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HANDLING AND PACKING OF FROZEN BREADED SHRIMP AND INDIVIDUALLY FROZEN PEELED AND DEVEINED SHRIMP

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BACKGROUND

The shrimp industry of the South Atlantic and Gulf coasts is one of the leading fisheries of the United States both in value of the original catch and in value of the processed products. Even the weight of catch, which usually ranges from one-fifth to one-fourth of a billion pounds, is impressive. Statistics for several typical years are given in table.

United States Catch of Shrimp and Production of Breaded and Individually Frozen Shrimp for 1950, 1954, 1956, and 1960 ^{1/}								
Area of Catch and Type of Product	Production				Value			
	1960	1956	1954	1950	1960	1956	1954	1950
 (Million Pounds) (Million Dollars)			
Area of Catch:								
South Atlantic	31.0	25.5	28.6	36.5	8.5	7.8	6.9	10.0
Gulf	205.7	193.6	237.2	151.8	57.6	62.5	53.7	33.1
Total	236.7	219.1	265.8	188.3	66.1	70.3	60.6	43.1
Type of Product: ^{2/}								
Breaded shrimp	70.4	50.9	24.8	6.6	47.0	37.3	17.6	4.2
Individually frozen shrimp ^{3/}	19.3	7.5	4.2	No data	18.5	7.3	2.6	No data

^{1/}E. A. Power -- *Fishery Statistics for the United States - 1960*, U. S. Department of the Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries, and other years noted.
^{2/}Some of the major shrimp products produced other than raw headless.
^{3/}Includes some bulk-packed, peeled, and deveined shrimp.

Although the amount of shrimp caught remained relatively constant during the 1950's, the value of breaded shrimp increased more than tenfold. Plants for producing breaded shrimp increased from 1 in 1949 to 25 in 1960 with products worth in excess of \$60 million a year.

In addition to breaded shrimp, individually frozen peeled and deveined shrimp is another product packed by many of the breeding plants that is rapidly increasing in popularity and in quantity of production.

PROCESSING METHODS

Initially, breeding shrimp was strictly a hand operation, but as demand increased, the need for machines to reduce the amount of hand labor became urgent, and several mechanical devices for breeding shrimp were developed. Some shrimp are still breaded by hand, but most are now breaded by machine. Devices were also invented to peel and devein shrimp. Although many of these devices are in use, hand peeling and deveining are employed in a number of plants for processing the larger shrimp and for manufacturing products of premium quality. Packing the shrimp in boxes is done entirely by hand. Furthermore, no inexpensive method has yet been found that is as good as a hand operation to distribute shrimp over a pan

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U. S. Bureau of Commercial Fisheries.

