After processing and freezing, the packer must maintain the finished products in continuous sub-zero storage, using a non-fluctuating temperature with sufficient air channels for cold circulation. In shipping to wholesalers or storage warehouses every precaution should be taken to avoid a temperature rise at any point in the chain of distribution to the ultimate consumer.

To sum up, remember the following: 1. That quality in any shrimp product can be no better after processing than before: *buy for quality.* 2. That prime quality in fresh shrimp is a characteristic which is lessened each hour the product remains unfrozen, however much care is taken of the product and however small may be such change in the initial period of holding — even under ideal conditions: *complete the processing in the shortest possible time.* 3. That plenty of melting ice is essential to proper holding, no matter how low a holding temperature may be possible. Don't spare the ice and see that it melts at a satisfactory rate. 4. That cold is a protector of quality, an insulator against the normal warm air of the processing room. Surround the product with this protection through all steps of processing. 5. That the lower the temperatures can be held at all points in the processing cycle, the less harmful bacterial action there will be, and the quicker the product can be frozen when it reaches the freezer. In particular, keep batter well under fifty degrees F. in the breading step. 6. That to protect the ocean-goodness characteristics of fresh shrimp, freeze it quickly. 7. That cleanliness of all equipment, pans, etc., which come into contact with the product at any stage is vital. Harmful bacteria are ever-present and will soon be out of control if not checked by adequate cleaning and sanitation methods: institute proper equipment-sanitizing methods. 8. That cleanliness of all persons handling the product is equally or even more essential than that of equipment. Have your plant personnel made aware of the importance of cleanliness in the operation. Provide for regular health checks. Provide for sterilization of hands on entry or re-entry to the processing room.

Finally, remember that consistent high quality is not easily achieved nor is the cost low, but a business and an industry can grow with quality as a partner, but not well without it. Beautiful labels, wonderful advertising programs can help mightily to sell the consumer her first package of breaded shrimp, but what quality she finds *in* the package will determine not only how soon she will buy another package but also *if* she will ever buy another package.

Handling Shrimp In the Canning Plant

H. R. Robinson

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In this country the Dunbar family began the canning of shrimp in 1867. The early problems were mainly concerned with finding a suitable container for use in preserving the shrimp. The growth of shrimp canning was aided in large measure by the advances in can manufacture and can sealing equipment. One of the first problems encountered was to prevent black discoloration caused by iron sulphide. Thanks to the development of an enamel for use on the interior of the cans it is no longer necessary to sew the shrimp

into cotton bags before placing them in cans, as was the case with these early pioneers.

Generally speaking, the cans and can closing equipment are the only element of shrimp canning which has reached a state of near perfection. The term "near" perfection is used, for even in this field there is a constant search for new and better enamels. For example, in recent years some discoloration of canned shrimp has been noted. The can manufacturers have now developed an entirely new enamel for use on the interior of the cans, and the first commercial production using this new enamel is to be made later this month. Would that we canners had no worries other than concerned the quality of the cans, for then, indeed, we would be in a Utopian state!

However, since shrimp canning processes have not developed to such a state, it will be profitable to examine the current methods employed in canning shrimp, together with the attendant problems. There are 41 shrimp canneries in operation this year, 1953, which means that there are almost as many different ways of handling shrimp. Of necessity, this outline will have to draw heavily upon the experiences and processes of our own firm, although an attempt will be made to include all of the major variations which exist.

With canning, as with other segments of the shrimping industry, quality control begins on the fishing grounds. The initial shore operation begins with the receipt of the shrimp at the cannery. The shrimp pass through a washer and de-icer, then over an inspection belt where decomposed and discolored shrimp, as well as extraneous matter, are removed. It is probable that the visual methods of inspection will always be with us, though most producers would welcome any method which would improve detection and elimination of shrimp not suitable for use.

Following this inspection comes the weighing of the shrimp. While some firms assume ownership on the fishing grounds, our firm does not do so until the shrimp have been inspected. To our way of thinking this puts the burden of maintaining the quality of the raw shrimp squarely on the shoulders of the fisherman, for he knows that any loss will be his.

The next step is picking, and this is accomplished either by hand labor or by mechanical methods, or by a combination of both. Picking involves the removal of the head and shell from each shrimp. The time-tested method is to peel by hand. In recent years a machine has been developed and is now in use by a large number of firms. The possible effects of the action of the mechanism upon the texture of the shrimp is still to be accurately evaluated.

The waste material resulting from the picking operation is disposed of by means of dehydration. The resulting shrimp meal, which contains as its main elements approximately 50 to 55 per cent protein, eight to nine per cent nitrogen, and 10 to 11 per cent ammonia, is used either in feed manufacture or as fertilizer. The waste material salvaged from mechanical picking does not have the same composition as the waste from hand picking, for some of the elements are literally washed down the drain. A number of producers make no effort to salvage the waste material, since the cost of dehydration outweighs the commercial value of the resultant product. To our knowledge there has been very little work done on the by-products of shrimp.

