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PROCESSING OF SEAFOOD INCLUDING SHELLFISH AND CRUSTACEANS

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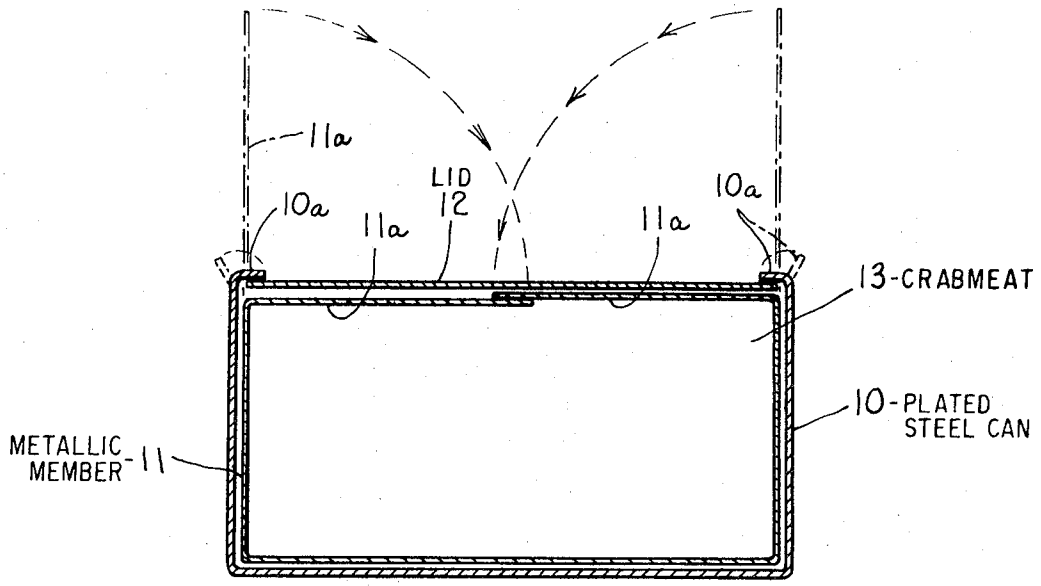


Fig. 1.

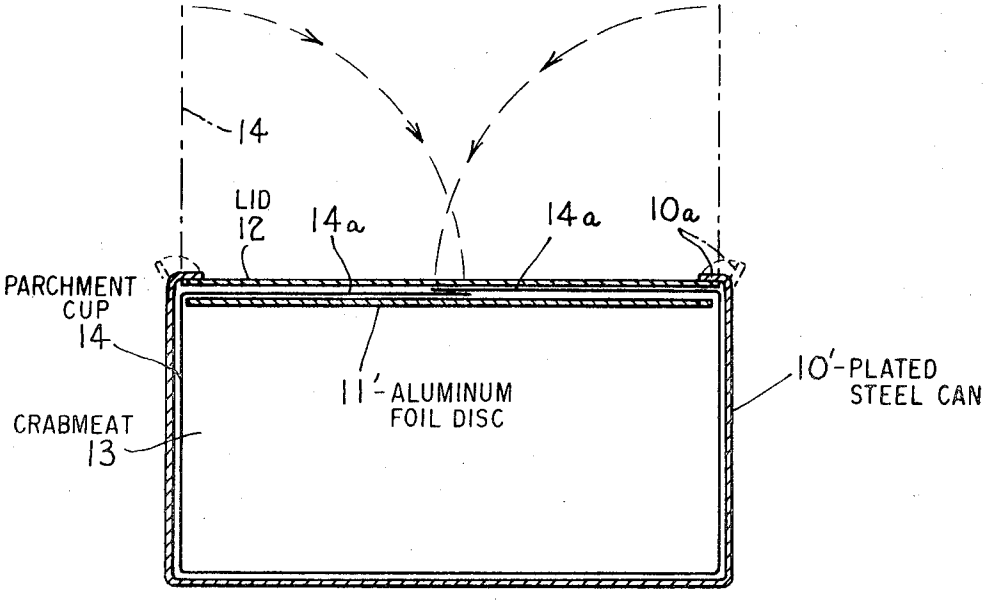


Fig. 2.

