FREEZING FISH AT SEA--NEW ENGLAND

Part 6 - Changes and Additions to Experimental Equipment on the Trawler Delaware

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ABSTRACT

THE COLD-STORAGE CAPACITY OF THE EXPERIMENTAL TRAWLER DELAWARE WAS INCREASED, AND SEVERAL CHANGES AND ADDITIONS WERE MADE TO THE EXPERIMENTAL FREEZING EQUIPMENT AND REFRIGERATION MACHINERY.

INTRODUCTION

The freezing-fish-at-sea project currently in progress at the Boston Fishery Technological Laboratory of the U. S. Fish and Wildlife Service's Branch of Commercial Fisheries has these general objectives: (a) the development of handling, freezing, and storage facilities which can be installed and used successfully on existing vessels of the New England fleet, and (b) the establishment of the technological and economic feasibility of freezing fish "in the round" at sea for later processing ashore.

LOAD OF HADDOCK ON DECK OF DELAWARE PRIOR TO FREEZING.

The experimental equipment installed by this laboratory on the trawler Delaware has been described in Part 3 of this series (Butler, Puncochar, and Knake 1952). As a result of experience gained during the 1951 season, several changes and additions were made to increase the efficiency of the operation. These changes and additions, made during the vessel's 1951/52 winter lay-up period (and tested during the 1952 operating season), are described herein.

EQUIPMENT CHANGES AND ADDITIONS

INCREASE IN COLD-STORAGE CAPACITY: The cold-storage space for frozen fish was increased by approximately 1,000 cubic feet with the addition of another insulated bulkhead in the iced-fish storage space (see figure 1). Construction details were similar to the forward bulkhead previously described (Butler, et al 1952). Located two pen-sections forward of the existing forward bulkhead, the new bulkhead

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encloses a space approximately ten feet fore and aft, across the full width of the vessel. Both bulkheads enclosing this space are fitted with refrigerator doors to provide access from either the cold-storage space aft or the single remaining iced-fish storage pen, forward. A deck hatch, part of the ship's original structure, provides access for unloading the frozen fish.

The original fish hold (7 five-foot pen-sections in length) is now partitioned as follows: one pen-section forwardmost for storing iced gutted fish; two pen-sections insulated and refrigerated for storing round frozen fish; three pen-sec-