Following picking, in our own cannery the shrimp pass over inspection belts where a final quality check of the raw shrimp is accomplished. Like producers in other branches of the shrimp industry, we canners are aware of the potentials of deveined shrimp. Consequently, subsequent to inspection

comes a grading of the shrimp in order that the larger sized shrimp may be deveined before they continue their journey through the cannery. Both grading and deveining may be accomplished in one of two ways — by hand, or mechanically. Some of the machines presently in use show great promise, and as they are further perfected they will come into general use.

Up to this point all of the handling has been of raw shrimp. The main contributions of scientific research in connection with these phases of the operation will continue to consist mainly of the improvement of existing machinery or the development of new machinery, together with a determination and evaluation of the effect, if any, which the machinery has upon the shrimp.

Whether the shrimp are deveined or not, the next step in the canning procedure involves blanching — that is an initial cooking of the shrimp. Normally a boiling saline solution is used. There is no uniformity within the industry as to the length of cook or the strength of the saline solution. The blanch accomplishes three things: (1) the curling of the shrimp, (2) the extraction of water and solubles from the shrimp, and (3) the production of a pink color. The blanch is one of the most important processes in the canning operation. Slight changes in either cooking time or strength of cooking solutions have a pronounced effect upon the finished product. There is considerable room for study and improvement of this phase of the operation.

Following the blanch the shrimp are graded for size, and cooled. Cooling occurs both before and after the grading operation. The actual grading is accomplished mechanically, most firms using vibrating graders.

Now follows a careful check to insure that the shrimp are free from bits of hulls and other extraneous matter. Simultaneously, the shrimp are checked for size and any shrimp not properly graded by the machine are placed in their proper group.

The packing operation comes next. Shrimp are packed by hand, each can being filled to an exact weight. Like other canned items canned shrimp must meet a drained-weight requirement which is established by a federal "Standard of Fill of Container." The weight of shrimp which must be placed in each can in order to obtain the required weight in the finished product varies according to the size of the shrimp and with the manner of blanching.

Following the packing operation the cans are conveyed towards the closing machines where the tops are sealed upon them. Prior to actually entering the closing machines a hot liquid is added to the can. Some firms, including our own, add a saline solution directly to the cans. Other firms add water and a salt tablet. Variations in the strength of this brine directly affect the weight of the finished product, as well as its texture and firmness.

The blanching, the packing and the added brine all affect the weight and quality of the final product. A change in any one of these operations will more than likely result in the necessity for compensating changes in the others. To illustrate, let us assume that we decide to change our blanch. This may be accomplished either by changing the strength of the cooking solution or by changing the length of time of cook. If we lower either one it will result in less extraction of water and solubles from the shrimp. Unless there is a compensating change made elsewhere the finished product will probably be underweight. The reverse is true, for an increase of either the strength of cooking solution or the length of time of cook will result in the

finished product being overweight, due to excessive moisture extraction in the blanch. Neither consumers nor regulatory bodies would be apt to complain in the latter case, but the Profit and Loss Statement of the firm will soon reflect a complaint.

Once the cans have been sealed the next step is the actual processing, that is, sterilization through heat. The length of time of the process depends partly on the initial temperature of the product — the average temperature of the contents of the coolest cans going into the process. The liquid which is added to the can should be at a temperature not less than 200° F. The sealing of the top upon the can should take place as quickly as possible, to insure a good vacuum.

The sealed cans should move to the cookers within a reasonably short time after closure, with the maximum delay not exceeding thirty minutes. As the time lapse between closure and processing increases, the initial temperature decreases, necessitating an increase in the time of processing. It is also known that an undue delay between closure and processing will result in a loss of vacuum in the can.

The actual processing has received a great deal of scientific attention. Processing techniques are likely to receive considerable improvement in the near future.

Upon completion of the actual processing, canned shrimp should immediately be cooled. With some canned products the cooling cycle may be terminated when the temperature of the can contents is down to 110-120° F., thus permitting the remaining internal heat to dry the exterior surface of the can. This is not so with shrimp, which should be completely cooled to insure the complete termination of the cooking.

It may come as a surprise to some here to learn that as canners, we consider refrigeration as one of our most efficient tools. In our own firm we use refrigeration at two levels. It is used first as a means of regulating production within the cannery. For this purpose we employ storage facilities where the temperature is maintained at 26-28° F. Our second use of refrigeration comes in the storage of the finished product. For this purpose we maintain warehouse storage facilities where the temperature is approximately 65° F.

The entire canning operation is designed to result in the best possible marketable product. Despite our best efforts to date canned shrimp have certain limitations; they do not remain in prime condition indefinitely. With age there comes a softening, accompanied by a fading or blending of color. The occurrence of struvite crystals in canned shrimp is a problem that has yet to be solved, as is true with a number of canned seafood items.

Because of the varied problems we are constantly working to make the canned shrimp produced in each successive year better than those produced in the preceding year.

The Organization of a Quality Control Program In a Fishery Plant

W. F. Hampton

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Quality control is a technique used in the production of a product with two objects in mind: one is to keep the product out in front in the race for