

**THE WEST GERMAN
RESEARCH VESSEL WALTHER HERWIG**



**UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE**

BUREAU OF COMMERCIAL FISHERIES

Circular 266

UNITED STATES DEPARTMENT OF THE INTERIOR

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Research Vessel Walther Herwig**

By

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Circular 266

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The West German Research Vessel Walther Herwig

By

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ABSTRACT

The Walther Herwig is a modern fishery research vessel built for the West German Government and launched in 1963. The vessel was primarily designed as a stern trawler for use in high sea fisheries investigations with emphasis on mid-water and bottom trawling. Pertinent features of design, equipment, appurtenances, arrangement, and location are described in some detail for the benefit of interested groups or organizations who may be planning to build or outfit vessels of their own for similar use.

INTRODUCTION

The Walther Herwig is a modern fishery research vessel operated by the Federal Republic of Germany (West Germany). This vessel was built in Bremerhaven, Germany, by The Seebeck Weser Corporation (Aktiengesellschaft "Weser" Werk Seebeck). She was launched in February 1963 and commissioned in June upon delivery to the Federal Research Establishment for Fisheries (Bundesforschungsanstalt für Fischerei), a department of the Ministry of Food, Agriculture and Forestry (Bundesministerium für Ernährung, Landwirtschaft und Forsten). The Federal Fisheries Research unit has four

branches, two of which have, to date, used nearly all of the vessel's sea time. These two branches are the Institute for Fishing Techniques (Institut für Fangtechnik), corresponding somewhat to our Bureau of Commercial Fisheries Branch of Exploratory Fishing and The Institute for High Seas Fisheries (Institut für Seefischerei), functioning similarly to our Bureau of Commercial Fisheries Division of Biological Research. Several other branches may participate occasionally in the Walther Herwig cruises; however, generally their use of the vessel is insignificant.

GENERAL DESCRIPTION

The Walther Herwig is a tall, sturdy vessel. Its distance from the top of the bridge to the waterline is about 40 feet. Although the large surface of the house and the high hull line give the vessel a strong tendency to "sail" when heading across the wind, the vessel is remarkably seakindly. Very little motion results when towing or steaming into or before the wind. When in the troughs, the width of the hull helps to minimize roll without the aid of an antiroll device. Winds up to 45 knots will

not prevent fishing unless the seas are too high.

The principal dimensions of this vessel (rounded to the nearest whole number) are: length, 273 feet; beam, 41 feet; draft at bow, 13 feet; draft at stern, 17 feet; depth to upper deck, 23 feet; depth to lower deck, 15 feet; molded volume of displacement, 80,500 cubic feet; and displacement about 2,576 short tons or 2,300 long (marine) tons of sea water. Frame spacing is 1.97 feet.

The vessel has a bulbous bow, two bow thrusters in separate tunnels (both may be used for either thrusting to port or starboard), an "active rudder," and a stern chute (fig. 1). The two bow thrusters are each powered by 200-horsepower, 380-volt alternating current, 345-ampere, 50 cycles per second electric motors. Speed is controlled by varying the active fields of the electric motors with a maximum speed of 575 revolutions per minute. The bow thrusters have three-bladed propellers of 41.3-inch diameter and adjustable pitch set at 25.2 inches. The "active rudder" is an auxiliary propeller mounted in the trailing edge of the main rudder. This propeller is enclosed within a nozzle and pivots with the rudder. Because the rudder turns 90 degrees, the combined use of the bow thrusters and the active rudder can move the vessel sideways for maneuvering in close places or for holding the vessel on station against the wind, the current, or both. The active rudder is powered by a 250-horsepower, 380-volt alternating current, 425-ampere, 50 cycles per second electric motor

with speed adjustable to 575 revolutions per minute. Its three-bladed propeller is 45.7 inches in diameter and has a pitch of 25.2 inches.

The main propeller is five-bladed and 116.1 inches in diameter and has a pitch of 107.9 inches and an area of 37.1 square feet. It delivers a maximum thrust of 22 tons at 190 revolutions per minute and is of "Alcunic" material (an aluminum-nickel-bronze alloy).

Depending on the type of activity and the consequent fuel consumption, the endurance of the Walther Herwig is about 35 days. Water is carried in tanks and also supplied by evaporators. The fuel carrying capacity is 350 tons; normal consumption during steaming is 9 to 10 tons daily. Fishing operations use less fuel; daily consumption during average fishing activities is about 5 to 6 tons. The average cruise is 2 months. The longest cruise planned for 1966 was to the South American coast; this cruise was scheduled to last about 4 months.

All living quarters and working areas (except deck areas) are air-conditioned.

DESCRIPTION BY DECKS

The Walther Herwig has a top of house, five decks, a hold, and a double bottom (figs. 2 and 3). Four decks are above the water level; two of these are in the bridge structure. The following description of the vessel considers first the decks of the bridge and then proceeds toward the keel.

TOP OF HOUSE

In accord with recommended safety practice, a standby magnetic compass is located on the top of the house. The top of the house also provides an area for mounting the supports for the radar scanners, various weather instruments, and Decca¹, Loran, and radio antennas. An overhead framework supports an awning for protection from the tropical sun.

NAVIGATION BRIDGE

The navigation bridge is the top deck. The pilothouse (figs. 4 and 5) occupies the forward side of the deck, spans the width of the bridge, and is continuous with the chartroom aft along the starboardside. Also, a fishing station and an electronic fishing equipment room are located on this top deck.

¹Trade names referred to in this publication do not imply endorsement of commercial products.

Pilothouse

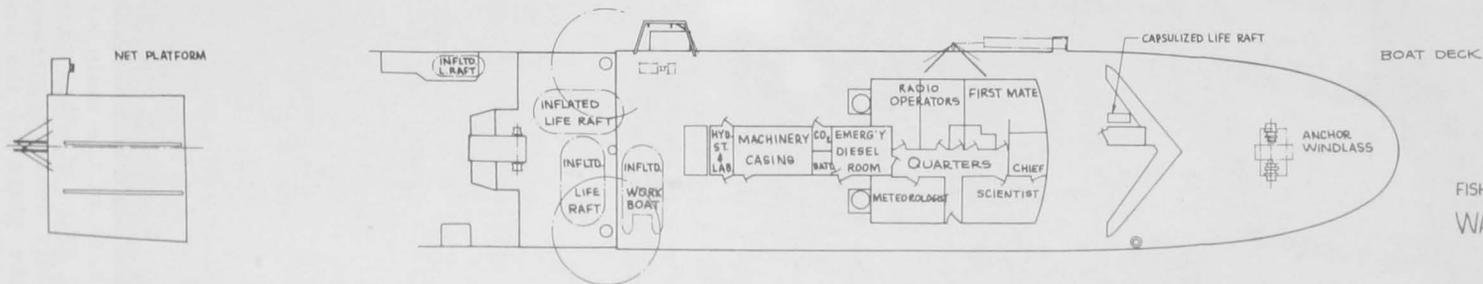
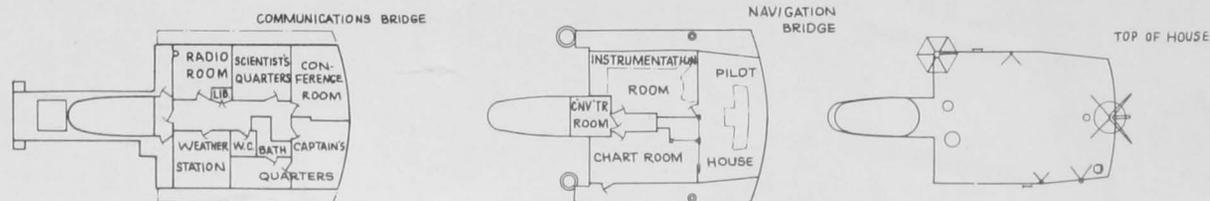
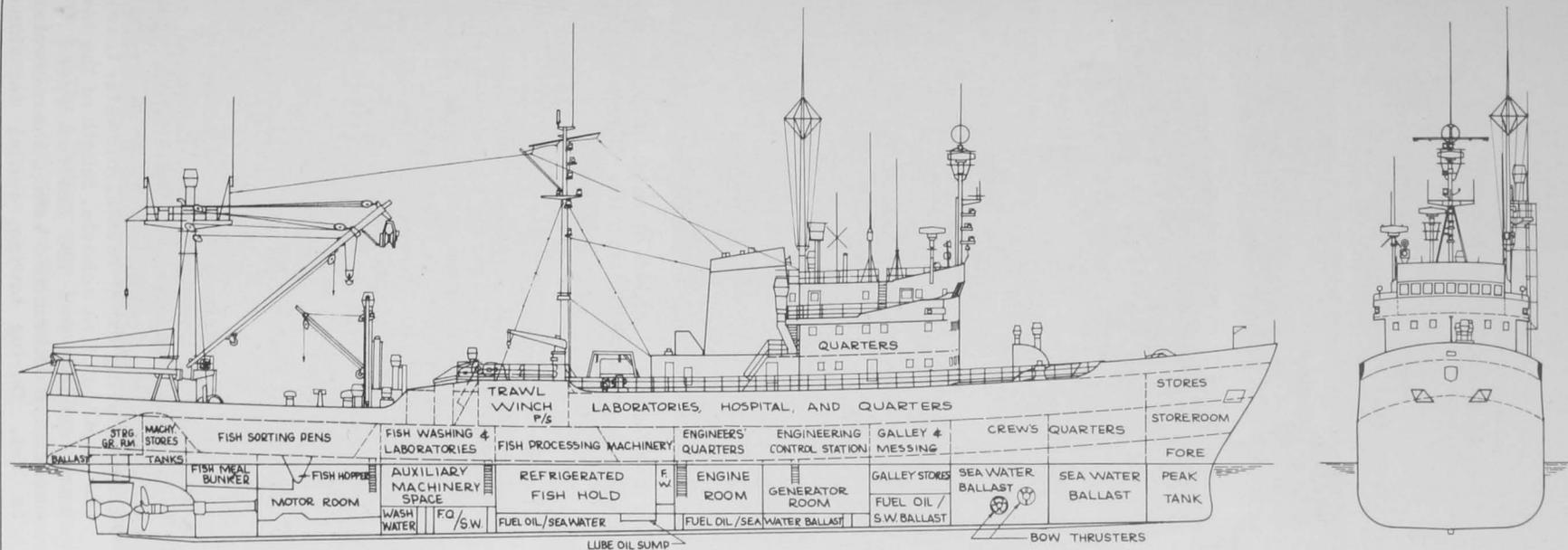
Instruments in the pilothouse include two radars; a net sounder (headrope transducer) recorder unit; an echograph depth indicator; a rapid-flashing acoustic depth indicator for use in harbors, channels, and other shallow water areas; radiotelephone; ship's intercom; ship's telephone; automatic course plotter; gyrocompass (with repeater units in most other stations and laboratories); automatic pilot; vessel water-speed indicator (with repeater units in other ship location as needed); propeller thrust indicator (in tons) with repeaters in the electronics room and elsewhere; propeller revolution indicator; the wheel for the main rudder; and indicators and controls for various other components such as the main engine, bow thrusters, and "active rudder."

