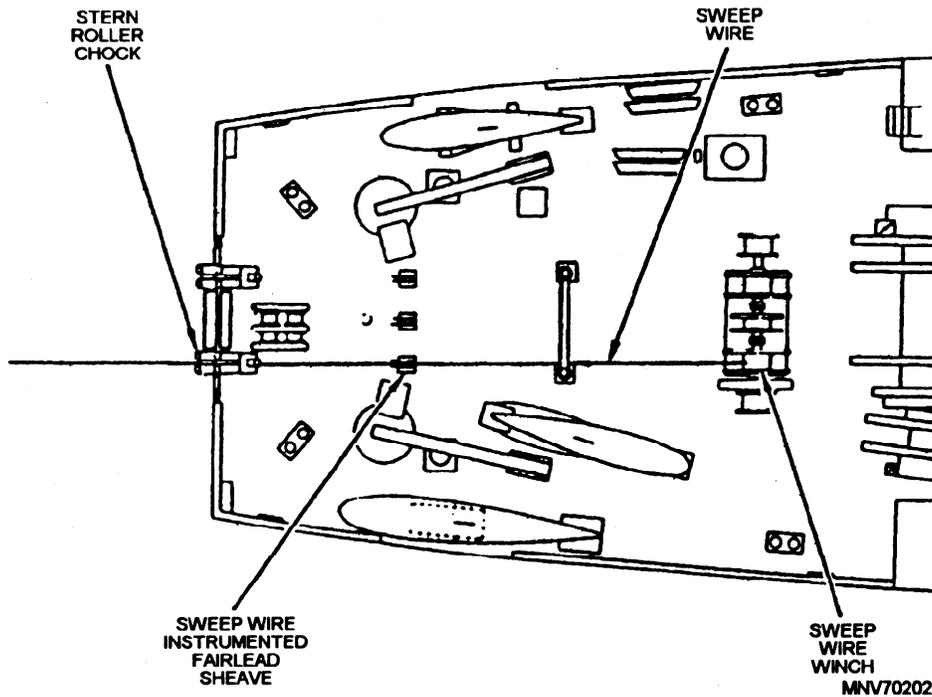
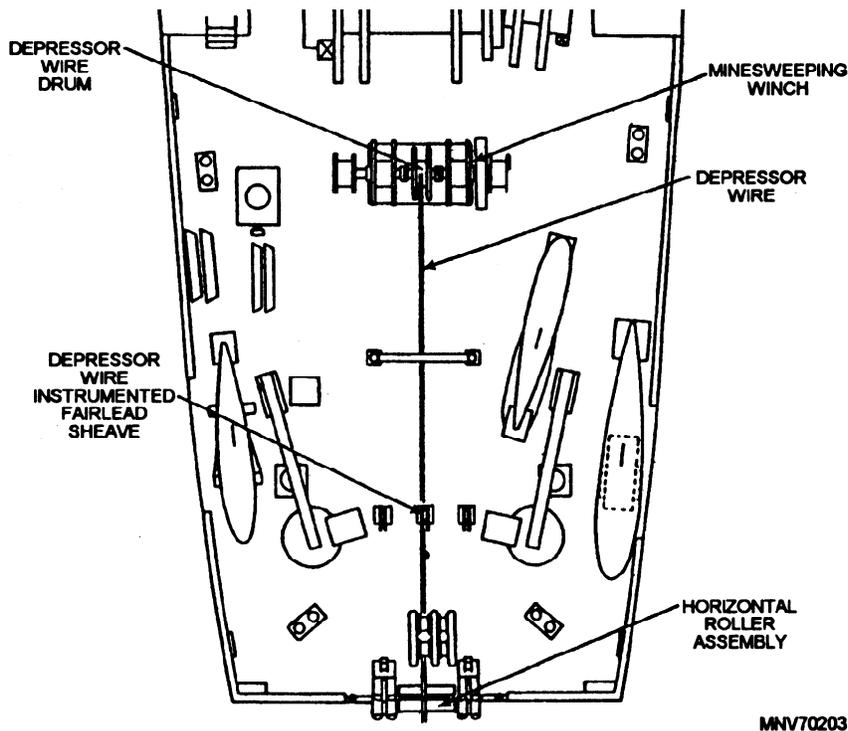


Figure 8-3.—Sweep wire.

An MCM-1 class ship is equipped with two sweep wires. Right-hand lay wire is used on the starboard side and left-hand lay wire on the port side to overcome wire sag during towing operations. The safe working load of the sweep wire is one-half of its breaking strength. Figure 8-3 illustrates the location of the sweep wire on the fantail of an MCM ship.

### DEPRESSOR WIRE

The depressor wire is a 5/8-inch, 1,800-foot-t-long wire rope used to tow a depressor that will regulate the depth of the sweep wire. Figure 8-4 illustrates the location of the depressor wire on the fantail of an MCM ship.



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Figure 8-4.—Depressor wire.

## MINESWEEPING CUTTERS

Various types of minesweeping cutters, both mechanical and explosive, are in common service use. Mechanical cutters are designed to sever the mine mooring when it is jammed into the jaws of the cutter. Explosive cutters sever the mooring by means of an explosive-driven blade.

Minesweeping cutters are further designated as end cutters, intermediate cutters, or wire rope cutters. The end cutter protects the otter from mine mooring wires. The intermediate cutters, located inboard of the end cutter, are used to cut mine moorings. The wire rope cutters are designed to cut the sweep wire or the depressor wire in an emergency. Table 8-1 lists common types of minesweeping cutters.

Table 8-1.—Minesweeping Cutters

Cutter	Type	Designation
Mk 9 Modified	Mechanical	End
Mk 12 Mod 2 Modified	Explosive	Intermediate
Mk 14 Mod 0 Modified	Explosive	Intermediate
Mk 15 Mod 0	Explosive	Wire rope