U. S. DEPARTMENT OF THE INTERIOR
 Fish and Wildlife Service
 Sep. No. 692

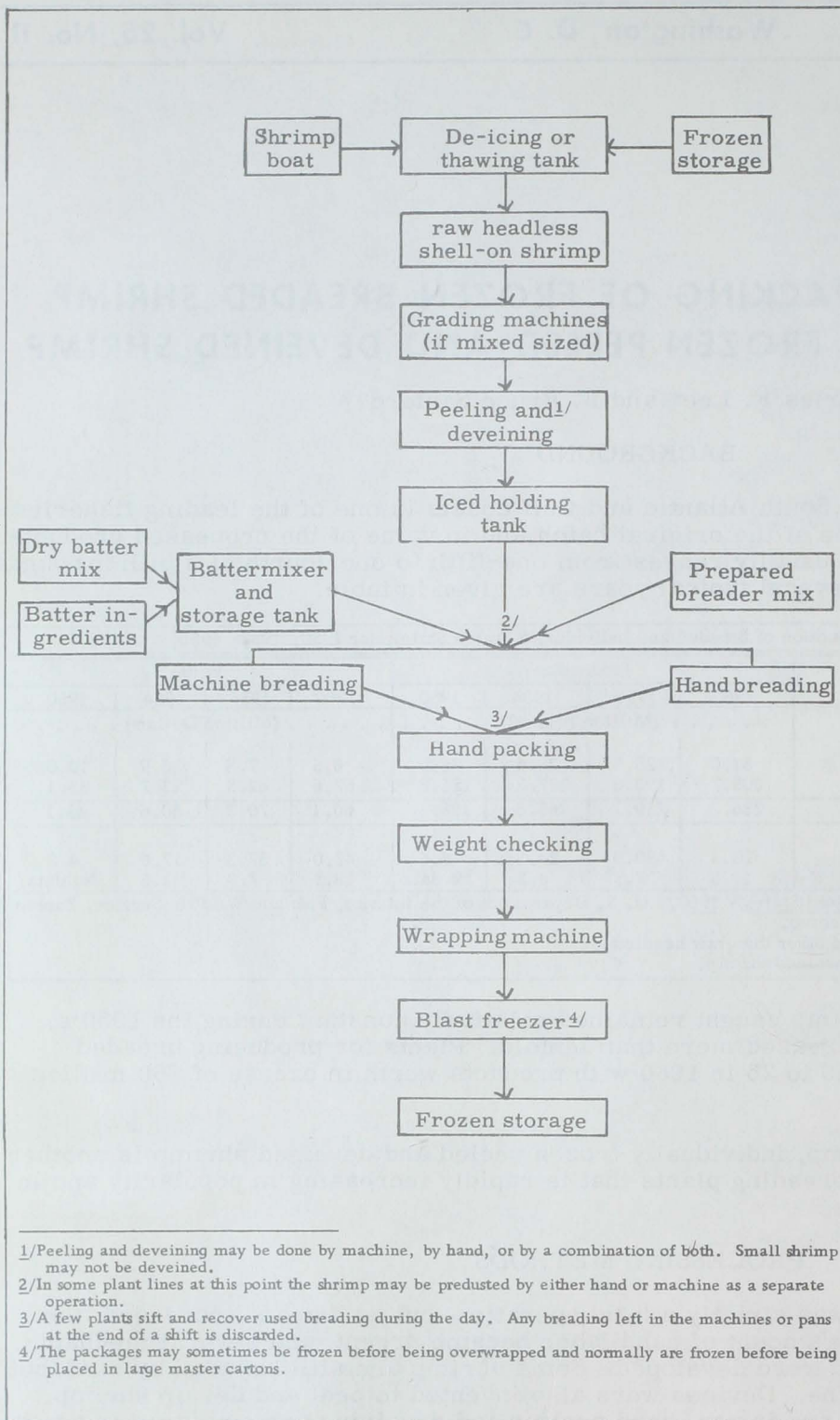


Fig. 1 - Flow diagram showing variations in processing in the preparation of frozen raw breaded shrimp (USDI inspectors check product and processing operations at all points.)

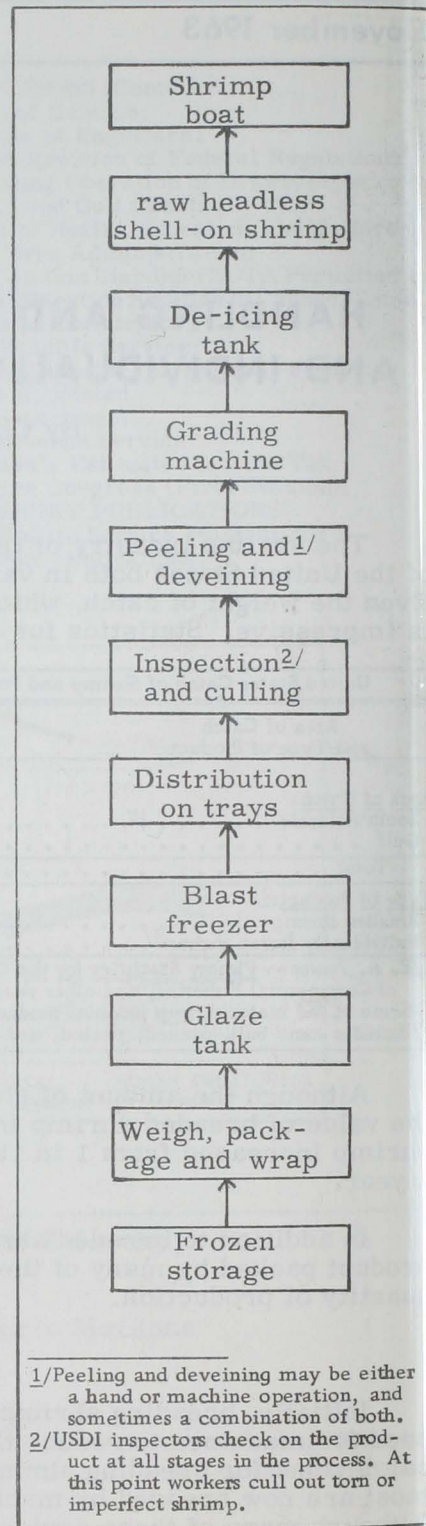


Fig. 2 - Flow diagram for individually frozen peeled and deveined shrimp.