Remote Control Stations

Each outboard wing of the pilothouse has a communications system and remote controls for operating the vessel from that position. A searchlight equipped with a shutter is available for sending messages, within the capabilities for this method, from each of the remote control stations. All deck officers are capable of sending and receiving messages by blinker.



Figure 1.--The stern chute. Note the "Süberkrüb" type of midwater trawl doors at each side of the chute, the purse seine platform with a tuna purse seine above the chute, and the offset stern mast with boom and power block. The rudder with the "active rudder" and the propeller are centered below the chute and forward of the stern.



FISHERIES RESEARCH VESSEL
WALTHER HERWIG

Figure 3.--Deck plans for the Walter Herwig (Plate 2).



Figure 4.--The pilothouse control console. This view is looking toward the starboardside of the pilothouse and shows the concentration of fishing, communication, and navigational equipment arranged around the "Captain's Chair."

Chartroom

The chartroom is continuous with the pilothouse and extends aft along the starboard side of the bridge. It contains the following instruments: visual radio direction finder, barometer, chronometer, vessel water speed and distance indicator (fig 6), Loran navigational unit, Decca navigational unit, and, of course, a chart table with chart storage drawers, and various navigation instruments.

Fishing Station

Three windows in the aft side of the chartroom afford a view of the stern chute and the fishing area of the main or upper deck. The largest two of the three windows are electrically heated to prevent icing. Imbedded within the glass of the heated windows are

extremely small copper conductor wires so fine that they can hardly be seen except when the light is at the exactly right angle. The smallest window can be opened to ensure visibility at all times. A remote control station, from which the vessel is controlled during fishing, is located beside these windows (fig. 7).

Electronic Fishing Equipment Room

Aft of the pilothouse, on the portside, is the electronic fishing equipment room. All electronic instruments used to find fish and to position the net on fish schools are in this room. During experimental midwater trawling, the depth of fish schools, length of the towing warp needed, and the desired speed of the vessel are determined before the midwater net is set. During towing, initial decisions to

change the vessel's course, speed, or warp length (required to keep the net on the fish) originate from this room, which has all the records of gear measurements, towing, and fishing. Fish catch data are relayed by telephone from the fish laboratory located on the fish handling and processing deck below the main deck. An intercommunication system and ship's telephone provide communications to the fishing area of the main deck and various operational areas. Intercom stations are located in areas where telephone is impractical, for example, the open deck at the stern where warp towing angles are frequently measured.

The electronic room has a sensitive fish finding echo sounder and a net sounder re-

recorder. Impulses from the fish finder are directed downward from the ship's bottom; traces of fish are recorded on a paper tape; and the position of the fish is shown relative to the bottom, or the water surface, or both. This instrument is equipped also with an enlarging cathode ray display tube to facilitate estimating the number of fish or density of the fish schools as well as their distance above the bottom. The net sounder recorder shows tracings from a transducer fixed to the head-rope of the net or in any other position. When the net transducer is positioned at the head-rope and pointed downward, it gives tracings of the footrope and the ocean bottom. Also, it shows fish that pass between the net head-rope and footrope as well as those that pass

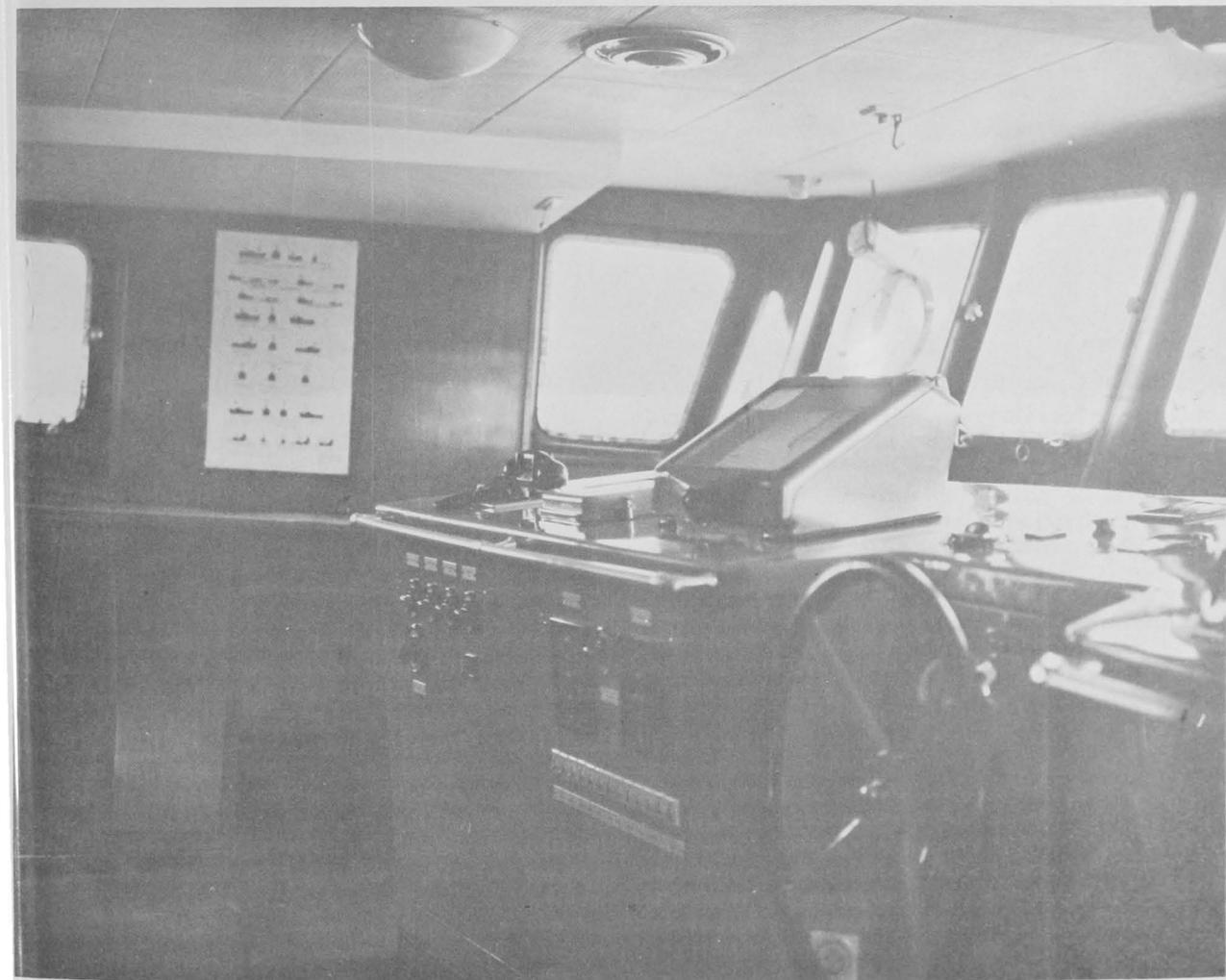


Figure 5.--The pilothouse control console. This view shows the portside of the pilothouse. Note the automatic course plotter on the tilted surface of the console above and to the left of the wheel.

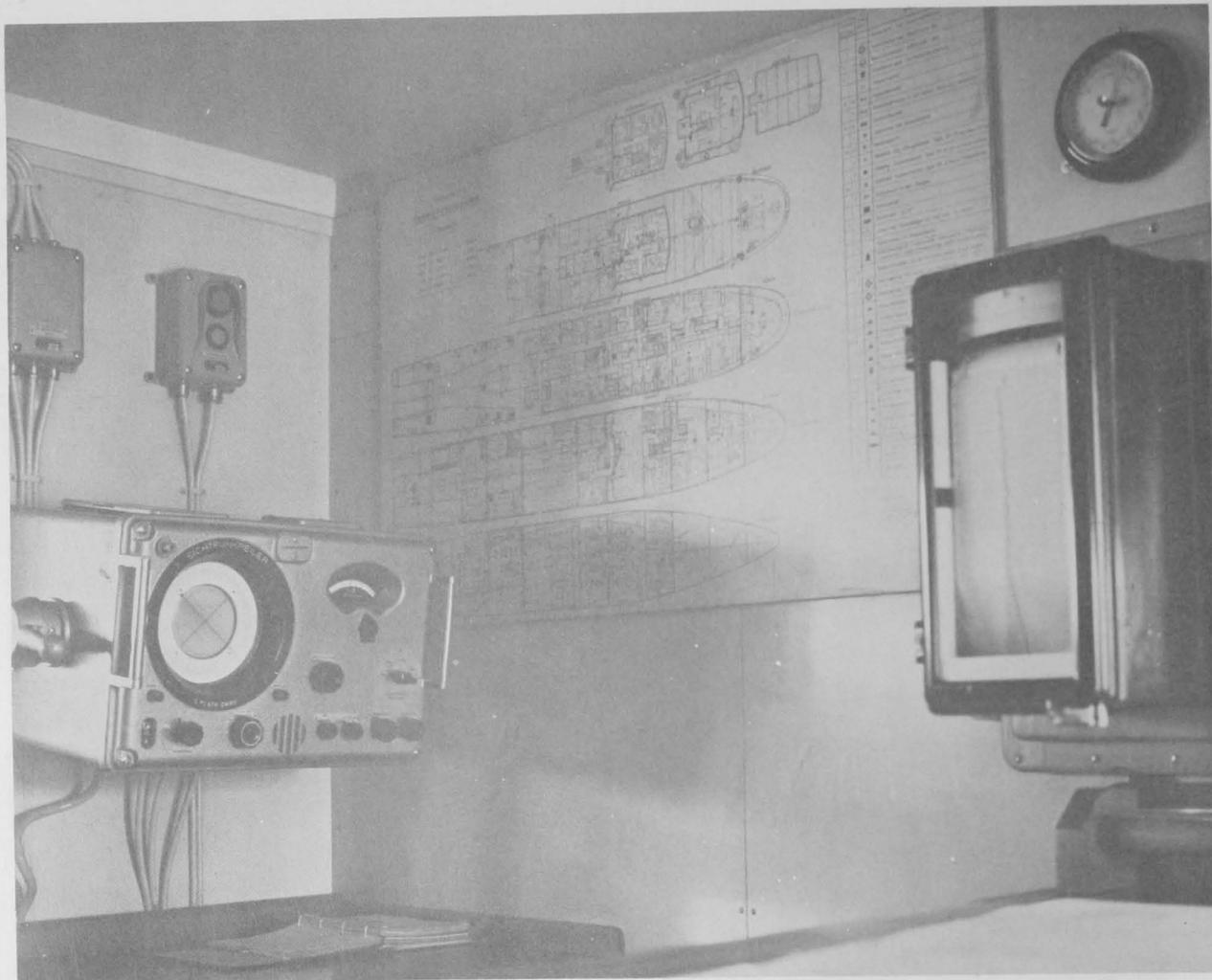


Figure 6.--Chartroom. The visual radio direction finder is at the left side of the photo. On the right side is a dial readout and strip recorder instrument for recording the vessel's water speed and distance. In the upper right-hand corner is a barometer.

beneath the footrope. At the present stage of development for this fishing method, midwater trawling can be successful only if the combined information from these two instruments is used.