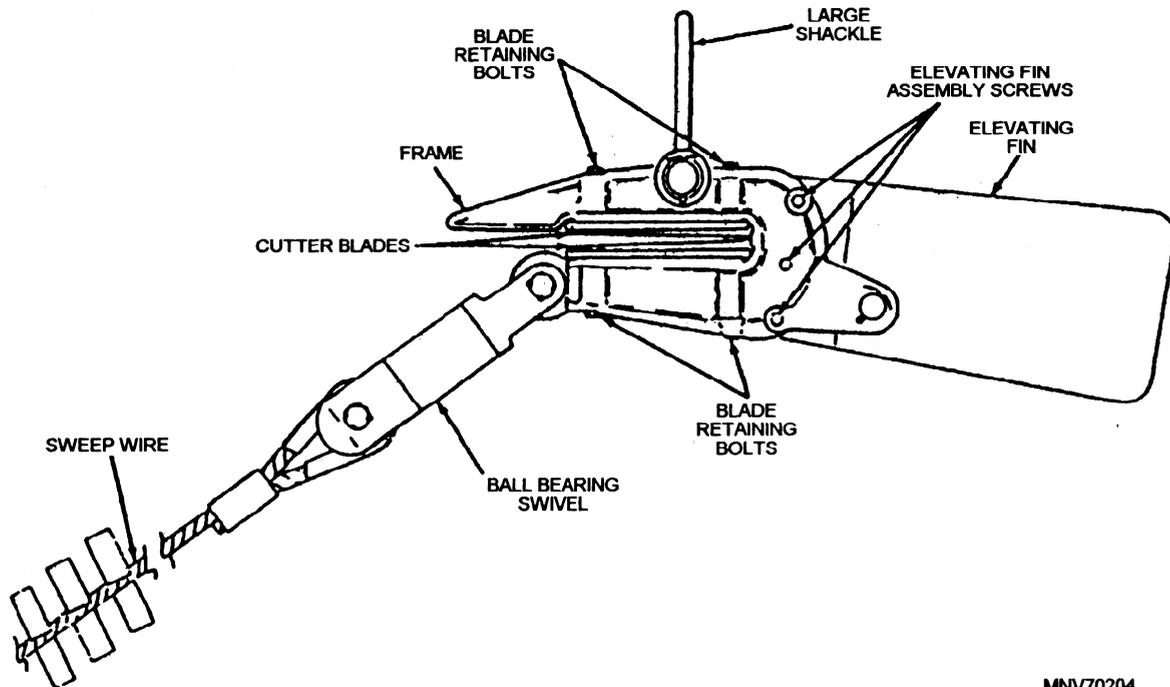
### Modified Mk 9 Cutter

The modified Mk 9 cutter (figure 8-5) is a mechanical end cutter that weighs approximately 38 pounds. The cutter is made from a nonmagnetic material, with the exception of the cutting blade, which is tungsten tool steel. It is designed to attach close to the outboard end of a sweep. When a mine mooring is jammed into the Mk 9's cutting jaws, the cutter severs the mine mooring. The end cutter protects the otter from fouling.

The Mk 9 cutter can be rigged as either a port or starboard cutter, with a reversible elevating fin and cutting blades. When the cutter is laid on the deck with its jaw facing forward, the elevating fin side down, and the cutting blades on top, the large shackle will point to the side of the ship for which the cutter is rigged.

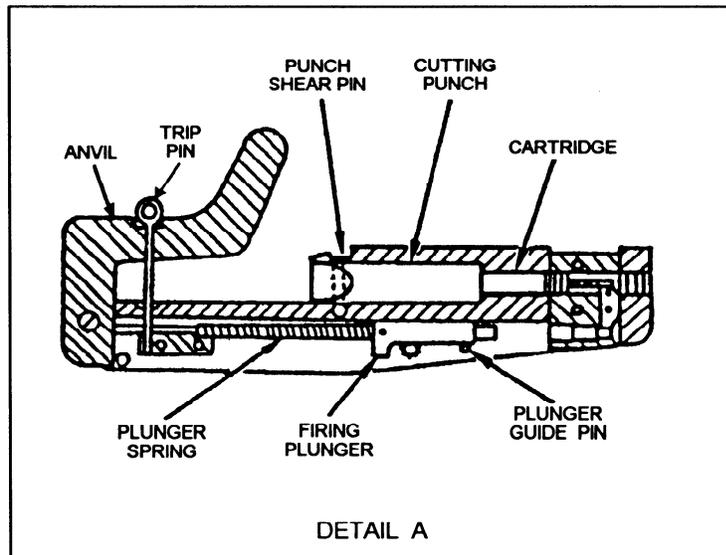
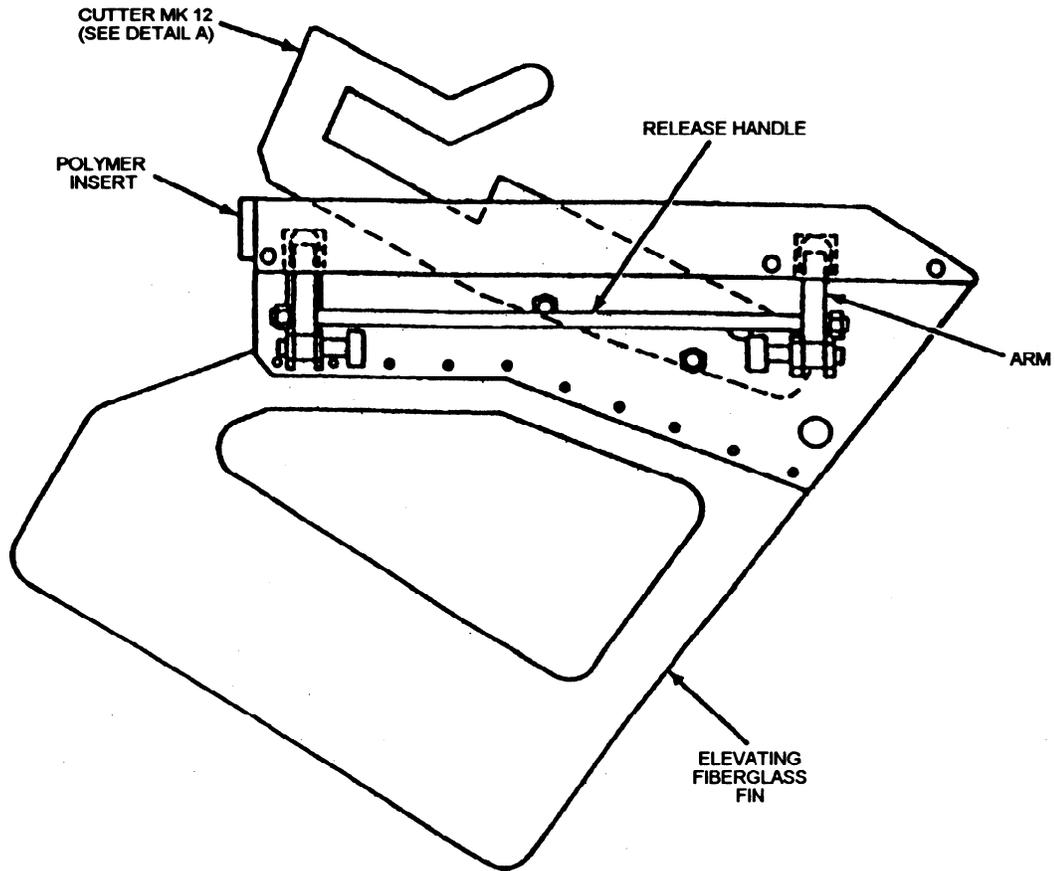
### Modified Mk 12 Mod 2 Cutter

The modified Mk 12 Mod 2 cutter (figure 8-6) is an explosive, one-time use per sweep, intermediate cutter that weighs approximately 25 pounds. It is made from a nonmagnetic material. In a typical minesweeping operation, four Mk 12 cutters are attached to each sweep wire.



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Figure 8-5.—Modified Mk 9 cutter assembly rigged for starboard.



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Figure 8-6.—Modified Mk 12 Mod 2 cutter assembly.

The cutter assembly is actuated by a mine mooring striking the trip pin, which releases the spring-operated firing plunger. The plunger transmits its motion to the rocker arm, which causes the firing pin to strike the cartridge primer, firing the Mk 192 cartridge. This