Fig. 3 - Shrimp boats at Thunderbolt, Ga. Note on the left the rope hoist used here, as in most areas, to lift baskets of shrimp from boat hold to dock.



Fig. 4 - The busy shrimp port at Hooker's Point, Tampa, speeds unloading operations by means of bucket conveyors.



Fig. 5 - The bucket leg can be lowered into the boat hold. Note pulley on the upper right.



Fig. 6 - Conveyor in withdrawn position. Shrimp mixed with ice drop into the tank in center left.

Fig. 7 - After unloading, the crew--usually two to four men--secure the net before icing for the next trip.



Fig. 8 - The conveyor from the wash tank discharges the shrimp directly to a large scale-scoop. In each "100-pound box," 105 pounds are packed to allow for water and ice. These plants handle only fresh shrimp, which are destined for either the breeding plant or the freezer.

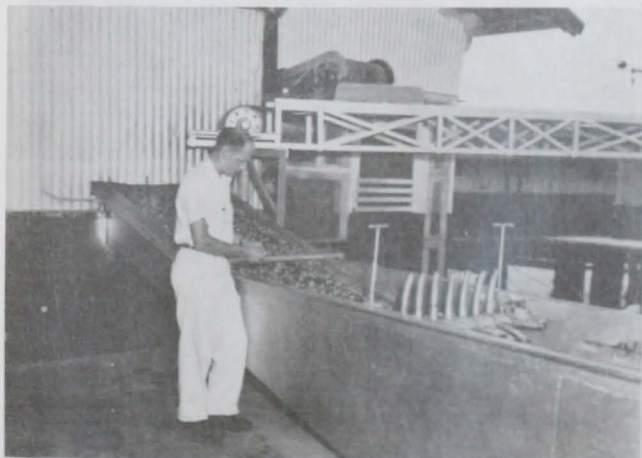


Fig. 9 - At the breeder plant, the boxes of iced shrimp are dumped into a large deicing and washtank that extends outside the building. The conveyor carries the shrimp into the coldroom. Here a U. S. Department of the Interior (USDI) inspector is examining the shrimp.

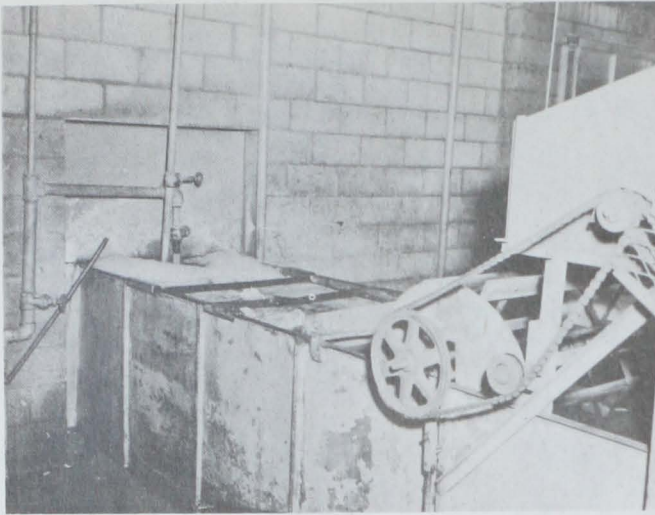


Fig. 10 - From inside the coldroom another washtank extends through the outer wall. The conveyor at the right carries shrimp to the graders.