Other equipment in the electronic room are: two acoustic scanning devices, a special deep-sea sounder, a strip chart recorder, various dials and indicators, a pushbutton ship intercom, and a ship telephone. One scanning device sounds in a horizontal direction or at any desired downward angle according to the direction in which the transducer is pointed. The other scanning device does not rotate but simultaneously sounds to both sides of the ship at right angles to the course; echoes from both sides are shown on their respective sides of a single recorder with both initial pulse traces shown at the center of the recording.

These two instruments can be used separately but are intended to supplement each other in searching for fish schools and for directing the vessel to schools when found. The deep-sea sounder has three recorders--one shows the entire water column from the ship's keel to the ocean bottom, the second expands any desired and selected portion shown on the first recorder, and the third expands any selected part shown on the second recorder. The strip chart records the water speed of the vessel at regular intervals. The various dials and indicators show constantly the water speed (in knots), propeller thrust (in tons), air temperature, and wind direction and velocity. A gyrocompass repeater shows the course of the ship. Sufficient space is available for additional experimental equipment.

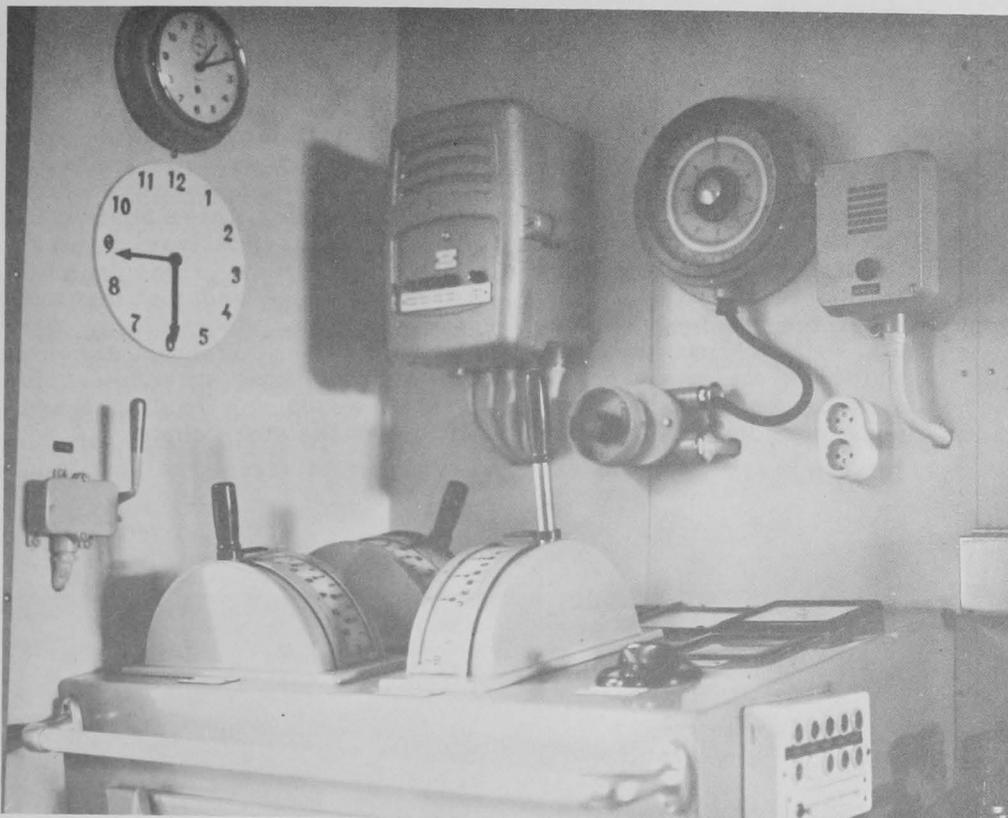


Figure 7.--All controls needed for maneuvering the vessel during fishing are located at this fishing station.

COMMUNICATIONS BRIDGE

The communications bridge is the next deck below the navigation bridge. On this deck there are: (1) the captain's accommodations - starboardside forward, (2) the weather station - starboardside aft, (3) a conference room - portside forward, (4) accommodations for two guests - portside center, and (5) the radio-room - portside aft. The weather station and radio-room are particularly well equipped.

Weather Station

The weather station is manned by a meteorologist and a specialized radio operator provided by the government weather bureau in Hamburg. With the facilities and information available, they are able to make accurate forecasts for the vessel and nearby fishing boats. The ship's wireless operator regularly transmits the weather forecasts.

Two types of equipment, a radiofacsimile machine and two weather radioteletype printers, are of major importance in gathering and using weather data. The radiofacsimile

machine receives and records synoptic weather data and prognostic charts; the radioteletype printers record current information forwarded from official government weather stations. Instruments for the gathering of on-the-spot weather data have their recorders or dials conveniently arranged within one housing. These data include outside air temperature, surface water temperature, barometric pressure, humidity, dew point, and wind direction and velocity.

Radioroom

Wireless operators stationed in the ship's radioroom have the ability and equipment to both transmit and receive voice and code (CW) messages. The wireless equipment can handle long, short, and medium radio frequencies. Transmission in the 410- to 512-kilocycle range is by a 300-watt transmitter. Very high frequency communications are by a 300-watt transmitter with frequencies in the 4- to 22-megacycle range. A 100-watt transmitter is used for voice transmission in the 1000- to 3000-kilocycle range.

BOAT DECK

The boat deck is below the communications bridge. All space on this deck within the bridge structure is occupied by quarters and accommodations for vessel officers and the chief scientist. The boat deck, external to the bridge structure, consists of the whaleback deck (in the bow area), walkways along the sides (outboard from the bridge), and the boat deck proper, aft of the bridge.

The only items on the whaleback deck are the anchor winch, the corkline winch for the tuna purse seine (located on the starboard side), and some lifesaving gear. A hood for an access ladder to the main deck is directly

forward of the bridge; an auxiliary inflatable liferaft is mounted at each side of the hood. Each raft is packed in a capsule and has a 10-man capacity.

On the boat deck, aft of the bridge, two 350-horsepower purse seine boats are mounted in davits (fig. 8)--one on each side of the vessel. In an emergency, these boats could be possibly used as auxiliary lifesaving gear.

The main mast rises from the boat deck aft of the stack and just forward of a liferaft storage area. Apart from carrying lights and supporting antennas, this mast provides the high point of attachment for the heavy tackle needed for hauling trawl catches on deck over the stern chute.

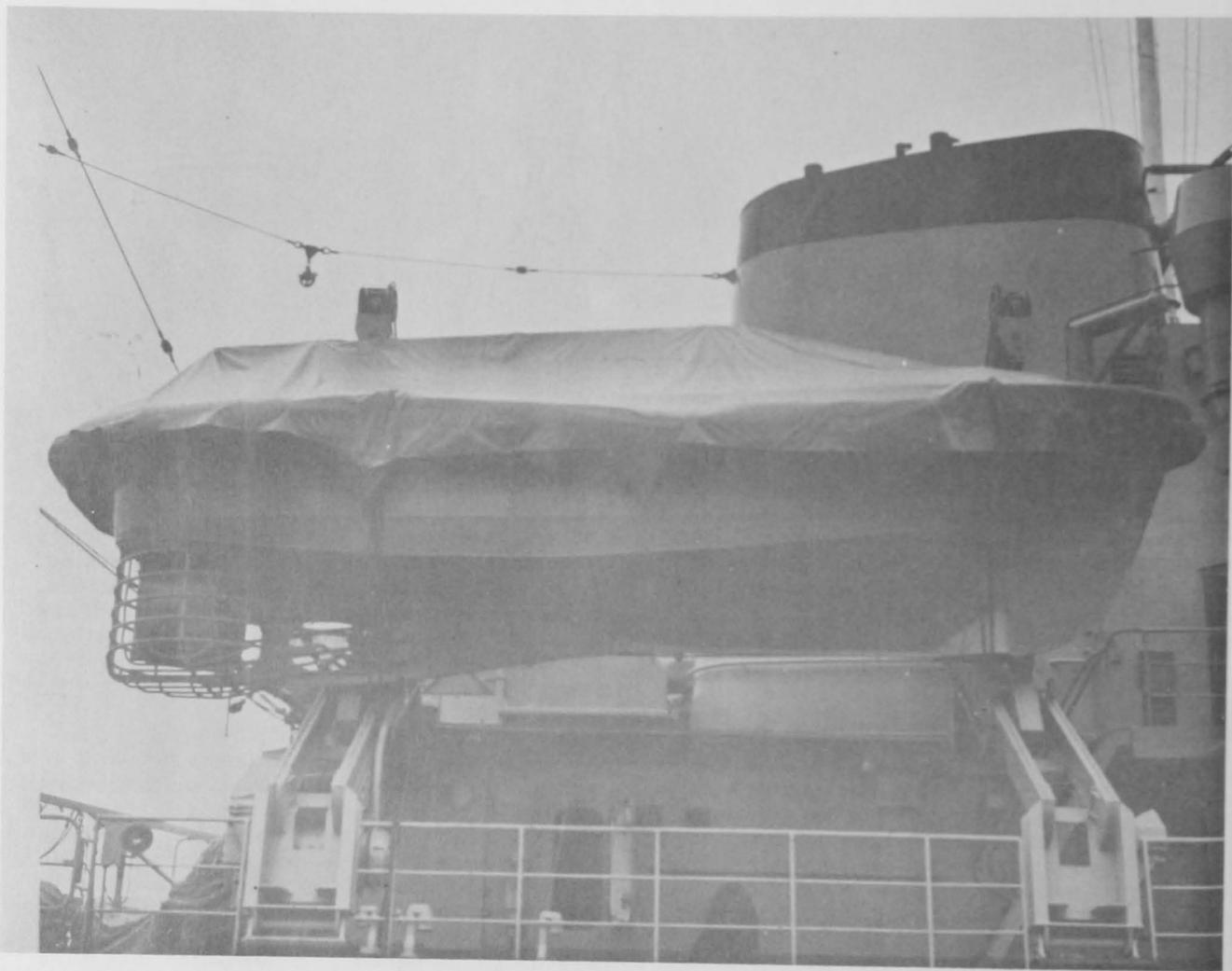


Figure 8.--Seine skiff. Note the propeller cage and nozzle type steering arrangements. The swell in the keel (near the bow) is a "well" for a fish finding or depth indicating echo ranger-sounder transducer.