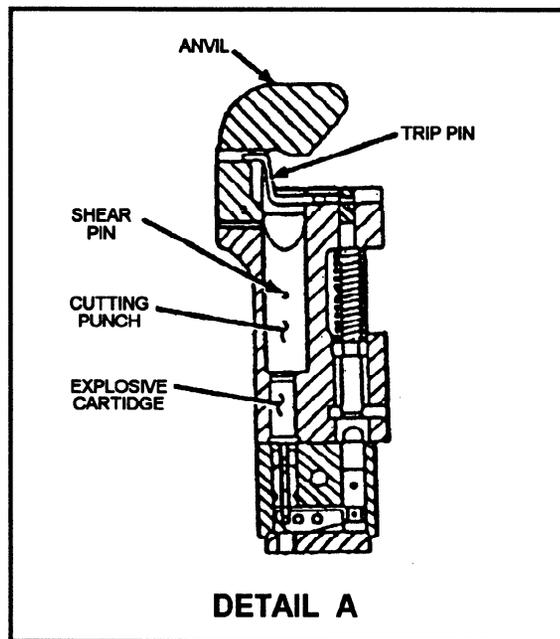
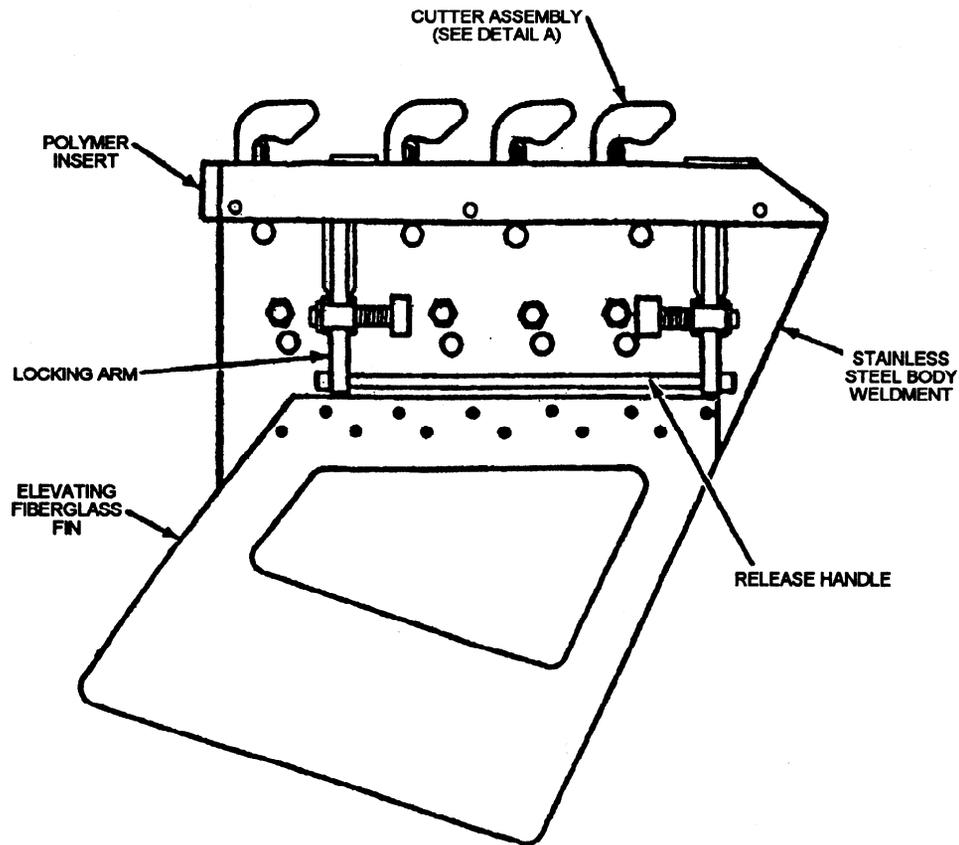
drives the cutter punch forward at high speed, causing the cutter punch to cut the mine mooring and also to shear the anvil screw, which separates the anvil from the cutter body assembly. When the anvil drops away, the way is cleared for succeeding moorings to be cut by the

remaining serviceable cutters attached to the sweep wire. The cutters are interchangeable from starboard to port sweep without modification.

### Modified Mk 14 Mod 0 Cutter

The modified Mk 14 Mod 0 cutter (figure 8-7) is an explosive intermediate cutter with quadruple cutters. It

is made of nonmagnetic materials and weighs approximately 33 pounds. The cutter assembly operates in the same manner as the Mk 12 Mod 0 cutter, with the anvil separating from the cutter body after a mine mooring is cut. This clears the way for succeeding moorings to be cut by the remaining units on the Mk 14



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Figure 8-7.—Modified Mk 14 Mod 0 cutter assembly.

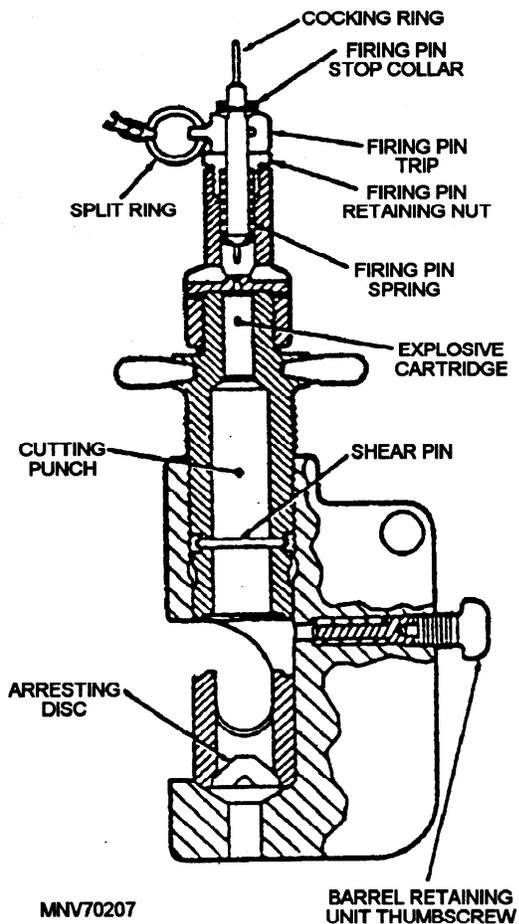


Figure 8-8.—Mk 15 Mod 0 cutter assembly.

### Mk 15 Mod 0 Cutter

The Mk 15 Mod 0 cutter (figure 8-8) is an explosive, single-cartridge-operated device designed to cut wire ropes. The cutter is used primarily as an on-deck emergency cutter for severing the sweep and depressor wires in emergency conditions. It is mounted on each sweep and depressor wire in use. Two types of explosive charge cartridges can be used, the Mk 154 for above water use, and the Mk 155 for below water use.

The Mk 15 cutter is actuated by a lanyard, which releases the firing trip pin. The spring-loaded trip pin releases a firing pin which strikes a cartridge that, in turn, drives a punch down the barrel of the cutter, through the wire rope.

### FLOATS

The purpose of minesweeping floats is to support either minesweeping otters or acoustic devices during minesweeping operations. The size 1 float (figure 8-9) is used in all mechanical minesweeping operations in support of the otter. The float also serves as a marker for the approximate outboard end of the sweep, allowing the sweep width to be checked by observation from the ship. Otter performance may also be visually checked by observing the depth at which the float rides.

The float's flag, with black and red horizontal stripes, indicates whether a port or starboard sweep is

cutter. The cutters are interchangeable from starboard to port sweep without modification.