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PROCESSING OF SEAFOOD INCLUDING SHELLFISH AND CRUSTACEANS

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ABSTRACT OF THE DISCLOSURE

A package containing seafood products in a processing liquid containing copper or iron ions and the like, includes a metallic can containing the seafood covered within the can with aluminum foil and the like, said package having been processed by subjecting the can and its contents to elevated temperature.

This invention relates to the controlling of objectionable discoloration in processed and packaged seafood products.

In the processing and packaging, namely canning, of seafood products, discoloration frequently results, and from the uninformed consumer's viewpoint, this discoloration signifies an inferior product.

There are two primary causes of the blue and black color formed in canned seafood. First, the blood and flesh of the shellfish and crustaceans, such as crabmeat, have a great abundance of heavy metals such as copper and iron. Also, there is inevitably some extraneous matter introduced into the end product through the normal channels of seafood processing. Some of these vectors carry the unwanted copper and iron. Examples of these vectors could be gills, viscera, shell, other body organs, occasionally seaweed, mud, etc. Also, these heavy metals can be introduced through processing water, which is frequently drawn from wells, equipment, water pipes, and the like. The second source of unwanted heavy metallic ions is the can used in packaging the final product. This can is essentially a tin-plated steel can with various grades of enamel coating. During dating, sealing, processing, and subsequent storage, this container may be the source of additional unwanted ions. Of particular significance is the method of coding the date on the can lid which almost invariably damages the enamel lining of the can. During the cooking process many cells of the meat rupture, exposing copper and iron to the free liquid in the can. These copper (Cu^{++}) ions combine with sulfates present in the free liquid of the can to form blue copper sulfate. Also, iron in the meat and from the can combine with sulfur present in the meat and water forming black iron sulfide. This problem was discussed in United States Pat. No. 2,669,520, issued to Carl R. Fellers on Feb. 16, 1954, and several remedies were advanced by him. The practice of this invention operates independently of Dr. Fellers development, although these two systems can be used to supplement each other.

Accordingly, it is an important object of the present invention to improve the appearance of canned seafood, especially crabmeat.

The construction designed to carry out the invention will be hereinafter described, together with other features thereof.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawing forming a part thereof, wherein an example of the invention is shown and wherein:

FIG. 1 is a schematic transverse sectional elevational view illustrating a preferred embodiment of the invention, and

FIG. 2 is a schematic transverse sectional elevational

view illustrating a modified embodiment of the invention.

The practice of this invention contemplates an oxidation-reduction chemical reaction. Aluminum in its natural state with a valence of 0 acts as a reducing agent and is oxidized by the copper (Cu^{++}) ions. These copper ions accept electrons from the aluminum and actually form pure copper on the surface of the aluminum foil. This reaction can be predicted from the use of a Latimer Oxidation Potential Chart, which lists elements (ions) in their relative order of reducing power. Aluminum being more active than copper, displaces copper from its blue complexes $CuSO_4$ forming white aluminum sulfate $Al_2(SO_4)_3$ and elemental copper.

The half cell reactions are as follows:

$$\text{Oxidation} \quad 2Al^{\circ} - 6\bar{e} \longrightarrow 2Al^{+++}$$
$$\text{Reduction} \quad 3Cu^{++} + 6\bar{e} \longrightarrow 3Cu^{\circ}$$
$$2Al + 3Cu^{++} \rightarrow 2Al^{+++} + 3Cu^{\circ}$$

A very similar reaction occurs in the case of iron. Aluminum possessing a greater reducing power as listed in Latimer's Oxidation Potentials displaces the iron from black iron sulfide.

$$\text{Oxidation} \quad 2Al^{\circ} - 6\bar{e} \longrightarrow 2Al^{+++}$$
$$\text{Reduction} \quad 3Fe^{++} + 6\bar{e} \longrightarrow 3Fe^{\circ}$$
$$2Al + 3Fe^{++} \rightarrow 2Al^{+++} + 3Fe^{\circ}$$

This process was tested extensively in controlled experiments producing dramatic results. The processed crab meat had a snow-white appearance.

