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- USSR -

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FACTORY-TRANSPORT REFRIGERATOR SHIPS OF THE SEVASTOPOL' TYPE

/This is a translation of an article written by A. M. Sterkin in Sudostroyeniye (Shipbuilding), No 11, Leningrad, Nov 1959, pages 1-6/

The Baltic Plant is building factory-transport refrigerator ships. Recently the construction of the first "Sevastopol'" type ship was completed.

Ships of the "Sevastopol'" type are designed for processing and freezing whale meat and freezing whole fish, and also for transporting frozen produce from the fishing grounds.

The diesel-electric ship "Sevastopol'" is a single-propeller two-decker with a topgallant forecastle, midship superstructure, and elongated poop; the engine room is located astern, and the freezing department and refrigeration plant -- amidships.

The ship was designed, taking into account the possibility of navigation on broken ice, in the ULR4/1 Class of the Marine Register USSR, with an excess freeboard. In the event of flooding of any one compartment, watertight integrity/[of the other compartments] is ensured. The ship's cruising region is unrestricted.

Principal Features of the Ship

Length between perpendiculars	118.0	meters
Midship depth	9.50	meters
Beam	16.80	meters
Summer load draft	6.70	meters
Dead weight	4,140	tons
Displacement	8,970	tons
Speed	17	knots
Cruising radius	8,000	miles

Cruising independence	40 days
Cargo hold space	5,400 cubic meters

The 6.7-meter summer load draft was determined on the basis of expectations for transporting one ton of refrigerated cargo per two cubic meters of space in the cargo holds.

Hull. The ship's hull is all-welded except for the riveted joint between the deck stringer and the sheerstrake along the upper deck and the midship superstructure deck. The framing system is a mixed one, customary for the ship type with an aft-located engine room: the upper deck and the bilge with double bottom in the midship part, for about 70 percent of the ship's length, are framed according to the longtudinal system, while the platforms and terminal ends of the ship are framed according to the transverse system. The principal grindwork of the hull is of grade-09G2 steel, while the secondary and minor structural elements are of 4s and 3s steels. The use of rolled curved sections No 22 in constructing the hull buttocks has reduced considerably the related labor input.

As shown by the experience gained in building refrigerator ships of the "Aktyubinsk" type, the welding of superstructures causes considerable warping. Hence, on the ships of the new series, the volume of welding of superstructure frames has been greatly curtailed by employing the intermeshing of frame and plate; the outside-wall plates have vertical welded joints.

General Layout. The ship's hull is divided by watertight bulkheads into eight compartments.

The living accommodations, designed for 170 persons, are located on the half-poop and in the forward superstructure.

The staterooms of the master and chief mechanic consist of a study, bedroom and lavatory with bathtub each. The first and second mates are assigned staterooms consisting of a study, bedroom and lavatory with shower each. All living and communal quarters are air-conditioned.

The cargo accommodations on the ship consist of four holds and four 'tween-decks. Platforms for dressing whale meat and bunkers for preliminary stowage of whale meat and fish are located above the hatches of holds No 2 and 3. The lower deck, which has neither a camber nor a sheer, is on the depth of 6.7 meters from the main deck, and it extends from the forepeak to the engine-room bulkhead,

separating the 'tween-decks from the holds. The insulation of the cargo holds is made of mineral felting, and the insulating of the lining of the inner bottom of cargo holds -- of mineral cork. Two layers of parchment serve to make this insulation watertight. The walls and ceilings in the holds and 'tween-decks are of two rabbeted series of 20-millimeter-thick planks, with a steel mesh placed in between the two series. The insulation of the inner bottom in the holds is covered with 50-millimeter-thick planking which is overlain with a layer of 65-millimeter-thick reinforced cement; two layers of parchment lie in between the wooden planking and the cement. Cooling brine-circulating batteries hang from the walls and ceilings of the holds. The cargo holds are provided with a system of ventilation for drying them after they are flushed with water. The supply ventilators are located in screened-off areas under ladders on the upper deck, and the cargo masts serve as natural exhaust vents. The illumination of the holds during cargo operations is ensured with stationary lamps and portable five-bulb chandeliers.

The placement of the freezing department in the midship part of the ship has ensured a rational technological scheme of the processing of produce and its transporting over the holds.

Communication between holds during transport of produce from the freezing department is ensured through sluice-valve-operated companion coors in the main 'tween-deck bulkheads. The companion doors can be opened by individual hand drive from the upper deck or by individual electric drives, thus ensuring the successive opening and closing of each door from either side of a bulkhead or, also, the simultaneous closing of all doors from the control board in the wheel-house.

The cargo hatches on the lower deck are provided with hatch covers placed on removable hatch beams. The cargo hatches on the upper deck are provided with hydraulically actuated heat-insulated watertight metal covors.