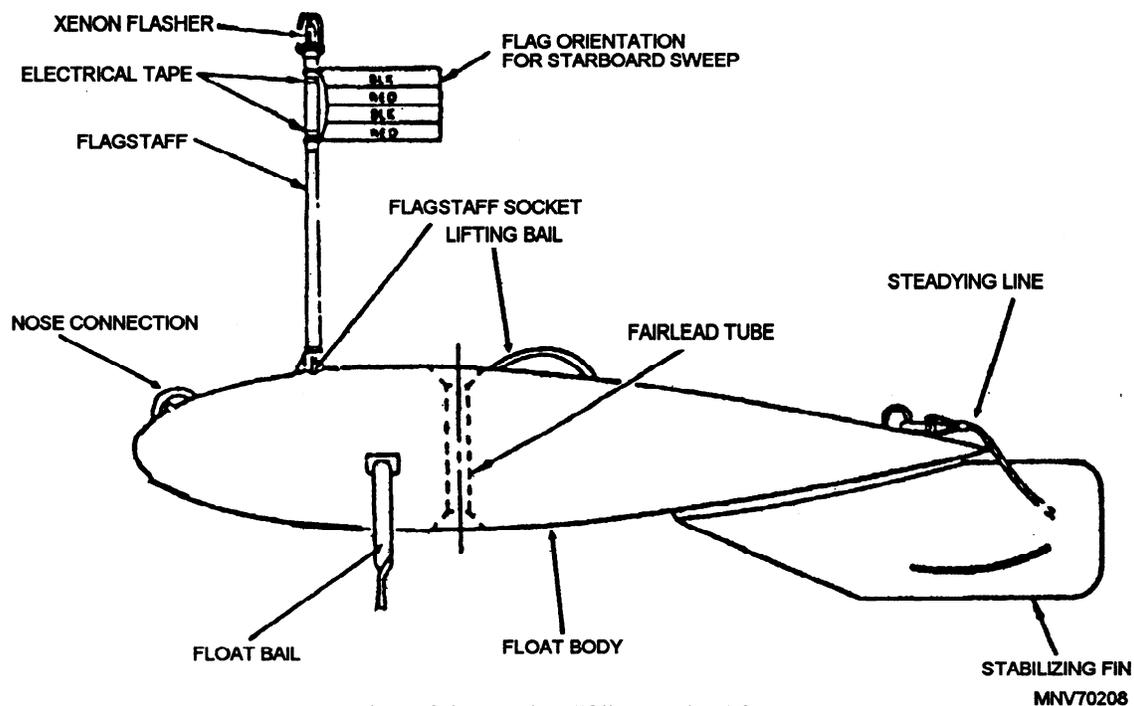


Figure 8-9.—Typical "O"-type, size 1 float.

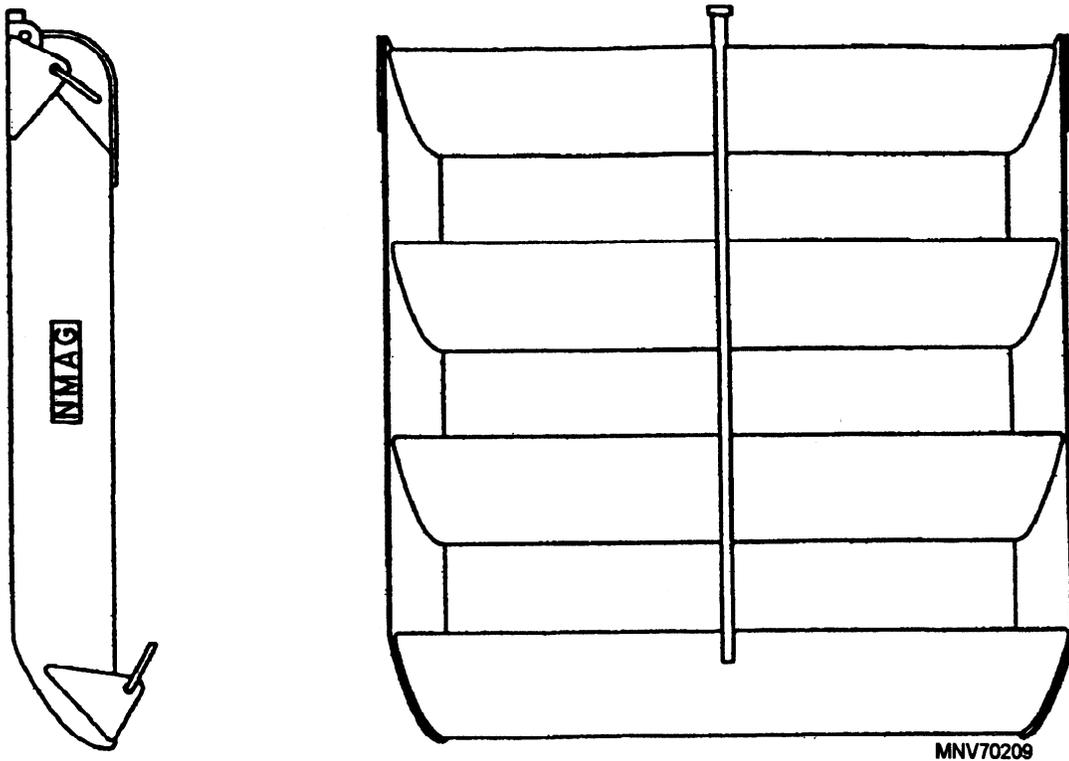


Figure 8-10.—Size-1 multiplane kite.

being conducted. A black stripe on top indicates a starboard sweep; a red stripe on top indicates a port sweep.

### MULTIPLANE KITES

The size 1 multiplane kite (figure 8-10) is designed for use as either an otter or a depressor. The function

that the multiplane kite performs is governed by the rigging of the bridle.

### Otter

The multiplane kite, when rigged as an otter (figure 8-11), provides span and depth to the outboard end of the sweep (figure 8-12).

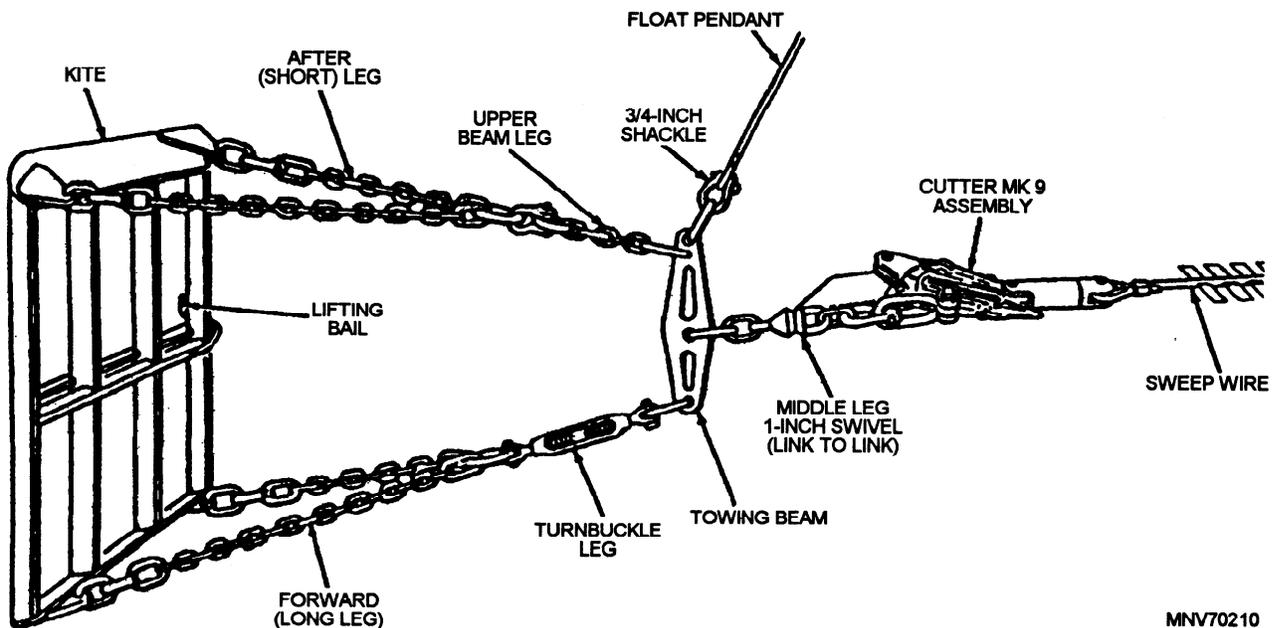


Figure 8-11.—Multiplane kite rigged as a starboard otter.