Safety Equipment

Most of the lifesaving equipment is stored on the after part of the boat deck. The main items are two heavy-gage, preinflated, rubber liferafts (fig. 9)--each with a capacity of 24 men. Two additional inflatable, lighter-gage, 24-man capacity liferafts are stored deflated in chests as supplements to the heavy-gage rafts. In addition, a heavy outboard-powered rubber workboat (already inflated) is available if needed. A light, two-oared, fiberglass skiff is at hand, but probably would be of limited value in an emergency. Each man on board is provided with a plastic foam type of lifevest that supports the head and chest to help prevent

his drowning when unconscious. A number of liferings are available for instant use in case of emergency. Inflatable "swim collars" are provided for all men working in the small boats (fig. 10). Davits are located on each side to launch the liferafts and the rubber workboat.

Hydrographic Facilities

A hydrographic winch, davit, and removable outboard platform (fig. 11) are located at the port rail just aft of the port seine skiff davits. The "water bottle room," used for handling hydrographic water sampling (and other) equipment, is located nearby in the bridge structure



Figure 9.--Preinflated liferaft with boom for launching over the portside.

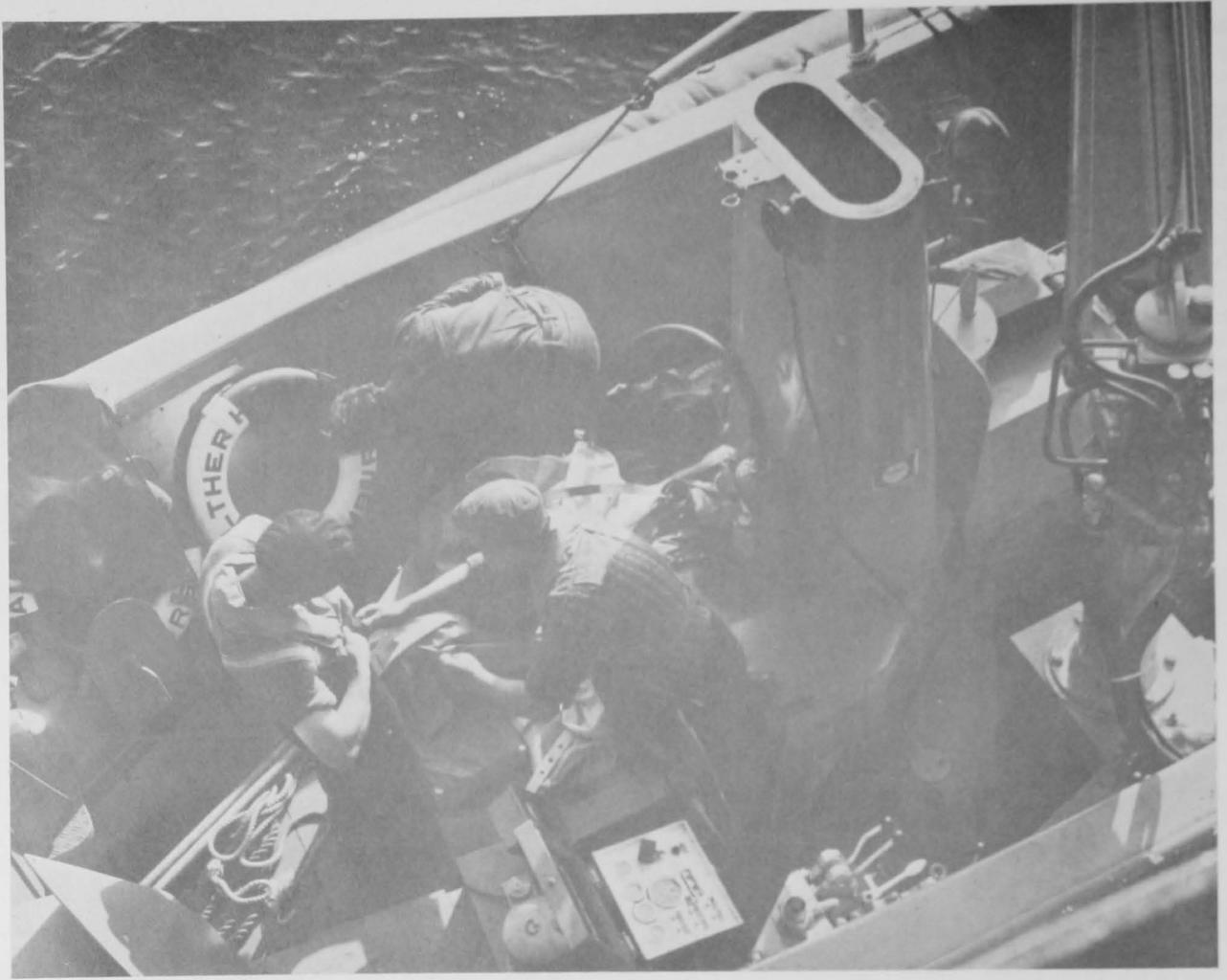


Figure 10.--Crew in seine skiff donning inflatable "swim collars."

at the after side of the stack; entrances to this room are located on both the port and starboard sides of the house.

Auxiliary Winches

The vessel has three winches, which are used for the purse line and towline of the large tuna purse seine and are used also as auxiliary trawling winches. Two of these auxiliary winches are located at the after end of the boat deck in a position overlooking the fishing area of the main deck below. Both winches are used for fishing; both face toward the stern. One winch is positioned over the centerline of the vessel; the other is to the starboardside. The starboard winch is designated "Seebeck No. 1" whereas the center positioned winch is called "Seebeck No. 3"; the second winch of this series (Seebeck No. 2) is positioned on the portside of the main deck

just forward of the stern mast, which is offset to the portside.

During the first part of the cruise in September 1965, the "Seebeck No. 1" winch was used for the electrical conductor cable carrying the electric current to the net during electro-fishing trials. The "Seebeck No. 3" winch was used (a) to operate the heavy tackle that hauled aboard the cod end of trawls with a large catch and (b) to help haul aboard the body of long (300-foot) midwater trawls after the wings had been brought to the trawl winch drums (fig. 12).

All three of the auxiliary winches operate on separate electrohydraulic power, but the maximum pull of each winch depends on the output of the electric motor driving the hydraulic pump. All three hydraulic pumps are axial piston pumps and deliver fluid at a pressure of about 750 pounds per square inch. All winch drums turn up to 300 revolutions per minute and have electric brakes.

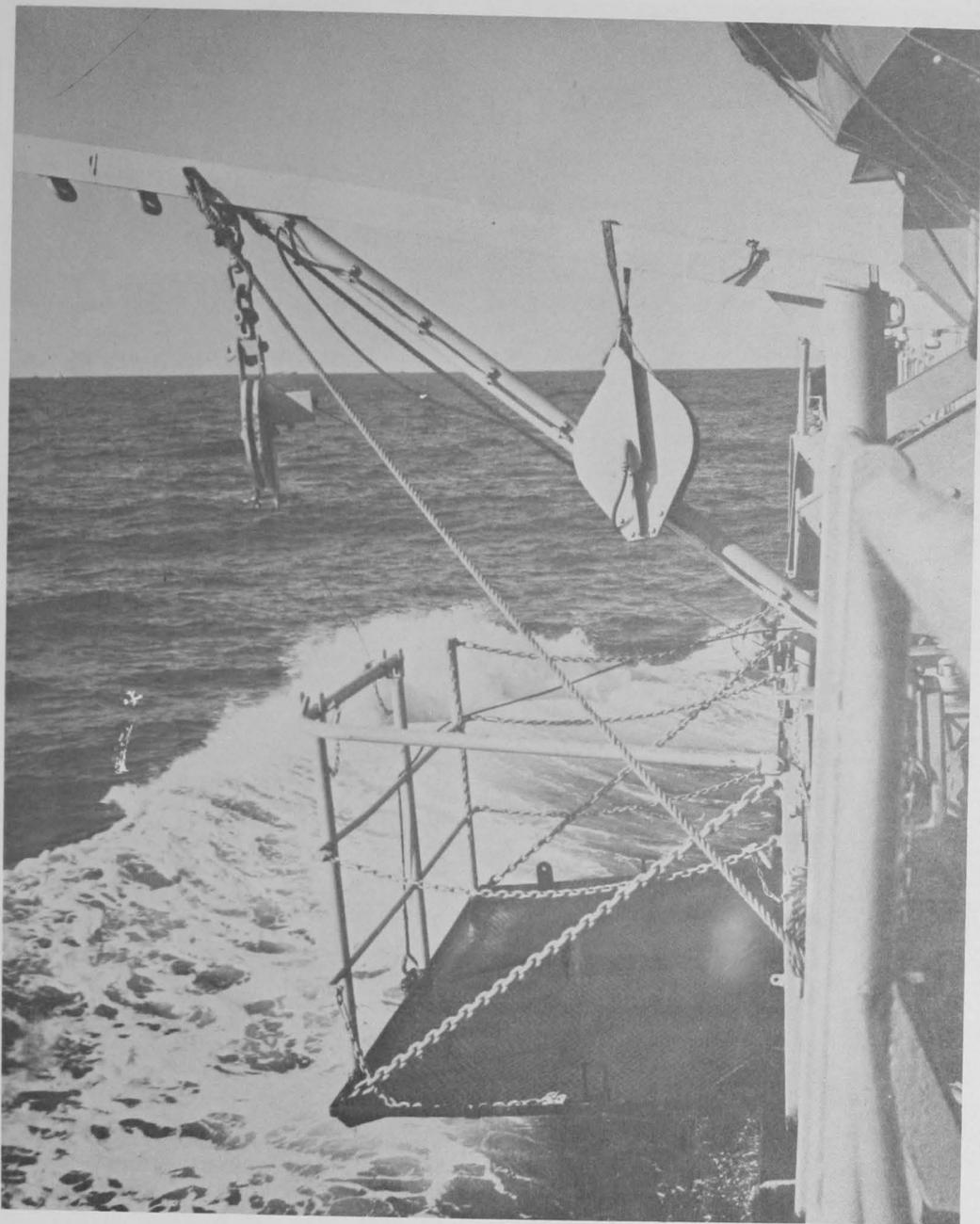


Figure 11.--Hydrographic boom and platform.