Power Facilities.* The ship is provided with four grade-3D100 diesel generators operating one electric propelling motor. The ten-cylinder vertical compressorless diesels with reciprocal-stroke pistons are rated at 1,250 kilowatts and 810 RPM each. The nominal power rating of the main

*The "Sevastopol'" power installation is analogous to the installations on vessels of the "Aktyubinsk" type, which were circumstantially described in M. N. Vol'fenzon's article (Sudostroyeniye, No 4, 1957).

generators is 1,375 kilowatts each, at a voltage of 500 volts and RPM of 810. The nominal power rating of the double-armature d-c electric propelling motor is 2x3,500 HP, at a voltage of 1,000 volts on each armature and a RPM of 115-140.

The generators and the electric motor are equipped with protective guards and forced ventilation.

The ship's power plant consists of three grade-DG-300 auxiliary diesel generators (one, emergency) with 8ch 23/30 motors of approximately 450 HP and 750 RPM each.

The control of the main generators and of the electric propulsion as a whole is carried out from an electric propulsion control board installed in the central control room. The control of the auxiliary diesel generators and the distribution of electrical energy are carried out from the main distribution board in the central control room.

As distinguished from vessels of the "Aktyubinsk" type, the electric propulsion scheme of the "Sevastopol'" makes it possible to propel the ship through any one diesel generator, which is of great importance when operating the ship in the fishing grounds.

The scheme of electric propulsion ensures the operation of any one diesel generator fro the benefit of the freezing installation; in this connection, the reduction of voltage from the nominal 500 volts to the desired voltage is achieved by reducing the RPM of the generator from 810 to 560.

The absence of an intermediate bulkhead between the engine and boiler rooms in the new ship has made it possible to install two panels of control and measuring instruments and of instruments for signaling emergencies and breakdowns of the main and auxiliary diesel generators. The panels also contain manometers indicating the steam pressure in the steam mains, and other instruments. The mechanic on duty at the panels is thus enabled to observe the performance of the entire power installation.

To reduce noise in the ship's engine room, anti-noise shields are mounted on the main and auxiliary generators.

In winter, at temperatures reaching minus 25 Centigrade degrees, the air conditioning system ensures the warming of the air in the central control room to 17 Centigrade degrees and the increasing of humidity to 30 percent. In summer the air in the central control room and around the panels is cooled.

In the serially built ships of the "Sevastopol'" type, designed for operation in the northern regions, special tunnels protect the pipes running between the engine room

and the forepeak bulkhead. This makes it possible to inspect the pipes periodically and to exclude the possibility of their freezing in fuel tanks when receiving fuel with a negative temperature.

Production Equipment. The refrigeration plant ensures the freezing of 100 tons of whale meat or dish daily and the maintenance of a temperature of minus 18 Centigrade degrees in the cooled cargo holds, and it is also utilized in the air conditioning system in the summer.

The freezing department is air-cooled, with direct evaporation of ammonia; the holds are cooled by means of brine.

The ammonia system includes five two-stage ammonia assemblies operating on direct current and having each a refrigerating capacity of 97,000 kilocalories an hour at evaporation temperature of minus 33 Centigrade degrees and conditioning temperature of plus 30 degrees. The lowering of brine temperature to cool the holds occurs in the evaporator by means of an a-c two-stage ammonia assembly with refrigerating capacity of 150,000 kilocalories an hour, evaporation temperature of minus 30 degrees and conditioning temperature of plus 30 degrees.

When the ship travels loaded with cargo or in fishing grounds, the air conditioning system is serviced by a high-pressure d-c compressor which operates the emergency evaporator of the brine system through an a-c winch transformer. When the ship travels idle, the air conditioning system is serviced by a high-pressure a-c compressor and by the main evaporator of the brine system.

The cooling of condensers, intermediate coolers and compressors is conducted by two electric pumps with delivery capacity of 180 cubic meters an hour each, and one electric pump with delivery capacity of 90 cubic meters an hour.

The principal cooling equipment is located in the compartment for refrigeration machinery, which has two entrances (one directly frm the open deck). The entrances and passageways between the equipment are sprinkled.

The artificial forced supply and exhaust ventilation ensures a continual exchange of air (exhaust of air is conducted through the mainmast).

The processing and freezing of produce proceed along two autonomous lines from the dressing platforms above the hatches of holds No 2 and 3. Reserves of whale meat or fish can be stored in the bunkers situated on the edges of each dressing platform, where the produce can be pre-cooled by salt water circulating in a closed cycle through brine coolers. From the dressing platforms the whale meat is

conveyed through the receiving ports in the front walls of the forward superstructure into the cutting machines. Two such machines, with a processing rate of 60 tons daily each, are located on the upper deck. After being cut, the meat proceeds onto conveyer belts where it is washed with water while traveling.