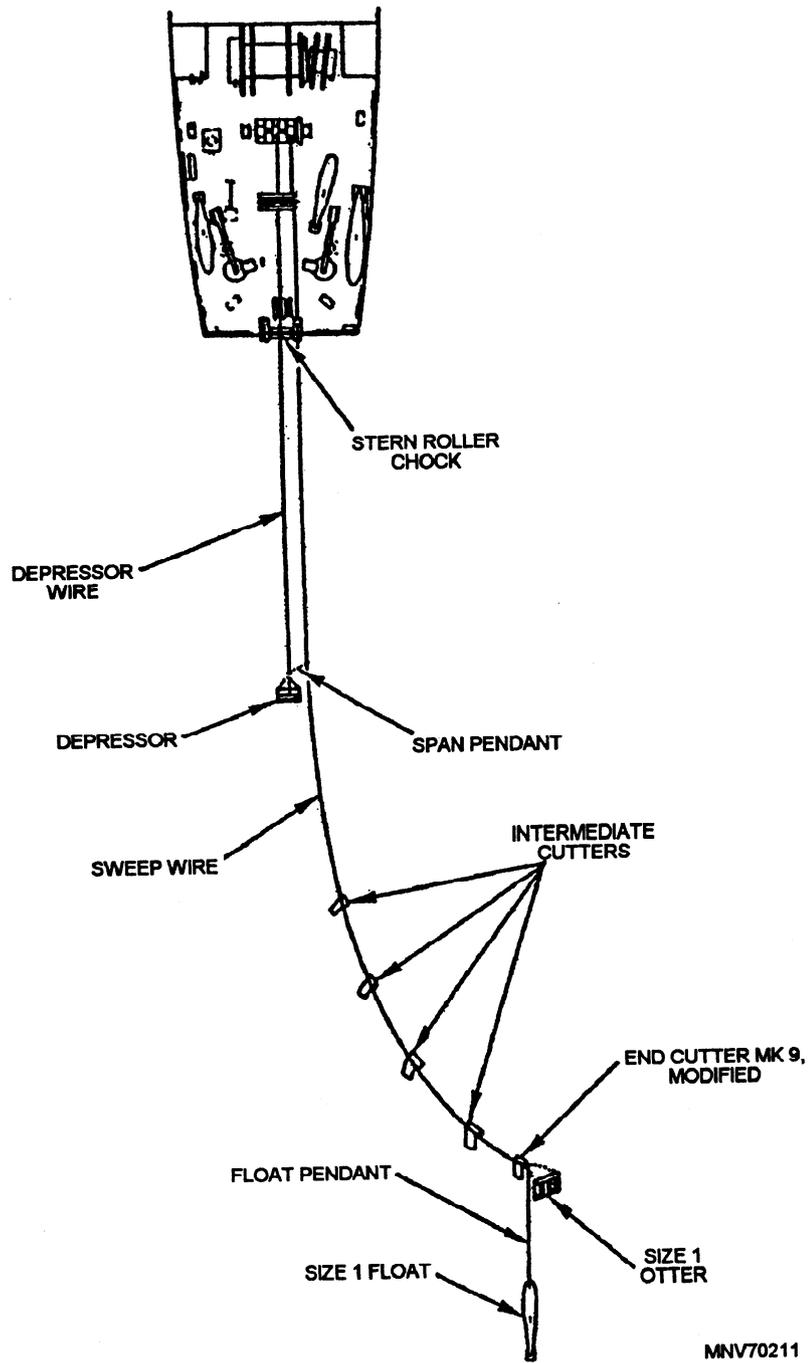


Figure 8-12.—Moored minesweeping “O”-type gear.

## Depressor

The multiplane kite, when rigged as a depressor (figure 8-13), provides span and depth to the inboard end of the sweep (figure 8-12).

## BRIDLES

Bridles are used to connect multiplane kites to the sweep/depressor wire and to govern their function in the minesweeping configuration.

## Otter Bridle

Figure 8-14 illustrates an otter bridle and its components.

## Depressor Bridle

Figure 8-15 illustrates a depressor bridle and its components. Some sweeps use both depressor and otter setups.

## MECHANICAL SWEEP CONFIGURATIONS

Mechanical sweep configurations, using standard "O"-type gear, are illustrated in figures 8-16 through 8-19.