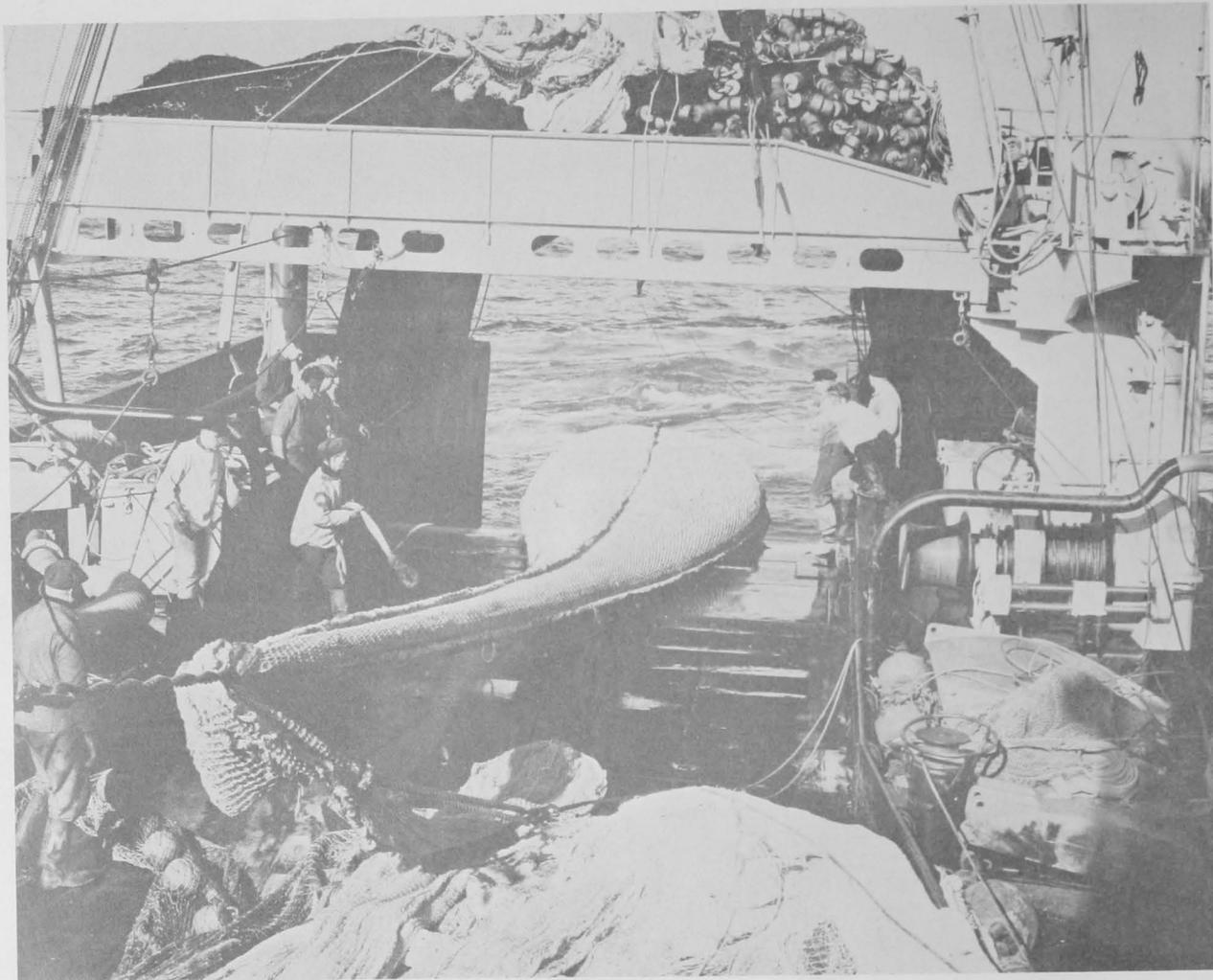


Figure 12.--Bringing the catch aboard, Note (a) the direction of pull on the strap around the net and (b) the pile of netting in the foreground of the photo. The net is taken in by repeatedly strapping off lengths of the net that are hauled forward alternately from the portside and starboardside; the pile of netting in the foreground is made from successive bights of the net resulting from this procedure.

Net Platform

The net platform for the tuna purse seine is on the same level as the boat deck. The net platform is aft of the openwork deck and above the stern chute; it extends across the entire width of the stern (figs. 1, 13, and 15). At times, the vessel carries two purse seine nets: a large California tuna purse seine may be stored on the net platform; and a Norwegian, 3/8-inch mesh, fat-herring purse seine may be stored along the starboard rail on the main deck.

UPPER DECK

Below the boat deck is the upper deck; this is the main deck or fishing deck. It is divided into two general areas, which are used for different functions. The forward part is en-

closed at the sides by an upward extension of the hull and overhead by the boat deck; it is used mainly for living quarters and accommodations. The after part is open; it is used for fishing and fishing gear storage.

Main Deck Forward

The forward part of this deck is used for hospital facilities, personnel accommodations, officers' and scientists' messes, steward's pantry, and storage facilities. In addition, the central air-conditioning unit is amidship along the centerline; it extends upward through the boat deck--additional access is through a door in the starboardside of the stack housing on the boat deck. A hydrographic laboratory is midship on the portside and is equipped with conventional instrumentation. A vertical well, with a cross section of about 3 by 3 feet, is located just forward of the port trawl winch

drum and opens downward through the ship's bottom. Through the well, experimental acoustic and hydrographic equipment can either be lowered or installed under the ship near the keel.

Main Deck Aft

On the main deck, the chute and the ramp are located at the stern of the vessel. In addition to the "Seebeck No. 2," the main deck has the transducer winch (which was provided by a cooperator), the trawl winch, seven auxiliary winches, and a power block. Also, on the main deck, various fishing and experimental operations can be performed.

Chute and ramp.--Centered at the stern of the vessel is the chute and ramp (figs. 1 and 13). The chute is about 16 feet wide and 32 feet long. It is

equipped with a grillwork gate to close off access when not fishing; a chain serves the same purpose while a trawl net is being towed. The ramp has a convex surface with about a 30-degree downward slope from the horizontal plane.

Immediately forward of the inboard end of the ramp, a flush hatch cover can be raised hydraulically to permit the catch to be dropped on the fish-handling deck below. This portion of moveable deck is nearly as wide as the chute; it is hinged along its after edge. The hinged section is about 4.5 feet long and 14.5 feet wide. When raised, it also provides a barrier to prevent the catch from going back down the ramp and overboard. The deck opening is about 7 inches smaller than the hatch cover.

The cod end is emptied into the opening by raising the net from a point near the extension piece thus forcing the fish to run out of the opened cod end (fig. 14).

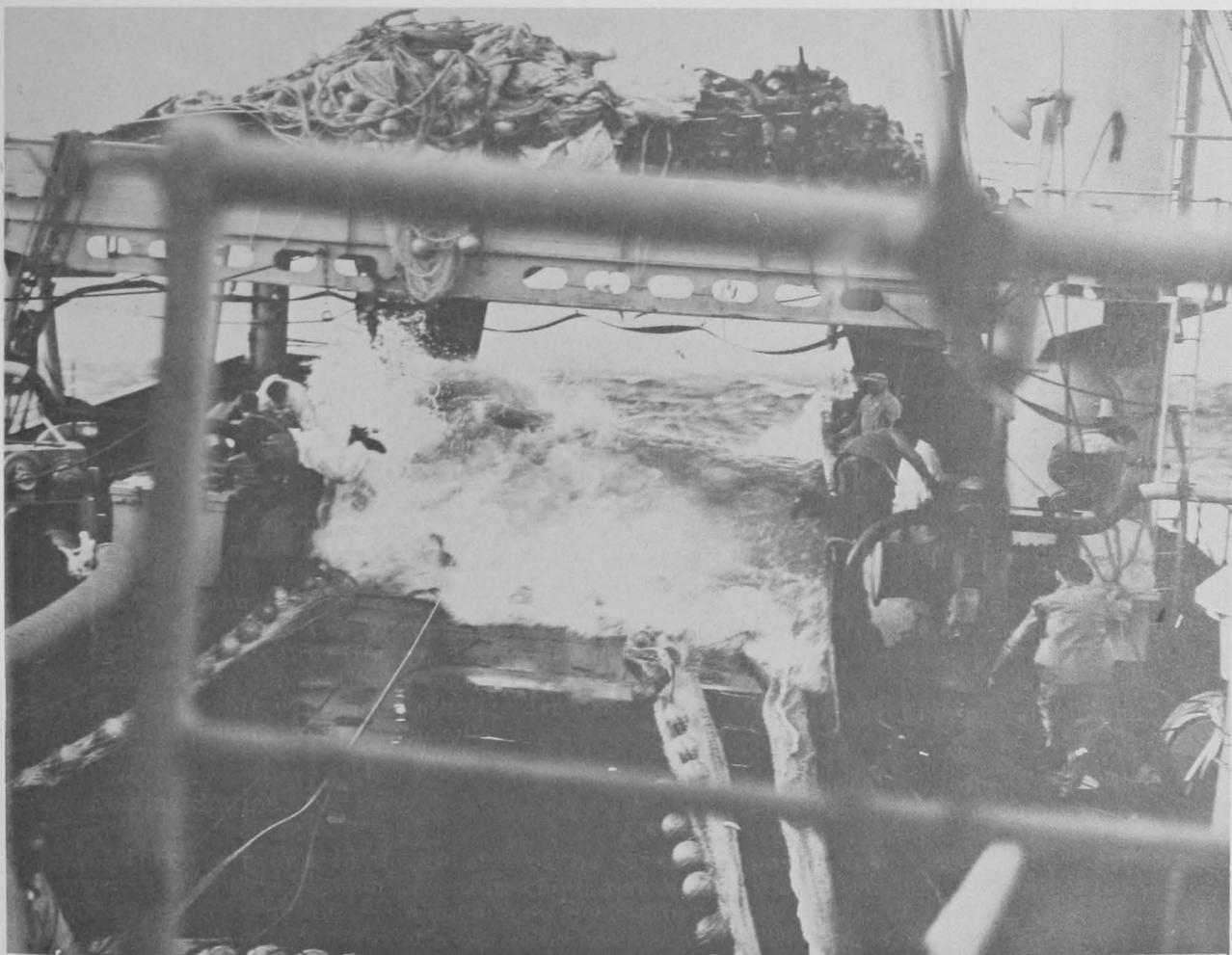


Figure 13.--Taking a sea up the chute during a haulback. Note the wingends of the net, which had just come aboard, lying at each side of the deck.