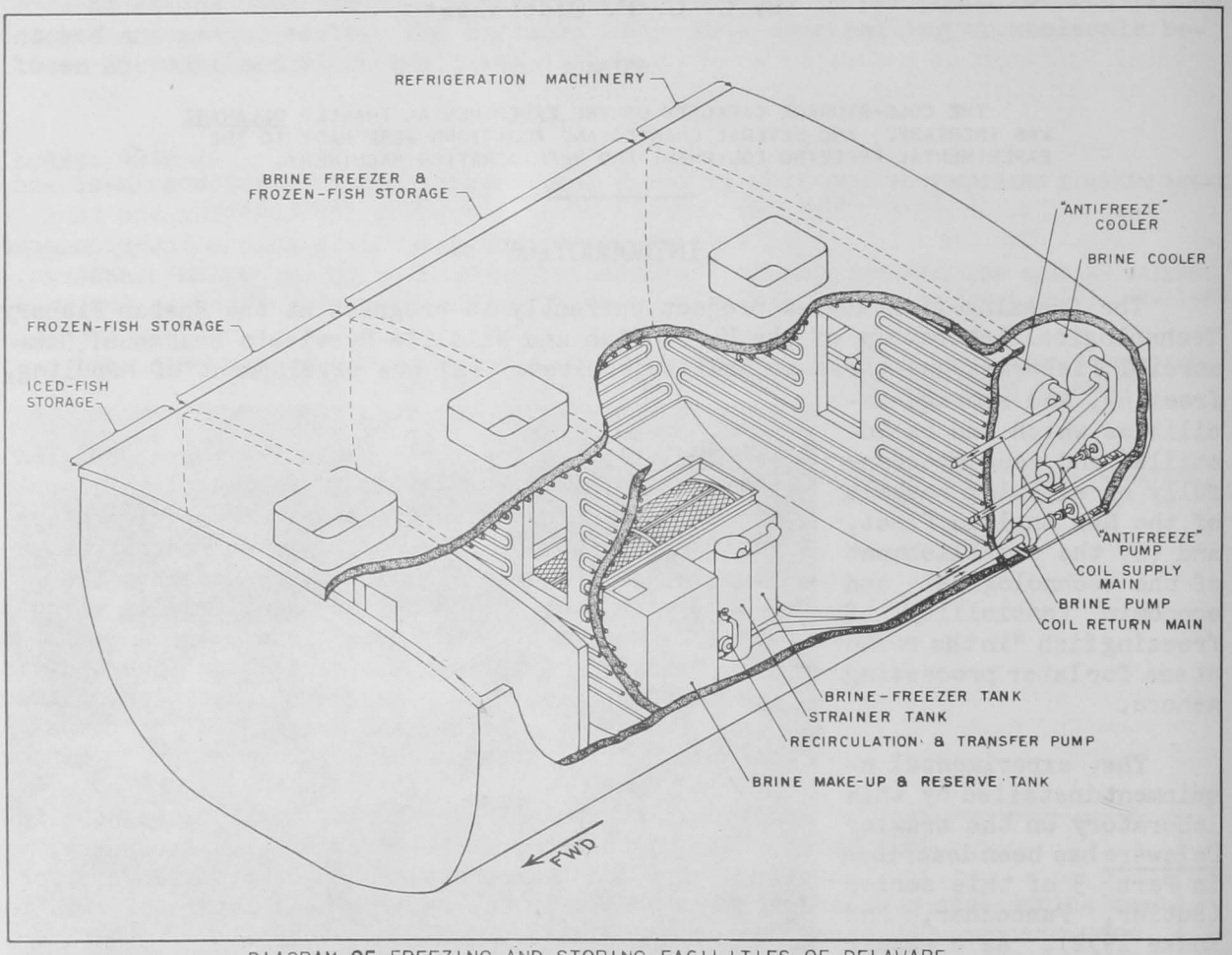

DIAGRAM OF FREEZING AND STORING FACILITIES OF DELAWARE.

tions insulated and refrigerated for storing round frozen fish and for housing the brine-freezing apparatus; and one pen-section aftermost housing the refrigeration machinery.

The new forward frozen-fish storage space is refrigerated by 1,500 feet of 1¼-inch iron-pipe coils mounted on deckhead, bulkheads, and skin. Wooden gratings are laid on the floor to aid in the circulation of air under the piles of frozen fish.

The cooling coils of both frozen-fish storage spaces were arranged to provide flexibility of control in maintaining the desired storage temperatures. The refrigerant, an aqueous solution of ethanol referred to herein as "antifreeze," is pumped through the shell-and-tube cooler in the refrigeration machinery room (Butler, et al 1952), circulated through the room cooling coils, then returned to the cooler. A rectangular 40-gallon "antifreeze" supply and surge-tank, located

above deck, is connected by a 3/4-inch line to the 2-inch return main. Four banks of coils, one on each side of the two refrigerated spaces, are supplied with the chilled "antifreeze" through a 2-inch supply main by means of four conveniently located distribution valves. Thus, the refrigeration supplied to either storage space may be regulated.

BRINE MAKE-UP TANK AND ACCESSORIES: A brine make-up tank was constructed to serve as a reservoir for maintaining the optimum brine level in the freezer irrespective of the amount of fish-loaded, and to serve as a make-up tank for preparing brine of the desired concentration to overcome normal dilution of the freezing medium. Two possible sources of dilution of the freezing medium are the gradual addition of sea water associated with the fish, and the slight uptake of salt by the fish during the freezing process.