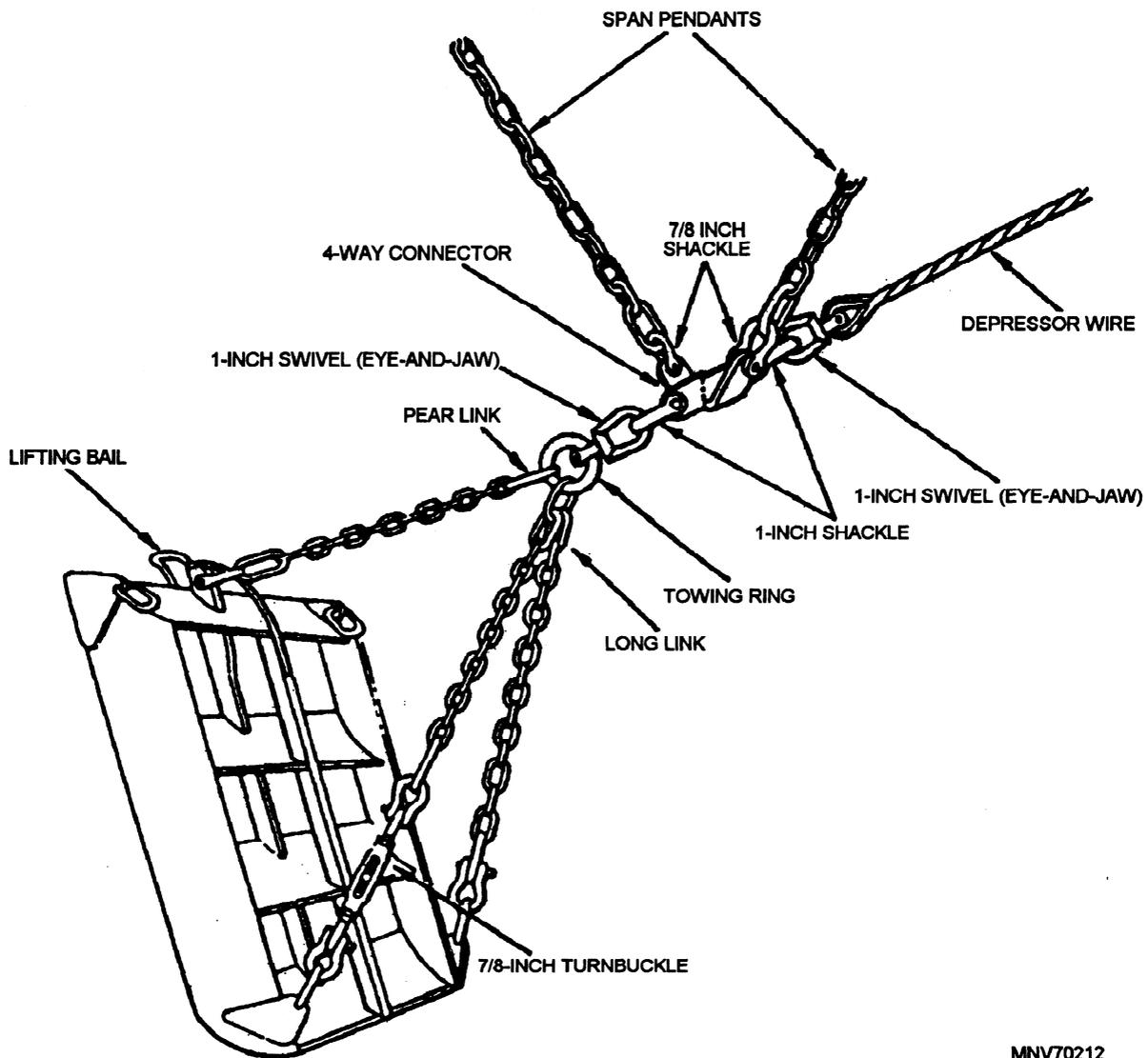
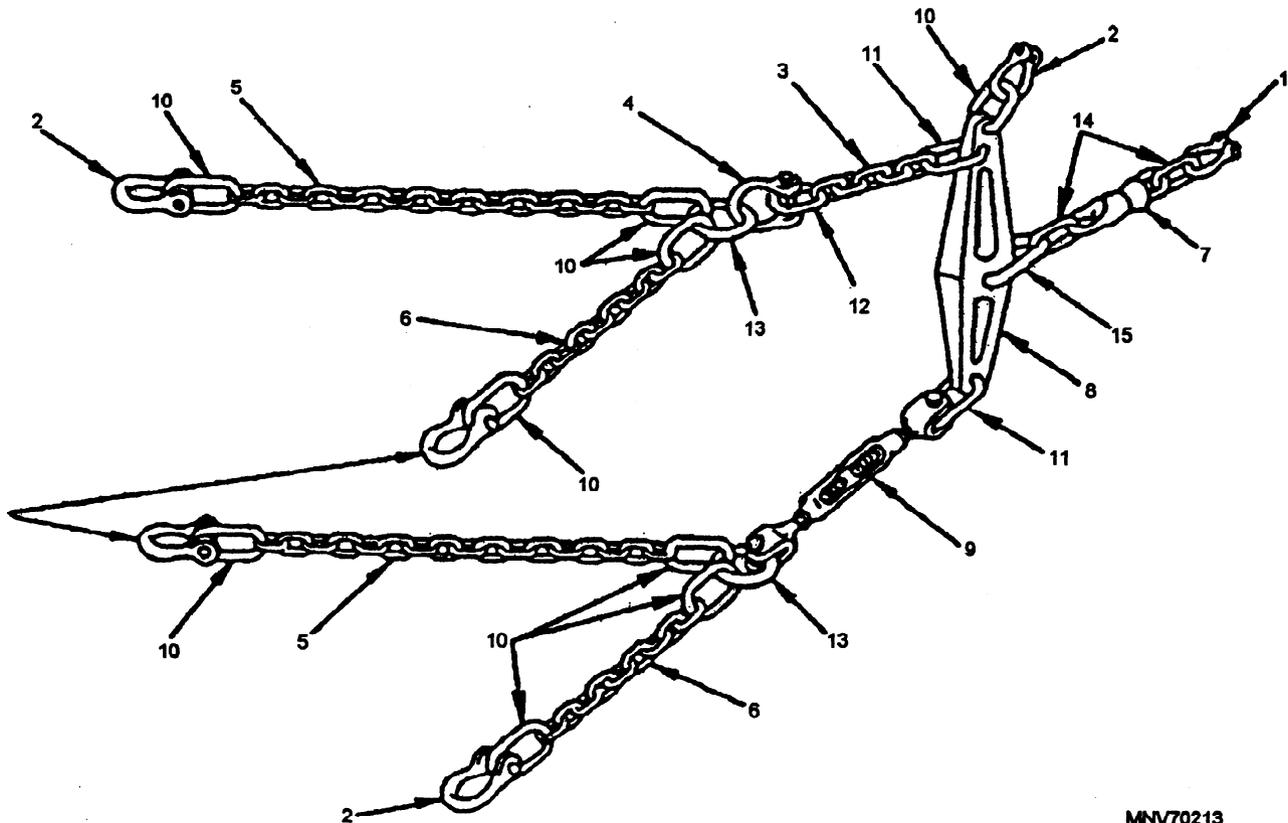


Figure 8-13.—Multiplane kite rigged as a depressor.

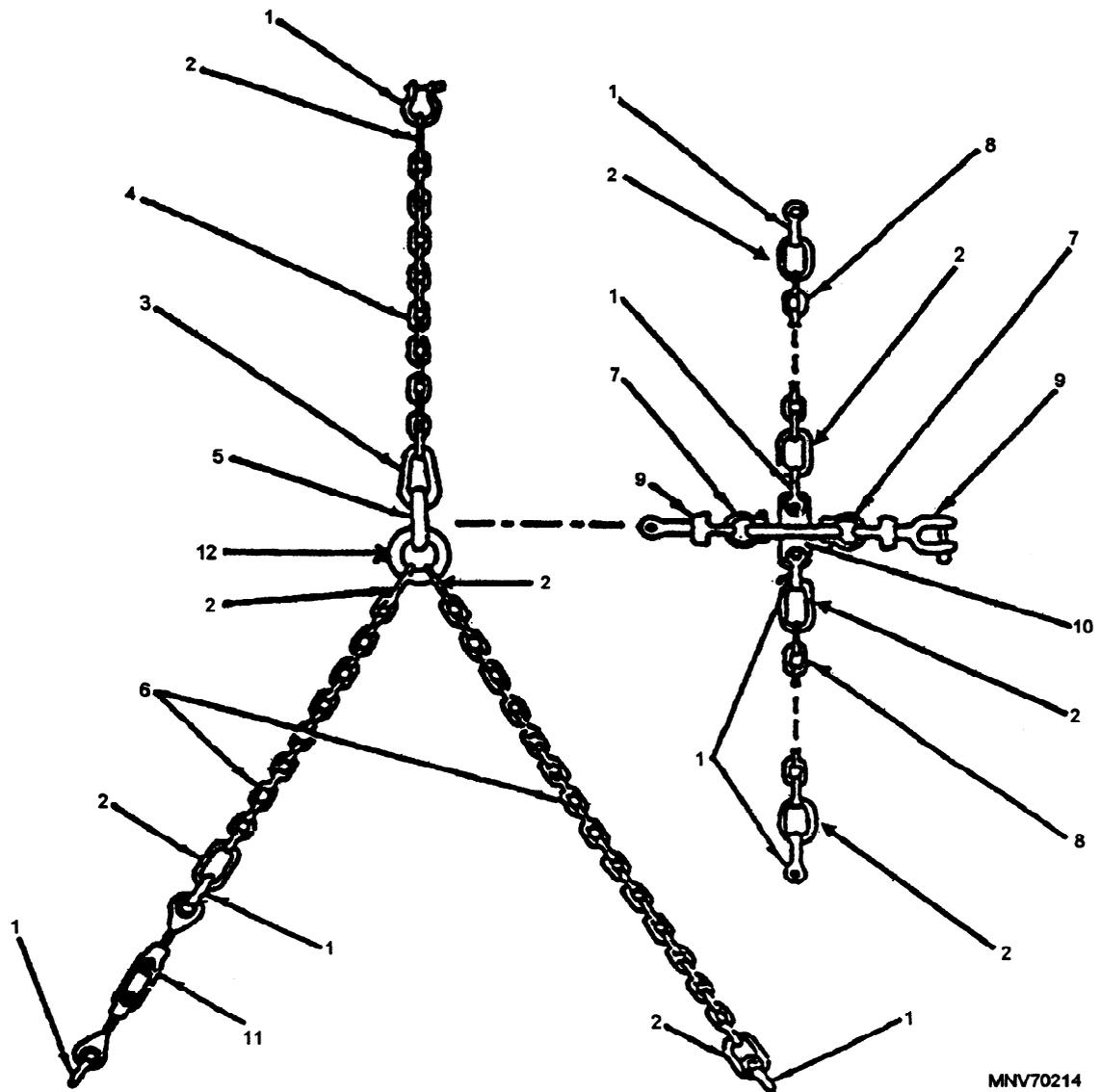
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- |                                         |                                  |
|-----------------------------------------|----------------------------------|
| 1. Shackle, anchor, screw pin, 1-inch   | 9. Turnbuckle, 7/8- × 6-inch     |
| 2. Shackle, anchor, screw pin, 3/4-inch | 10. Long link, 3/4-inch          |
| 3. Upper beam leg, 3/4-inch chain       | 11. Long link, 7/8-inch          |
| 4. Shackle, anchor, screw pin, 7/8-inch | 12. Long link, 7/8-inch          |
| 5. Forward (long) leg, 5/8-inch chain   | 13. Ring, 1-inch × 5 1/8-inch OD |
| 6. After (short) leg, 5/8-inch chain    | 14. Long link, 1-inch            |
| 7. Swivel, link-to-link, 1-inch         | 15. Pear link, 1 1/8-inch        |
| 8. Beam                                 |                                  |