Figure 14.--Dumping the catch.

Transducer cable winch.--The winch for handling the transducer cable (fig. 15) has two slip rings (fig. 16) and is rigged for level winding. It is electrically powered and has four braking ranges. When the pull exceeds the selected braking range, the winch pays out and the motor acts as a generator to provide dynamic braking. The capacity of the winch drum is about 1,093 fathoms of 0.46-inch electrical conductor wire.

The wire has a 1/6-inch diameter steel conductor wire at the center; this core also serves as the strength member and has a breaking strength of about 3,080 to 3,520 pounds. The core has polyamide insulation. The second conductor is of braided copper around the core and is equivalent to a No. 15 American wire gage. The polyethylene insulation for the braided layer is the outside cover of the wire.

Main trawl winch.--The main trawl winch occupies the forward end of the fishing area. Although the winch is centered athwartship, the drums (fig. 17) are separated by a distance of about 17 feet so that the winch drums are near the sides of the vessel. Each drum is about 70 inches wide and 57 inches in diameter, has a 14.5-inch diameter core, is rigged for level winding, turns up to 65 revolutions per minute, and has a pull of 16 tons. Although each drum generally carries about 1,200 fathoms of 1-inch wire, the maximum capacity for this size wire is about 1,600 fathoms. Each winch drum is individually powered by a 200-horsepower, direct current electric motor requiring 300 volts and 550 amperes; excitation is 190 volts, 6.3 amperes. The duty cycle for this motor is 30 minutes at 147 kilowatts according to the manufacturer's recommendation; however, in actual practice additional power is

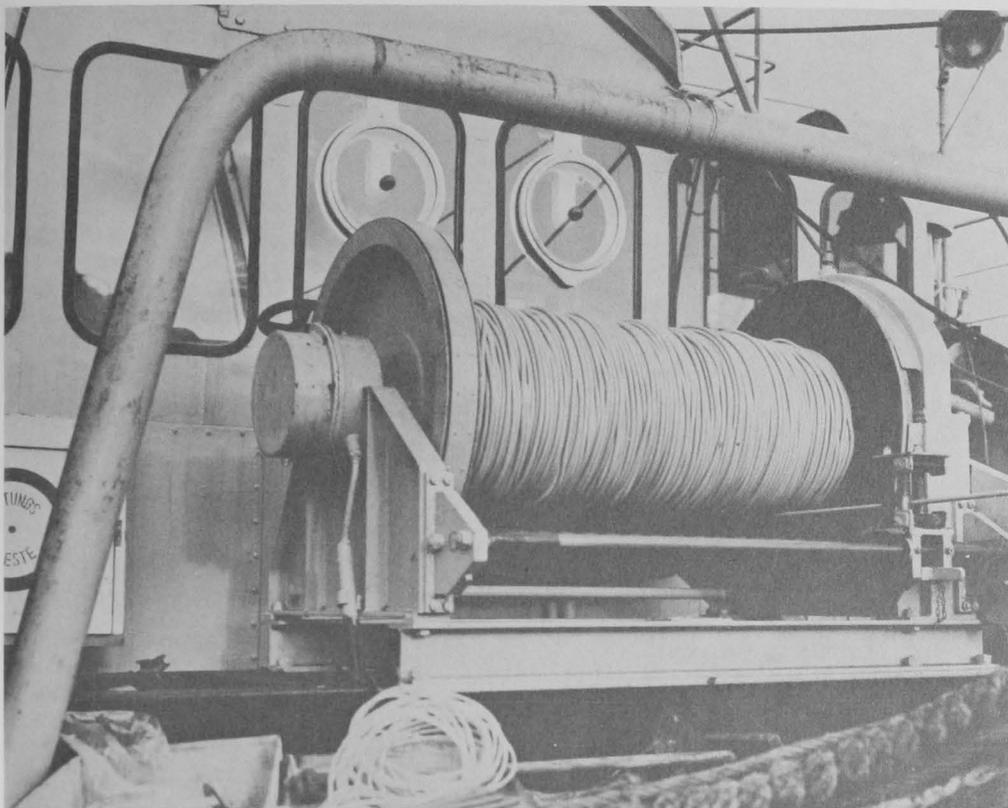


Figure 15.--The net transducer cable winch.

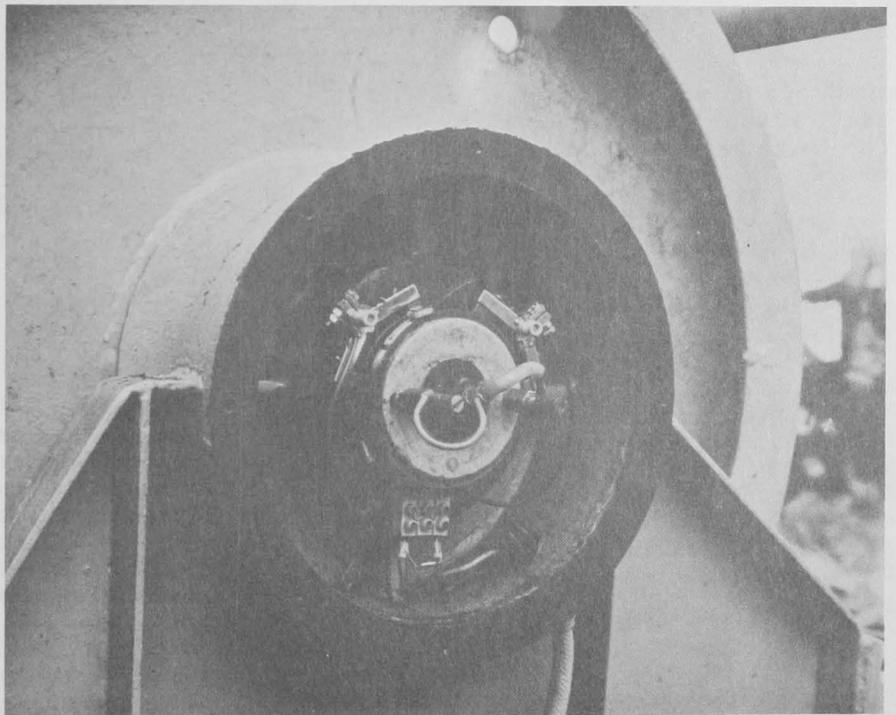


Figure 16.--Slip rings on the transducer cable winch.
Note the two rings and sets of brushes.

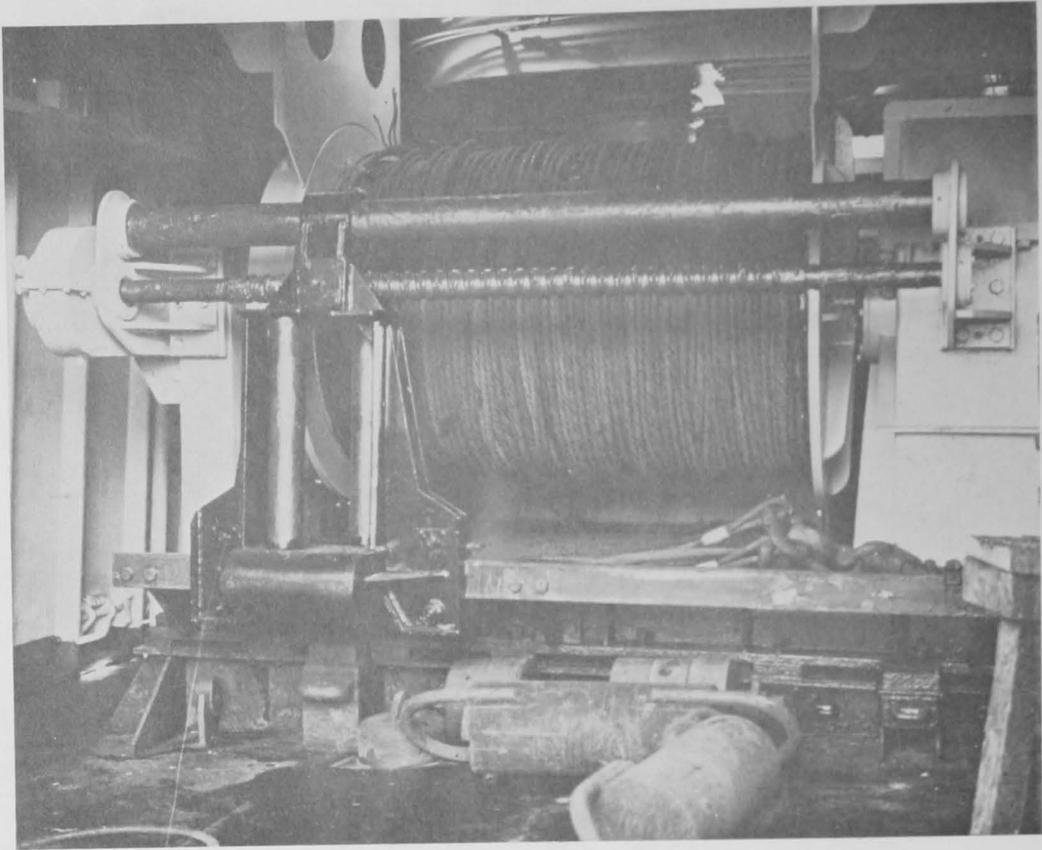


Figure 17.--Main trawl winch drum. Only one of the two drums is shown.

often applied for longer periods. The electric winch motors are cooled by forced air. The winch brakes are air operated and water cooled.

Auxiliary winches.--In the fishing operations area, there are seven other winches--a topping winch for the boom on the stern mast, a hoisting winch, a hanger winch, two cargo winches, a gear winch, and a choker winch. They are used either in the fishing operation or for handling the rigging. These winches are all hydraulically powered and operate off the same pump, which generates 2,700 pounds per square inch of pressure. The performance specifications of these winches are either 11 short tons pull at 65.6 feet per minute, 8.8 tons pull at 82 feet per minute, 5.5 tons pull at 131.2 feet per minute, or 3.9 tons pull at 196.9 feet per minute.

Winch control station.--All of the winches are controlled from an enclosed and heated control station aft of the trawl winch and between the winch drums. The station housing is about 14 feet wide. The operator faces toward the stern and has a clear view of the entire work area; rearview mirrors afford a view of both trawl

winch drums. The controls are powered by compressed air. Between the operator's station and the trawl winch engines, an extension of the control station housing provides cover for the electro-hydraulic pumps powering all of the winches except the trawl winch. Access to this space is through the winch control station.