When fish are to be handled, the machine's knife drum is removed and a conveyer belt for conveying to the fish-washing machines is installed on the dressing platform. Two fish-washing machines, with a handling rate of three tons an hour each, operate cyclically, and their handling rate can be adjusted according to the species of fish.

The subsequent processing and freezing operations are the same for both whale meat and fish. From the machine for cutting up whale meat or washing fish, the produce is conveyed along inclined ducts into below-deck collecting bins of the freezing department. From these bins the whale meat or fish is conveyed further by means of a worm gate valve onto tables where the produce is put on perforated shelves and placed into containers. The containers with the shelves proceed into freezing tunnels in which the meat or fish is frozen to minus 18 Centigrade degrees. Every freezer sheer line consists of four tunnels containing eight containers each. A blast of air cooled to minus 26 degrees is directed opposite to the direction of travel of the containers along a closed cycle through the air cooler and tunnel by an axial electric fan with a delivery rate of 38,000 cubic meters an hour at a pressure of 108 millimeters of the water column. Every such fan services two freezing tunnels. The freezing of whale meat lasts seven hours, and that of fish -- four and one half hours.

From the freezing tunnels the containers with frozen produce proceed for unloading to the ice-glazing apparatus.

The complex whole of the operations of the movement of containers, opening and closing of doors of freezer tunnels and concomitant closing of gate valves between freezer tunnel and air cooler is completely automated (independently for each group of tunnels). The automation system ensures guidance from a single panel. A sequential pushbutton guidance in individual sectors is provided for in the event of a breakdown in the automation system.

The frozen produce is carried by conveyers on the 'tween-deck level toward the hatches of cargo holds.

From the conveyers the produce is dropped onto the cargo platform which is then lowered into the hold. Within the hold the produce is distributed by portable conveyers ensuring movement at an angle of up to 15 degrees.

Miscellaneous Equipment. The cargo-handling facilities include eight three-ton booms (two for each hatch). In addition, a 15-ton boom is mounted above hatch No 4. The booms are serviced by three- and five-ton electric d-c winches.

Near hatch No 4, on the upper deck, are mounted two motorboats of the "Kavasaki" type, designed for transporting whale meat from the flensing base to the refrigerator ship. The boom with carrying capacity of 15 tons serves to lower and hoist the motorboats.

The hoisting of the 3,000-kg anchor is conducted by a BE8 electric windlass with a nominal force of five tons on the gypsy heads. Three transformers (one, emergency) are installed in the engine room for the purpose of feeding current to the cargo winches and the windlass.

The ShER13D/1 electric a-c hawser capstan ensures a traction force of five tons on the drum and a pick-up of hawser rope at a rate of 15 meters a minute. For mooring in the sea, to another ship, inflatable rubber fenders are provided. As for the lifeboats, they are executed of light alloy. Six of them, each accommodating 36 persons, have a propeller with manual drive, and the seventh, accommodating 28 persons, is a motorboat. In addition, the ship is equipped with one cruising dinghy and a "Dori" type fishing boat.

The REG3-3 electro-hydraulic rudder machine with a torque of about 30 tm on the rudder head, ensures the turning of the rudder (which in area measures 13.5 square meters) from one side to another within 30 seconds while the ship is traveling at full speed; the maximum angle of turning of the rudder is 35 degrees. The steering of the rudder is done from the wheel-house and from the upper bridge. There is also an emergency rudder drive, constituted by a hand-operated oil pump with roller drive on the poop deck, which ensures the turning of the rudder from one side to another by an angle of 2x15 degrees within 60 seconds, while the ship is traveling at a speed of not more than eight knots.

The ship is provided with facilities for carrying 160 tons of potable water and 260 tons of washing water. A water-distilling installation with capacity of 10 tons daily is provided for complementing the reserves of fresh-water. The water from that installation is used mainly for ice-glazing the blocks of frozen produce. The operation of the installation is automated.

The water system for fire control is serviced by two EPZhN-16/1 type centrifugal electric firefighting pumps with delivery of 100 cubic meters an hour and pressure of 80

meters of the water column each, which are installed in the engine room. The steam extinguisher system has been extended to all fuel compartments, the paint room, the lamp room, coffordams, dampers of the heat recovery boiler, and into the boiler room, under the boilers.

Carbon dioxide extinguishing is provided for in the cargo refrigeration holds, and engine room and refrigeration plant compartments.

The drying and ballast systems are serviced by two VTsNs-90/1 pumps (one for the engine room and the other for the remaining premises) with delivery of 90 cubic meters an hour each and with a total pressure of 30 meters of the water column and suction height of six meters of the water column. An EzhVv50/7 ejector pump with a suction height of six meters of the water column is provided as an emergency means of drying.

The ship is provided with up-to-date radio and navigating equipment.

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