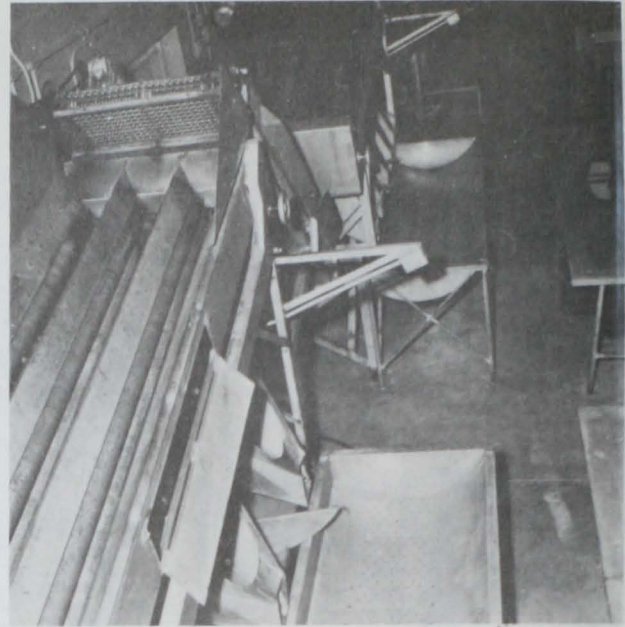


Fig. 11 - The shell-on shrimp are graded for size as they slide down between inclined rolls set at a slight angle. When there is a wide range of sizes in the material being fed, two graders are often operated in tandem, as in this installation. Three or four sizes can be graded out during one pass over the rollers.

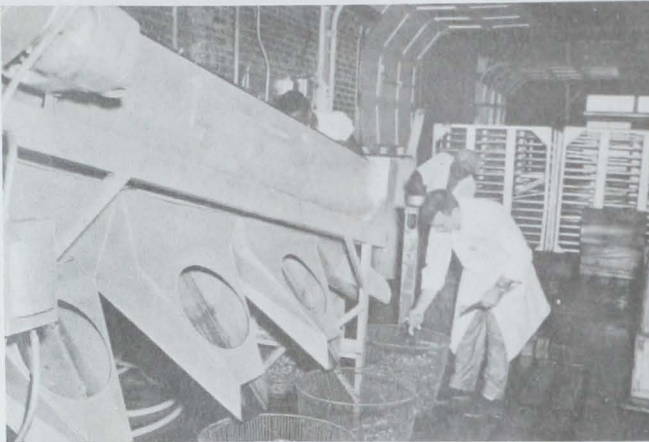


Fig. 12 - A USDI inspector is checking the shrimp coming from the grader. High quality of raw shrimp is essential for a Grade A breaded product.



Fig. 13 - After being graded, the shrimp are peeled and deveined. For the best grade of product, this operation is still carried out by hand. Bins feed the shell-on shrimp to the workers.



Fig. 14 - Often pans or trays are used to transport the shell-on and peeled and deveined shrimp to and from the working area.



Fig. 15 - Tables and pans used by the hand peelers are either stainless steel or aluminum to facilitate cleaning and sterilization. The plant is washed down thoroughly after each shift.



Fig. 16 - Machines have been developed to speed peeling and deveining. An operator positions the shrimp as she feeds them one by one into the machine.



Fig. 17 - The machine-peeled shrimp must be inspected for adhering pieces of shell and "sand veins," which would lower the grade of the frozen breaded product. Two machine peelers are visible in the background.



Fig. 18 - This machine, a deveiner, slits the shell and shrimp so the sand vein can be washed out, but the shell must be removed by hand.



Fig. 19 - The shells discharge from the conveyor belts under the work table. Weight lost in peeling is from 15 to 25 percent.

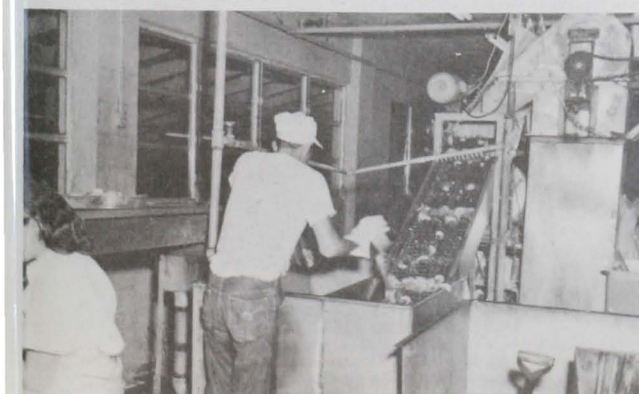


Fig. 20 - The peeled and deveined shrimp are held in a tank of ice and water until needed by the breaders. The machine in the background, fed by the conveyor, is a predester.



Fig. 21 - When only one breading machine is used, the shrimp may be predestered by tumbling shrimp and dry batter-mix in a revolving drum. Workers distribute predestered shrimp on the wire belt of the breader.



Fig. 22 - In some operations the peeled and deveined shrimp are predusted by hand before going to the breading machine. Many plants use two machines in tandem, eliminating the predusting operation.