Fishing operations.--Provision for two basic fishing methods (trawling and purse seining) are incorporated into the design of the vessel. Experimentation with bottom trawling and one-boat midwater trawling is of primary importance; purse seining is of secondary importance. Although specific objectives vary from cruise to cruise, cruise purposes are generally associated with trawl fishing such as (a) experimental use of an electric field as a fishing adjunct to bottom and midwater trawls, (b) study of the fish behavior in relation to the trawling gear, (c) development of improved midwater trawling techniques based upon knowledge gained through the study of fish behavior, and (d) studies to increase the fishing effectiveness of midwater nets through modifications to the fishing gear.

Other operations.--other experiments associated with fishing are conducted. Illustrative of this type of work are recent trials of emptying the cod end of a trawl with a fish pump designed to avoid injury to the fish. The successful development of a method to accomplish this aim is of practical importance to the German commercial fishing industry for saving the catch when it is so heavy that the net would burst while being brought aboard. Catches of herring lost from burst nets have been estimated up to 40 to 50 tons per haul.

LOWER DECK

The lower deck is divided into two general areas by a solid bulkhead.

Lower Deck Forward

Crew's quarters.--The forward part of this deck is used for the galley, the crew's mess, the central control station for the engine room, and accommodations for personnel. The galley is one of the greatest boosters for morale aboard the ship. The cook bakes bread and pastries, and even makes his own sausages. The meals are specially appetizing and tasty; care is taken to ensure a variety of dishes and to avoid a monotonous diet. Being situated on a lower deck, the crew's mess is less affected by motion during bad weather than the officers' and scientists' messes on the deck above.

Engine room complex.--The engine room of the Walther Herwig is not located on a single deck level or within one compartment area as in other vessels. Because the central control station, which is the "nerve center" or the engine room complex, is located on the lower deck, it will be discussed here together with the other machinery and equipment for operating the ship.

Beginning at the bottom of the hold and progressing upward, the propeller shaft is turned at a maximum speed of 190 revolutions per minute by two 1,000-horsepower direct current electric motors. The current for these motors is supplied from the generator room located at a higher level within the hold.

The generator room contains a bank of three 6-cylinder and one 12-cylinder high-speed diesel engines that produce 600 and 1,200 horsepower respectively (total 3,000 horsepower) at 1,500 revolutions per minute. Each of three diesels drives one alternating current and one direct current generator; the fourth diesel drives two direct current generators. The three alternating current generators each produce 412 kilowatts, for a total 1,236 kilowatts. The five direct current

generators each produce 400 kilowatts, for a total 2,000 kilowatts. The diesel generators are within a soundproof room with outside instruments and dials; glass ports allow limited viewing of the internal operation without entering the compartment. Because of the extremely high noise level, ear cups are worn by personnel whenever it is necessary to enter this compartment while the diesels are running.

An auxiliary engine room is located in the hold aft from the generator room and beyond a watertight bulkhead. An emergency diesel generator (260 horsepower) is located in this room along with all of the accessory machinery needed for the ship's operation. A combination blacksmith, machine, and welding shop is located along the starboard side adjacent to the auxiliary engine room.

The central control station for the engine room complex has the indicators, switches, and controls for all of the main and auxiliary engine room equipment (figs. 18 and 19). The duty officer does not leave this station during his watch. Communications with various parts of the ship, including areas exclusively devoted to machinery, are by telephone and intercom system. Routine maintenance or emergency work is handled by other engine room personnel of the watch. Plans, drawings, and wiring diagrams of all equipment installations and their components are available at this station in the form of a single continuous roll, which is installed in a readout device. The required drawing is selected by turning a crank to wind the roll until the desired drawing is in place under the transparent readout table. This device is in the left foreground of figure 18.

In the center of the console of the control station is an interesting lighted diagram showing the operating power hookup for the generators in use and those in reserve (fig. 19). Capability for detecting mechanical or electrical failure of the indicators or their components is ensured by a built-in system for testing and cross checking.

Lower Deck Aft

In addition to fish handling, processing, and storage facilities, the after part of this deck is used for laboratories and work areas.

Fish processing machinery.--The fish handling and processing machinery is positioned along the centerline of the vessel. Beginning in the stern area, an overhead opening with a hydraulically powered cover gives access to the catch when the fish are released from the cod end. Pens or checkers, below as well as forward to this opening, accommodate the fish. From the checkers, a long conveyor belt extends forward along the centerline of the

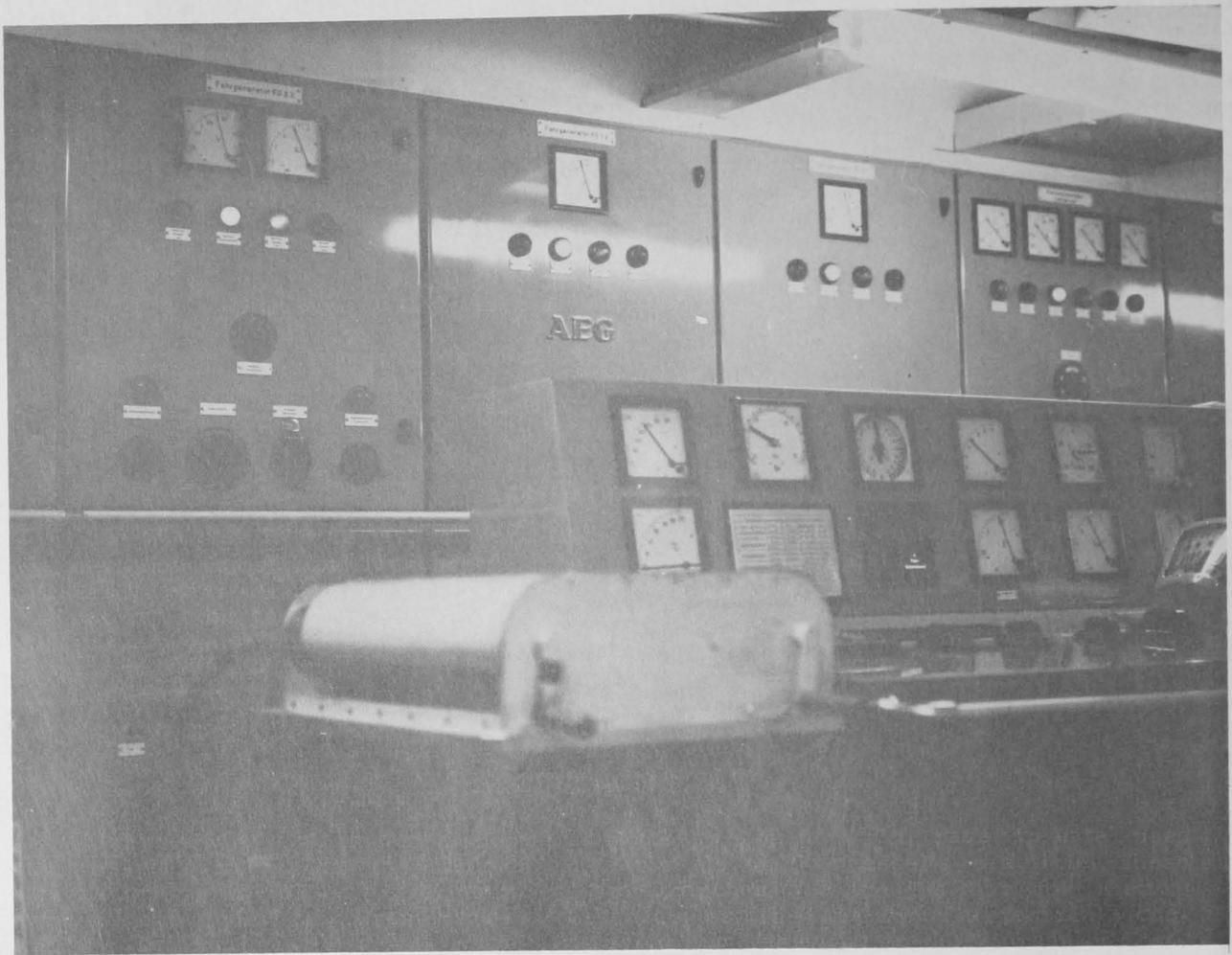


Figure 18.--Engineroom central control station.

vessel and, after passing through two bulkheads, nearly reaches the forward limit of the fish handling portion of this deck. The fish are sorted (some are gutted or filleted) and put on the conveyor; the nonfood fish go to the fish meal plant. The fish to be used for human consumption are conveyed to a rotary fish washing machine placed in line with the conveyor. After being washed and redeposited on the conveyor, the fish are carried through an inspection and sorting area. The fish that are inspected and found to be suitable for packing, freezing, or further processing are shunted off the conveyor into baskets. Fish that are not to have this processing are sent to the end of the conveyor where they are dropped into a funnel-shaped guide set into the deck. From the guide, they are chuted into the fish hold for icing. The packaging of fish (herring) into plastic bags is begun in the outboard areas near the forward one-third of the conveyor where ample space is available for temporary instal-

lation of experimental fish processing and freezing machinery. This area can also be used for storing surplus salt, fish boxes, and other material as well as fish meal when the meal storage area has been filled. Most of the baskets of fish destined for packaging are taken by elevator to the processing, freezing, and cold storage area in the hold below.

Damaged fish are taken back, either in baskets or by conveyor belt, from the inspection area to the hopper of the fish meal plant.