Figure 8-14.—Otter bridle.



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- 1. Shackle, anchor, screw pin, 7/8-inch
- 2. Long link, 3 3/8-inch inside length × 7/8-inch dia material
- 3. Pear link, 5 7/8-inch inside length × 7/8-inch dia material
- 4. After (short) leg, 3/4-inch chain
- 5. Ring, towing, 1-inch ID × 1 1/2-dia material

- 6. Forward (long) leg, 3/4-inch chain
- 7. Shackle, anchor, screw pin, 1-inch
- 8. Pendant, span, 3/4-inch chain
- 9. Swivel, eye to jaw, 1-inch
- 10. Connector, 4-way
- 11. Turnbuckle, eye and eye, 7/8- × 12-inch
- 12. Ring, 3 3/8-inch ID × 1 1/4-inch materials

Figure 8-15.—Depressor bridle, size 1.

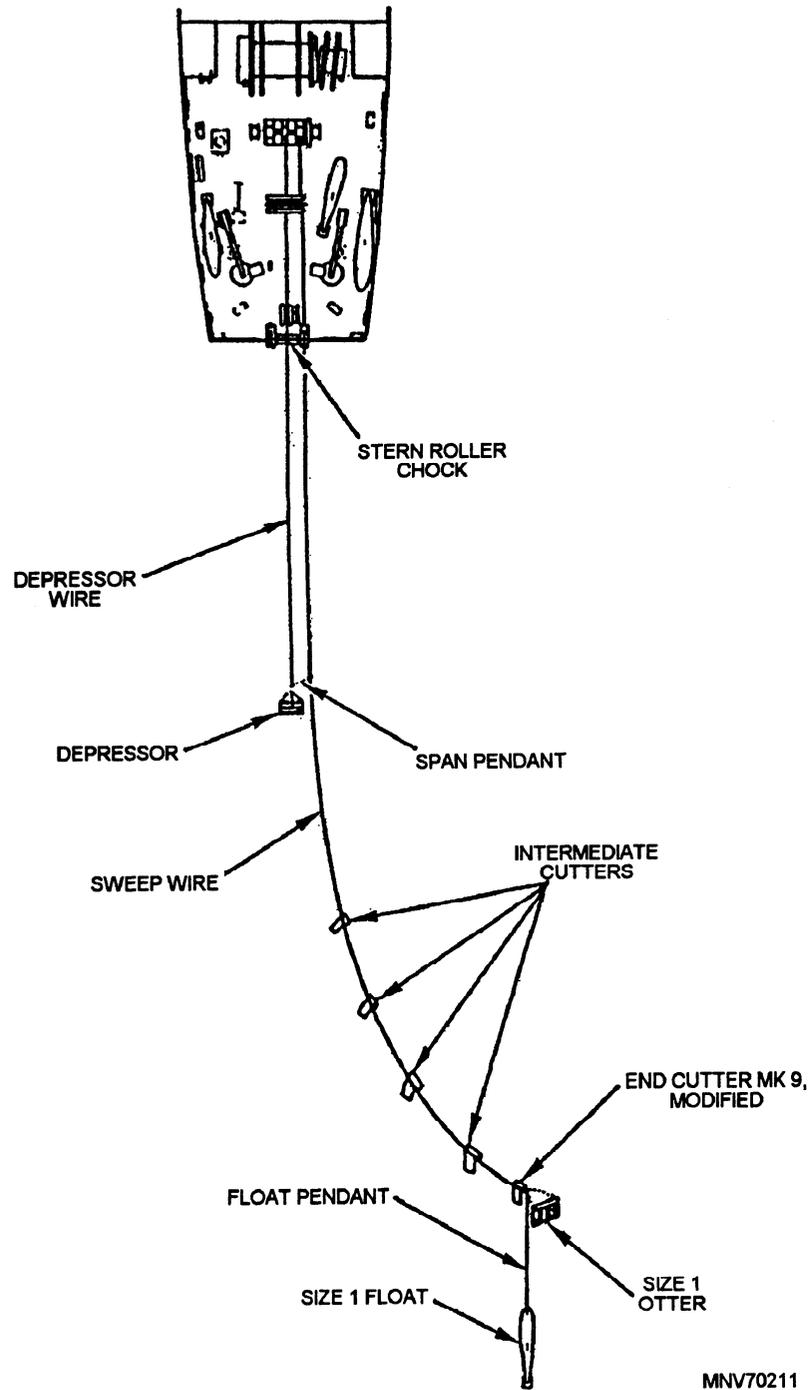


Figure 8-16.—Moored minesweeping configuration (single “O”-type gear streamed to starboard).