A rectangular steel tank, 5 feet high by 4 feet long by 2½ feet wide, was welded to the forward port side of the brine freezer to serve as the make-up and reserve. The top is enclosed except for a small opening for charging the tank with salt. The tank is fitted with an outlet and two nozzle inlets interconnected through a 1/4-hp. rotary pump to the freezer tank and to an overboard discharge. Valves are so arranged that the make-up solution can be recirculated in the make-up tank via the nozzle inlets to promote dissolving of the salt; the solution can be pumped from make-up tank to freezer (and vice versa), or it can be pumped overboard from either tank.

RELOCATION OF PUMPS: The brine and "antifreeze" circulating pumps, originally located adjacent to the freezer tank (see illustration in Part 3 of this series by Butler, et al 1952) have been relocated on the port side of the refrigeration machinery room. This change was made to provide more space and to reduce the refrigeration load in the cold-storage area, and to afford better access to the pumps for maintenance. At the same time, the original ½-hp. "antifreeze" circulating pump was replaced by a 1½-hp. pump to give adequate circulation through the enlarged cooling-coil system. To obviate the necessity of insulating the individual brine and "antifreeze" pipes and fittings, a cork-insulated partition, fitted with a small access door, was constructed to separate the area where the pumps and piping are located from the warm refrigeration machinery room.

REFRIGERATION PLANT: Additional controls and measuring instruments were installed and some modifications made to the absorption refrigeration machinery. While it is recognized that simplicity and ruggedness are major requirements for successful operation aboard a fishing vessel, the experimental nature of this installation enhances the need for accurate measurement and control.

To provide greater flexibility of operation, the system by which liquid ammonia was supplied to the shell-and-tube brine and "antifreeze" coolers has been modified. Formerly the supply to both coolers was controlled by a single low-pressure float control which, by means of equalizing lines joining the coolers, maintained the ammonia liquid level in both coolers simultaneously. The equalizing lines were removed and in their place was installed a separate thermostatic liquid feed control for the "antifreeze" cooler. Now either cooler can be operated whether or not the other is in use.

To guard against the possibility of freezing the brine in the tubes of the brine cooler when the brine temperature is near its freezing point and no fish are being frozen, an automatic evaporator pressure regulator was installed in the ammonia vapor line leading from the top of the cooler to the absorber. This control is actuated by the temperature of the brine leaving the cooler. When the brine is cooled to a predetermined temperature, the valve closes and stops the cooling process until the brine temperature rises again.

The level of aqua-ammonia in the generator of the absorption refrigeration machine (Butler, et al 1952) is indirectly affected by the rate of flow of cooling water through the condenser. To maintain an optimum level under varying refrigeration loads, an automatic flow regulator was therefore installed in the cooling water system.

Two 2-pen recording thermometers were installed in the refrigeration machinery room. One records the air temperature in the forward and the aft frozen-fish storage spaces, while the other records the temperature of the circulating brine before and after it passes through the brine cooler. The latter temperature recorder, used in conjunction with an orifice-plate flowmeter in the brine-circulating system, indicates the refrigeration output of the brine cooler.

While still further improvements in equipment are contemplated, the changes and additions described produced considerable improvement in the performance of the experimental brine-freezing and cold-storage equipment aboard the Delaware.

LITERATURE CITED

BUTLER, C.; PUNCOCHAR, J. F.; AND KNAKE, B. O.
1952. FREEZING FISH AT SEA--NEW ENGLAND. PART 3 - THE EXPERIMENTAL TRAWLER DELAWARE AND SHORE FACILITIES. COMMERCIAL FISHERIES REVIEW, VOL. 14, NO. 2 (FEBRUARY 1952), PP. 16-25.

TRADE SCHOOL FOR CANNING IN NORWAY

A trade school for the canning industry was opened at Ledål, near Stavanger, Norway, towards the latter part of August 1952, reported The Fishing News, a British fishery periodical. It is claimed to be the only school of its kind in the world and was built at an estimated cost of $US420,000.

Courses at the school last 18 months and are designed to train workers for positions as foremen, supervisors, and production planners. A number of offices and institutions relating to the canning industry moved into the school. Since fish canning is an important part of the Norwegian canning industry, there no doubt will be training in fish canning operations.