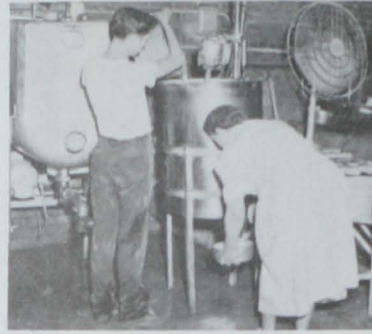


Fig. 23 - Whether shrimp is breaded by hand or by machine, large quantities of batter are needed. Prepared batter mixes may be used, but many plants prefer to mix their own. Formulas used are carefully protected secrets. Mixing tank is in foreground, and holding tank in rear.



Fig. 24 - This worker is cracking whole eggs for the batter mix. Dried powdered eggs or frozen whole eggs are also, and more commonly, used.

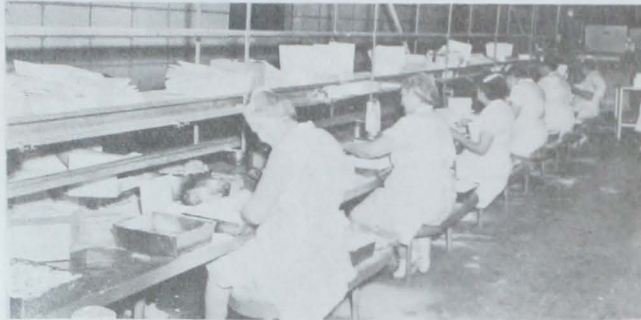


Fig. 25 - Hand breading is still favored by some plants. Predusting, batter-dipping, breading, and packing steps are all carried out by the individual worker.



Fig. 26 - Weights of the packed boxes are individually checked.



Fig. 27 - One plant has developed a special machine to batter and bread shrimp without breading the fantail. Workers suspend shrimp by the tail from pins on strips.

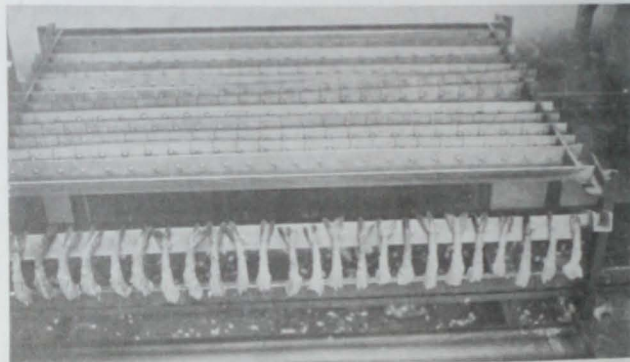


Fig. 28 - The strips of pinned up shrimp are secured on a rack that will carry them through a tank of batter.

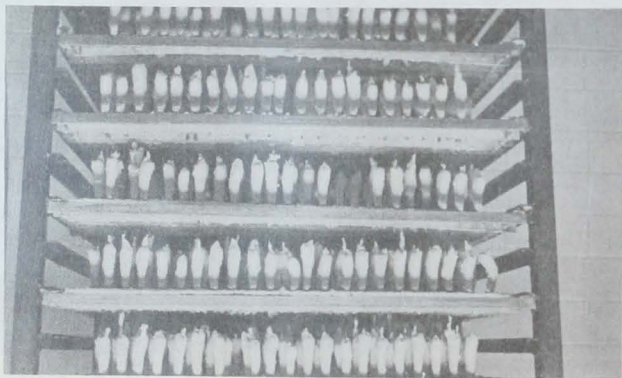


Fig. 29 - After being breaded, the strips of breaded shrimp are secured on another rack, which can be rolled into the blast freezer. Rapid freezing at temperatures from -10 to -40° F. helps preserve quality.



Fig. 30 - About 75 percent of the pack of breaded shrimp is machine-breaded. Several makes of machines are used. In all of them, good operation depends on an even distribution of the peeled and deveined shrimp on the conveyor belt.