Laboratories and work areas.-- The outboard areas of the fish deck are used generally for laboratories, shops, storage, and fish processing. Beginning at the stern and progressing forward--a rope, net, and twine storage room is located on the starboardside of the checkers; the carpentry shop is on the portside. The fish gutting area is immediately forward of the shops and fish checkers. A hatch is located on

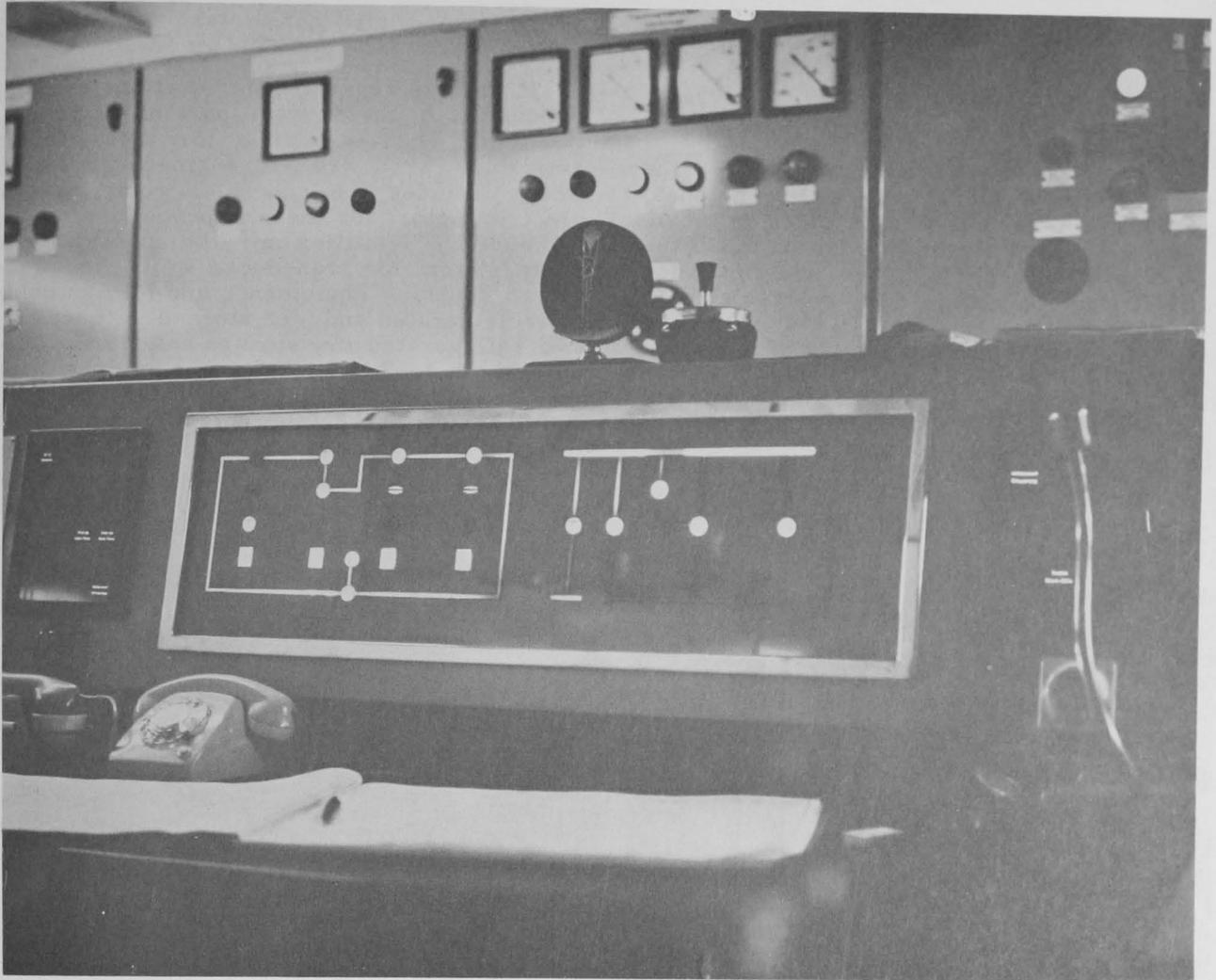


Figure 19.--Automatic power hookup indicator.

either side of the conveyor near its beginning and close to the checkers; both hatches open above the hopper of the fish meal plant located in the hold below. A short conveyor belt runs from near the forward end of the checkers to a special port. Debris and other unwanted material from the catch are discharged into the sea through a special opening in the starboardside of the vessel above the waterline; the cover to this opening is tightly dogged down when the discharge port is not in use.

The fish and electrical laboratories are located opposite to the fish washing machine. The fish laboratory is on the portside; the electrical laboratory (fig. 20) is on the starboardside. Both laboratories are in advantageous positions for their purposes--the fish laboratory is near where the catch is dumped and convenient for the purposes of biological work, and the high-voltage pulse laboratory is

almost directly below the position of the winch used for the electrical instrumentation cable, to which only a short lead is required.

A "do it yourself" type laundry washroom is located along the starboardside forward of the electrical laboratory. A shower head, and access to the fish meal plant, in the hold below, are located in a corresponding position on the portside.

The bacteriological and fish processing laboratory is located on the portside at the forward limit of the fish sorting, inspection, and processing area. The central part of the worktable in this laboratory is set in gimbals. This laboratory is adequately equipped with chemical and bacteriological equipment such as incubators, refrigerators, chemical furnace, and worktables with electricity and water. Access to the laboratory is through a sluice with double doors to avoid bacteriological contamination. A tank for keeping live

specimens occupies the corresponding area on the starboardside. The live-tank is set in gimbals to avoid water spillage and loss of specimens owing to the motion of the vessel during bad weather.

To evaluate the results of tests on the fishing effectiveness of gear and techniques, an accurate measure of each catch is taken. Because the quantity of fish needed to fill the different size checkers to the level of the top of each checker board is known, it is easy to obtain an accurate estimate of the quantity of fish in a catch. A random sample of fish from each catch is weighed and the length of the fish taken; therefore, an accurate estimate can be made of the weight of the catch and its species and size composition.

HOLD

The hold is separated into sections by solid bulkheads. In the forward part of the vessel, this deck is used mainly for tanks. In the amidships area are (1) engineroom space, which includes the generator room and the electric motors for the main propulsion power, (2) storage facilities for the galley, (3) a compartment for transducer wells (for electronic sounding equipment), and (4) fish holds for refrigerated and iced storage. In the latter, two refrigerated dry storage holds are available--both held at -18° F.; one hold encloses 2,471 cubic feet and the other, 1,200 cubic feet. A third hold has 2,230 cubic feet and is used for iced fish.

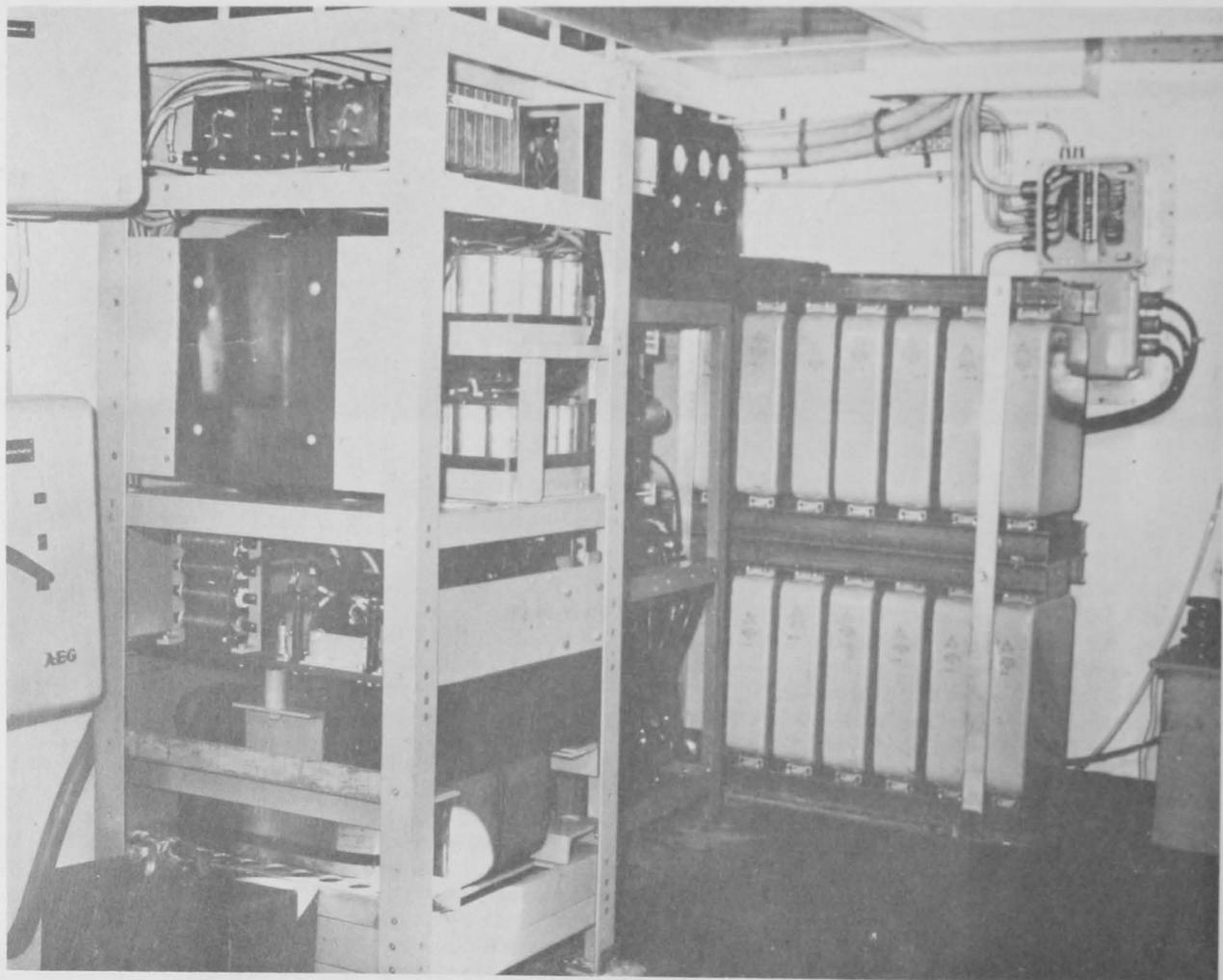


Figure 20.--Electrical pulse generating equipment. This laboratory provides a safe area for the high-voltage equipment; the laboratory is off-limits to nonauthorized personnel. The pulse generating equipment was used during electrical fishing trials. (Photograph through the courtesy of Smith Research and Development Company, Lewes, Del.)

The after part of the hold accommodates (1) the fish meal plant, (2) the auxiliary engineroom, including all of the other machinery necessary for vessel operation, (3) a machine shop, and (4) an area for the packaging and freezing of fish prior to refrigerated storage. Fish to be frozen are packed either into cardboard trays or into plastic bags and frozen by contact freezing or blast (air) freezing. Both systems use Freon cooled to -49° F. The freezing capacity of the contact freezer is about 4,800 pounds per day; the capacity of the blast freezer is about 4,000 pounds per day to -31° F.

DOUBLE BOTTOM

Tanks cover almost the entire bottom of the ship beneath the flooring of the hold. As an aid to stability, the tanks are always full. The

fuel oil floats upon water and, as the oil is used, it is replaced by sea water. Separators ensure against water in the fuel reaching the engines.

Evaporators adequately supply all of the fresh water needed for washing or other uses; however, the water from the evaporators is slightly saline. Potable water is carried in separate tanks.

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