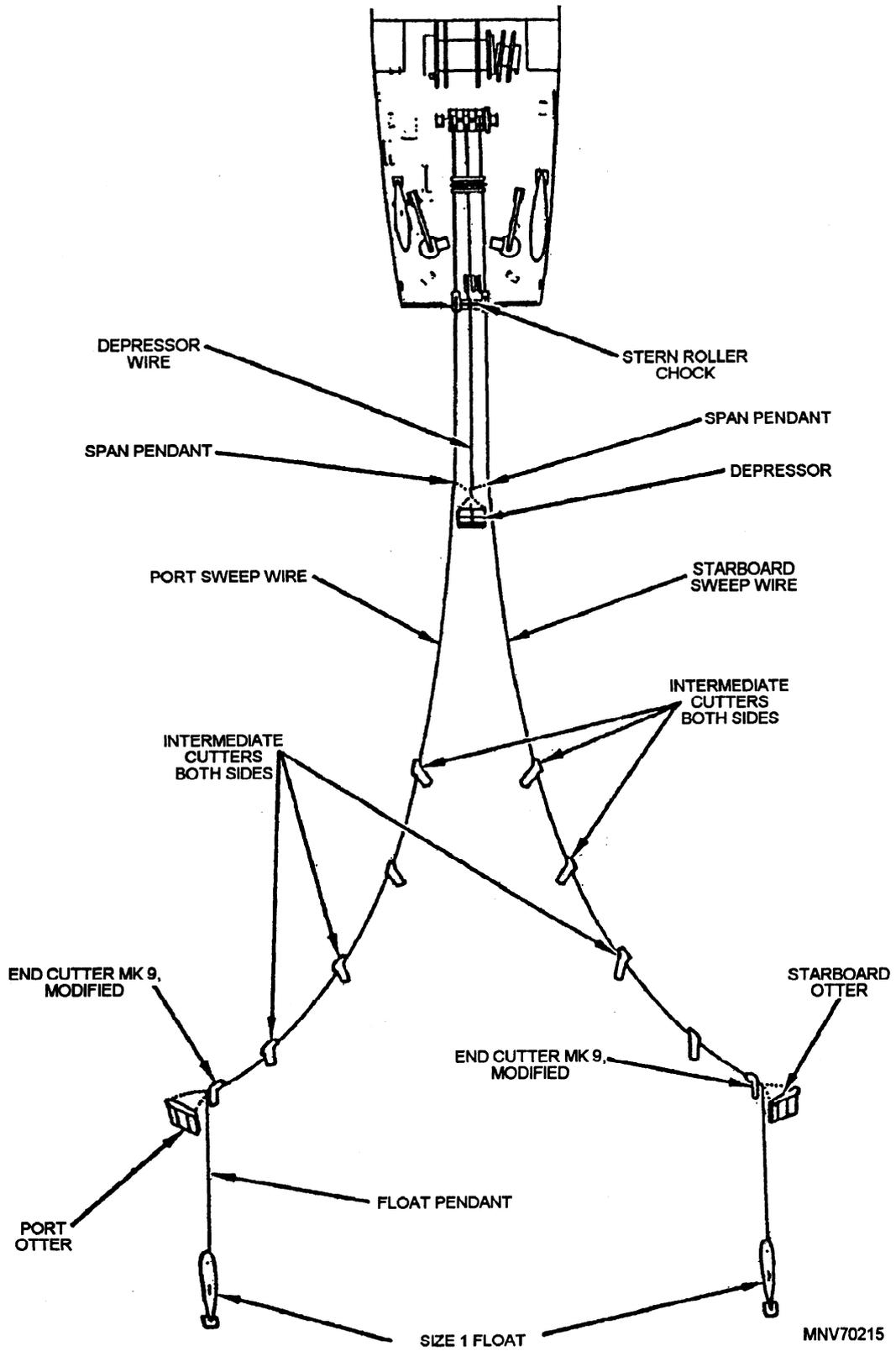


Figure 8-17.—Moored minesweeping configuration (double "O"-type gear streamed to port and starboard).

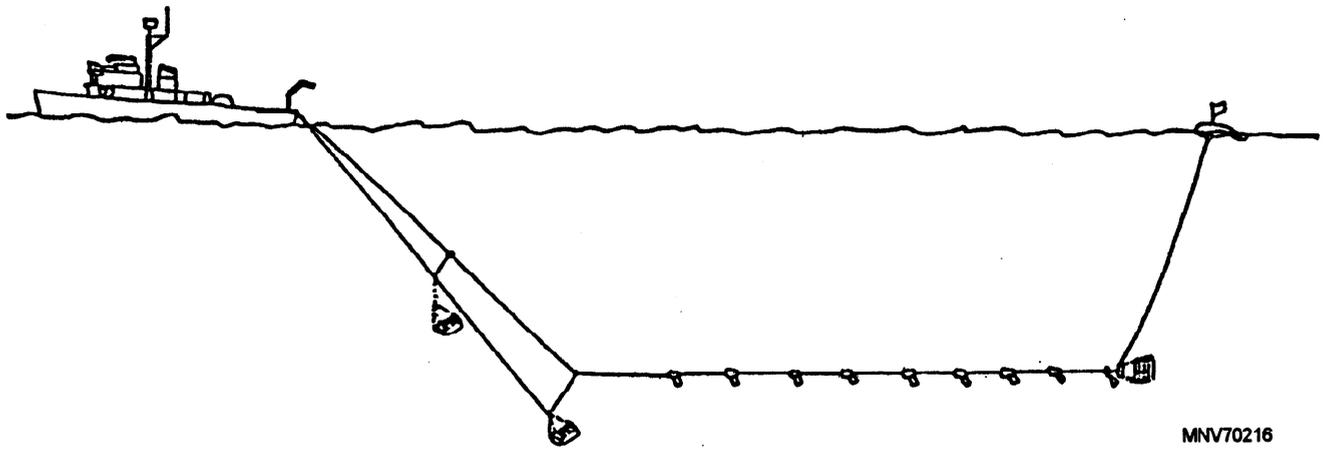


Figure 8-18.—Size 1 deep sweep (Single-ship deep sweep).

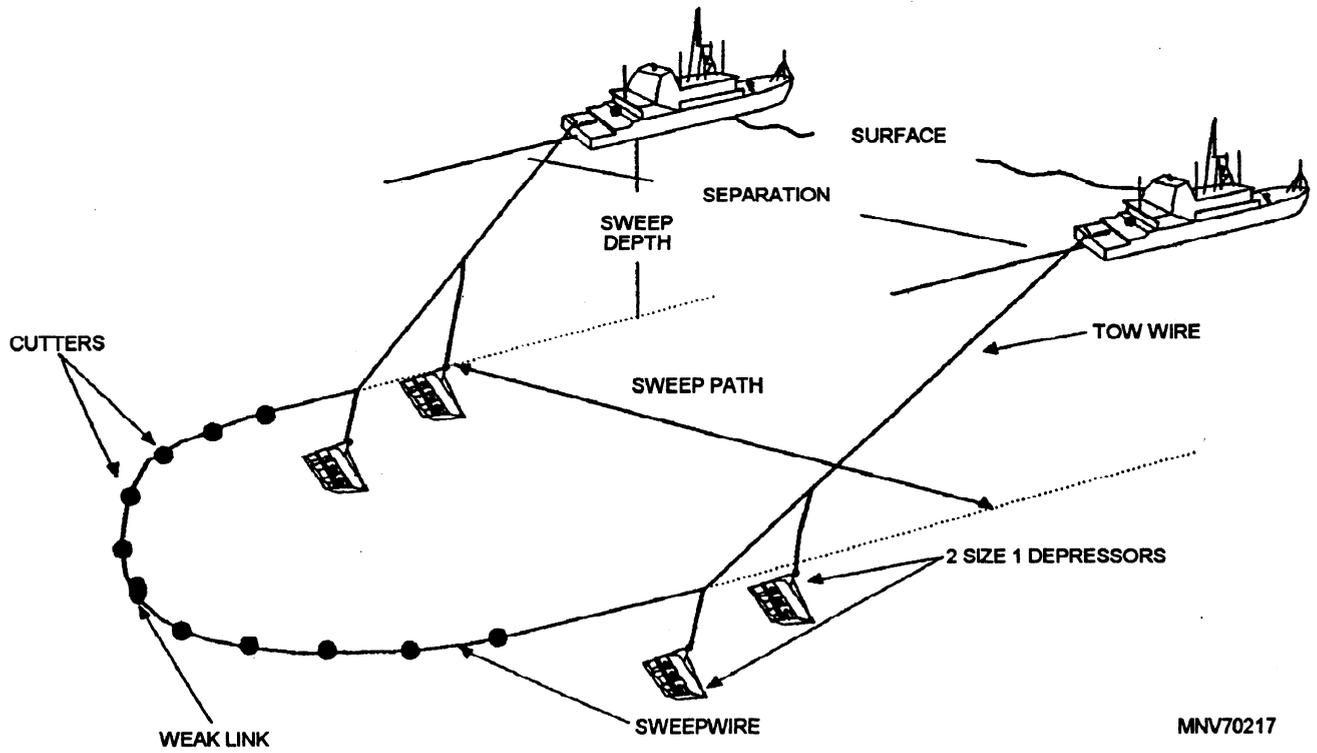


Figure 8-19.—Improved deep moored sweep configuration.