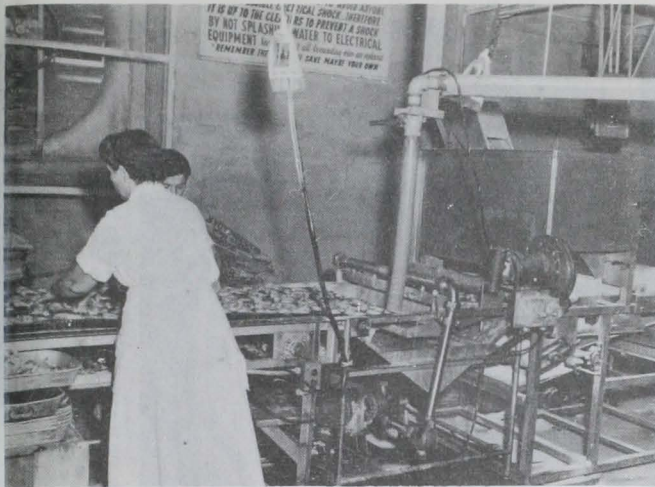


Fig. 31 - The belt with shrimp then dips under a curtain of batter flowing from the pipe in the right center. Note the many connecting unions, which permit complete separation of all parts for thorough cleaning of the batter system.



Fig. 32 - After the batter spray, a blast of air from the duct shown in left center blows off excess batter. This operation reduces excessive pickup and loss of breading.

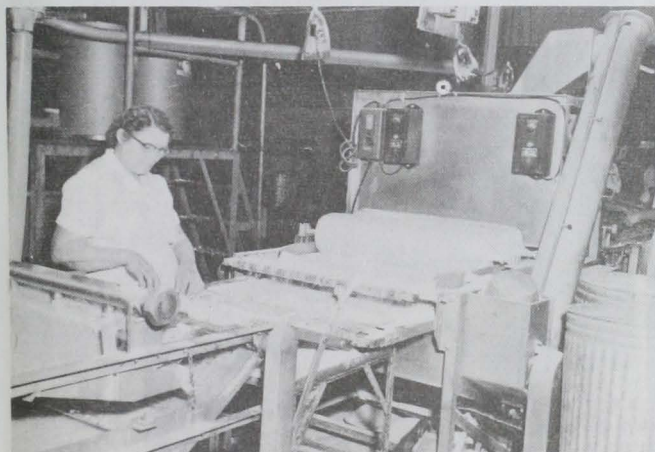


Fig. 33 - Breading also circulates, through the conveyor on the right. A layer of breading about 2-inches thick is built up on the belt to cover the shrimp. The large, soft rubber rolls then gently press the layer of shrimp and breading to get even coverage.

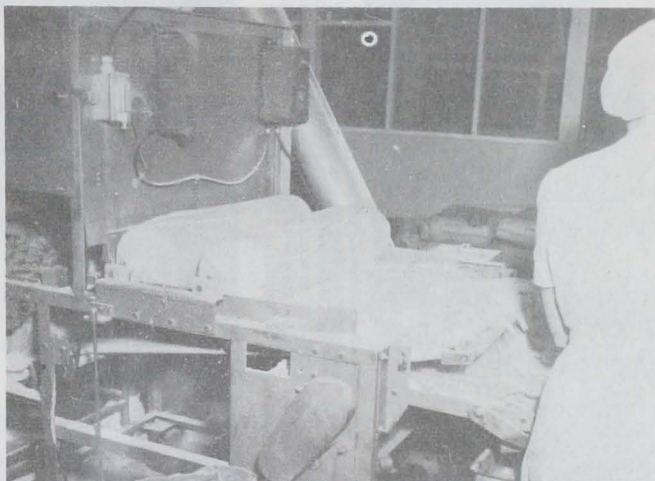


Fig. 34 - Excess breading separates and the reverse side of the shrimp is exposed as shrimp tumble from one conveyor to another at a lower level. This assures an even coat of breading.



Fig. 35 - Some redistributing is needed before the shrimp go under the second batter curtain. Note the plastic covers on the rolls. Direction of motion is to the right.

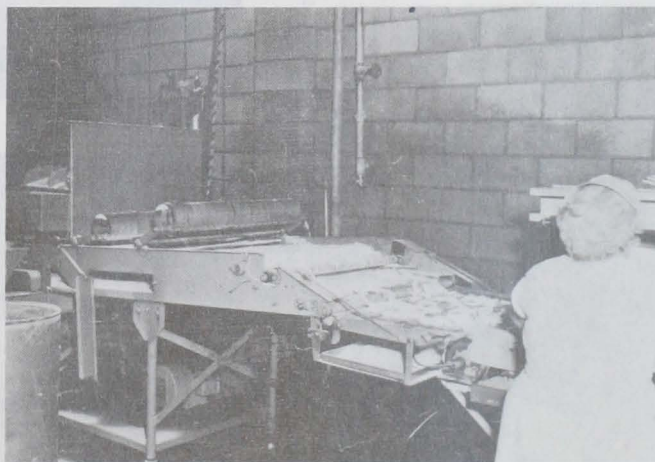


Fig. 36 - Some machines use a row of flexible stainless steel bands that pat on the breading as they intermittently press on the layer of breading and shrimp.



Fig. 37 - The end of the first breeder, the second batter unit and second breeder, and in the background, the first of the packers can all be seen in normal sequence.

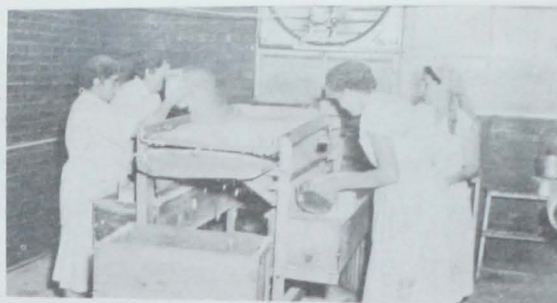


Fig. 38 - The separated breading picks up excess batter and gets lumpy. Here a vibrating sifter is used to separate lumps before reuse, in this case, by hand breaders. At the end of the shift, any breading still in circulation normally is discarded.



Fig. 39 - All breaded shrimp are hand-packed. Packers line each side of the discharge conveyor from the second breading machine.



Fig. 40 - In this plant, workers pack from a pan of breaded shrimp. Weight of each package is checked.



Fig. 41 - These workers are checking weight of institutional size (5-pound) packages. Conveyor at far left carries the packages to the wrapping machine.



Fig. 42 - This package shows the care used to produce an attractive product. These shrimp were pinned on strips and pre-frozen before being packed.



Fig. 43 - A typical wrapping machine. Rack at left is being filled with wrapped boxes. It then will be rolled into a blast freezer.



Fig. 44 - These shrimp are being frozen in a plate freezer. Refrigerant circulates in each plate, and stack of movable plates and boxes is put under pressure to give contact with both box surfaces.



Fig. 45 - Most breaded shrimp is packed under continuous inspection. Here an inspector checks the weight prior to determining the percent of breading.



Fig. 46 - Debreaded shrimp are weighed again. Plants provide laboratories for inspector's use.

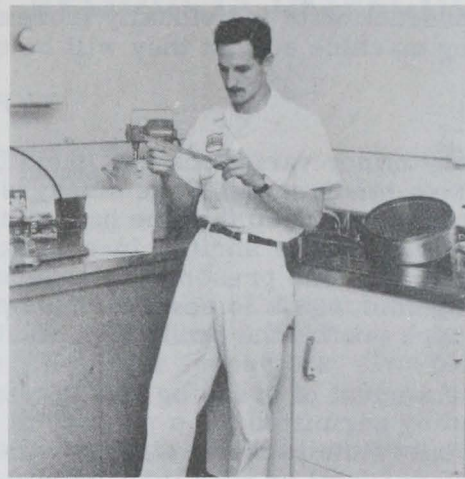


Fig. 47 - The inspector is using a slide rule to figure the breading percentage. Most inspectors are college graduates. They serve not only as inspectors but also as quality-control advisers.

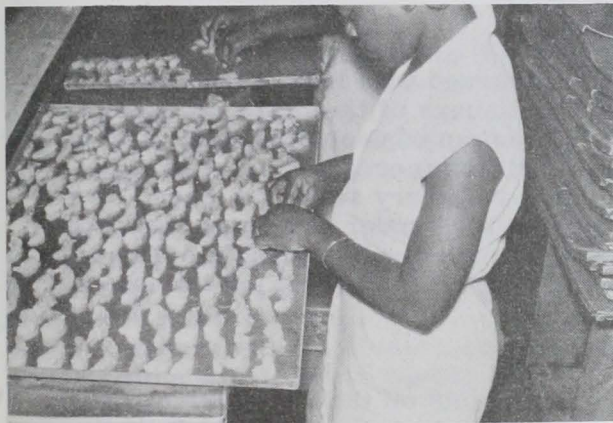


Fig. 48 - Individually frozen peeled and deveined shrimp is a second and increasingly popular product of many breading plants. Peeled and deveined shrimp are laid on pans so that they do not touch one another.

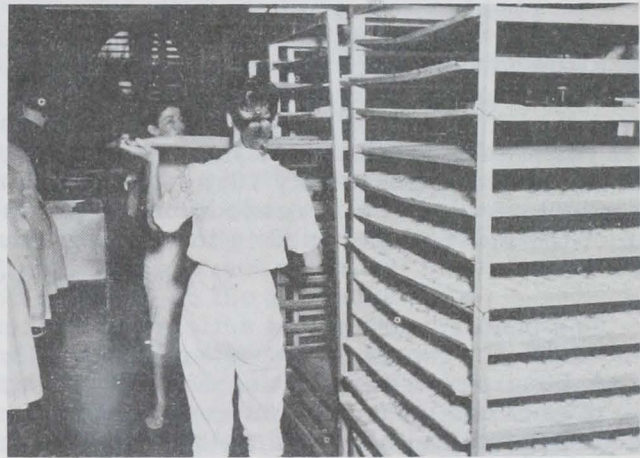


Fig. 49 - The racks are loaded with the pans of peeled and deveined shrimp.



Fig. 50 - The full rack is promptly wheeled into a blast freezer.

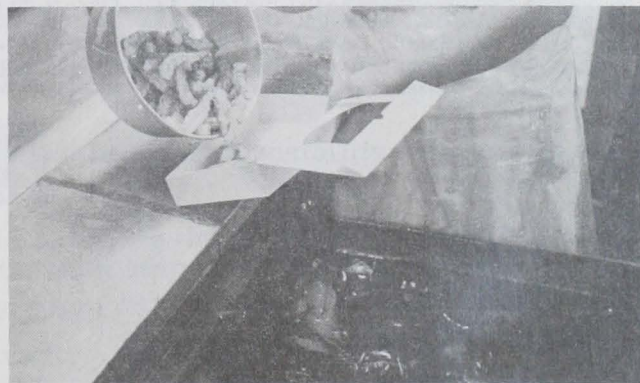


Fig. 51 - Freezing is completed very rapidly. The frozen shrimp are dipped for a few seconds into the tank of ice water (foreground) to pick up a glaze, removed in a strainer or wire basket, and immediately packed, cased, and returned to the freezer. The plastic window box is favored to display the attractive product that results when fresh jumbo pink shrimp, preferred for individually frozen shrimp, are available.

in the production of individually frozen shrimp or to spread them across the feed belt of a breading machine so that they will be evenly covered with batter and breadier mix.

TYPES OF PRODUCTS

[Many minor variations are found in types of breaded shrimp. The most popular product, made from medium and large sizes, is "butterfly" shrimp, given this name because the deveining cut is so deep that the halves spread open like butterfly wings. Small sizes, usually used for the popular shrimp-in-a-basket, are commonly breaded round or are deveined with a shallow cut. The presence or absence of a tailfin or "fantail," with or without the adjacent shell segment, leads to several other subtypes. There is some demand for shrimp breaded with a bare tailfin, the production of which requires a hand operation or a special machine.

The amount of breading is a factor of identity, though not of grade. The maximum amount of breading permitted for a product to be graded is 50 percent. Breading content of more than 50 percent of the packed weight is considered "heavy." Special packs with medium breading (35 to 45 percent) or with light breading (less than 35 percent) command a premium price. The size of shrimp, of course, also influences the price.

GRADE STANDARDS

The rapid growth of the shrimp-breeding industry occurred with few guidelines for quality, since breaded shrimp was a new product. In 1955, members of the industry, realizing that all producers are hurt when even small amounts of shrimp of poor quality or with excessive breading are marketed, requested the U. S. Bureau of Commercial Fisheries to develop a standard for grade of frozen raw breaded shrimp. This voluntary standard, based on several years of laboratory study, was the first to be implemented under the Bureau's Inspection Service created in July 1958. Now 21 plants pack under continuous inspection an estimated 80 percent of all breaded shrimp produced in the United States, making this standard one of the most widely used in the fishing industry.

MAGNITUDE AND VARIETY

The photographs in this article were taken in shrimp plants on the South Atlantic and Gulf of Mexico coasts. A flowsheet (fig. 1), illustrates the variations in processing that are encountered in the preparation of breaded shrimp. Figure 2 shows the steps in the production of individually frozen shrimp. The pictures illustrate the magnitude of the industry and the variety of machinery as well as the amount of handwork required to produce some 70 million pounds of breaded shrimp a year.

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