There are several embodiments of the invention which will produce the desired results and the particular modification employed will depend upon the cost factors for the particular product. One especially desirable embodiment includes a foil cup placed in the can which was later folded over the top surrounding the crabmeat completely in aluminum foil. The can is sealed hermetically in the usual manner and retorted in the usual manner. In addition to protecting the delicate flavor and color of the seafood product, this foil liner presented a clean, wholesome appearance to the can and product. FIG. 1 illustrates this preferred embodiment of the invention. A standard tin plate can with enamel interior coating is illustrated at **10**. A thin relatively flat metallic member **11** is provided in the form of aluminum foil of about .003 thickness. The can is sealed by the usual lid **12**. The flat metallic member **11** is folded over the meat **13** as at **11***a* so as to be in direct contact therewith. The can is sealed as at **10***a*.

A package produced at minimal cost, with ease of packaging and producing desired results included a foil disc of about .025 thickness over the top of the meat which was folded inside a parchment cup. This can was sealed and retorted in the usual manner. FIG. 2 of the drawing illustrates this modification of the invention wherein like reference characters illustrate like parts with prime notations added. The parchment cup is illustrated at **14** and is folded over the meat as at 14*a*. The foil disc is designated at **11'**.

Both modifications contained the usual additives, including a soluble sequestering compound and a soluble buffering compound and the cans were sealed and retorted in the usual manner. The best results were achieved when the product was retorted with the top of the can and aluminum disc in the "up" position. After storage for seven days the meat was found to remain white in appearance, while control samples containing the usual additives including calcium disodium (EDTA), but without the aluminum foil, exhibited undesirable discoloration. Crabmeat canned without any additives resulted in extensive discoloration on the surface and throughout the meat.

Crabmeat (cocktail lump and jumbo lump) canned with the inclusion of the usual additives, such as soluble se-

questering agents such as calcium disodium (EDTA), aluminum sulfate, and a soluble buffering compound, such as citric acid or phosphoric acid, did not produce desired results. Invariably these lumps of white meat formed blue-grey spots particularly, where they came in contact with the parchment which was against the inside of the can. Every test used this conventional method of color control which was standard operational procedure for packing crabmeat at the time. The successful method which is recommended here, uses aluminum foil discs to supplement the action of the additives as described in Pat. No. 2,669,520. These additives include a small amount of soluble ethylenediamine tetracetic acid or calcium disodium (EDTA) compound. A small amount of citric acid is preferably also used. The foil should be of sufficient thickness to facilitate handling.

Results using the foil were better at all points in time from one day to two months. Observations were made after 24 hours. This was not enough time for either system to reach equilibrium. At least three days had to be allowed under normal shelf storage to tell what the product was going to look like after normal shelf storage. In a weeks time the blue-grey spots would invariably be removed from the surface of the meat touching the aluminum. Where the surfaces were in contact with the conventional parchment, some blue-grey discoloration could be found. At least one week was normally allowed for storage before sample evaluation was made. Results after two months storage showed the foil producing excellent results where controls still showed blue-grey spots. These same conclusions can be drawn after seven months storage. When the foil was placed under the parchment cup improved results were achieved, but not as good as those achieved having foil in contact with product. Many variations of the above described embodiments, including placing foil at the top and the bottom of the can, will produce desirable results. It, also, is believed that the invention would be applicable to other seafood products including canned tuna, herring and the like.

The discoloration problem is aggravated by seasonal changes in the chemistry of the crab and becomes most pronounced during the late summer months. While the discoloration could be controlled by the addition of more calcium disodium (EDTA) the amounts necessary would be beyond permissible limits and would intrduce other undesirable factors. The additives used in practicing the invention should include soluble calcium disodium (EDTA) in desirable amounts and as permitted by the Food and Drug Administration under 275 parts per million. The additives also preferably include a soluble buffering compound.

The sealed cans of the invention are subjected to elevated temperatures as, for example, in retorting, about 240 to 250 degrees Fahrenheit, or pasteurizing, about 180 to 200 degrees Fahrenheit. When pasteurization is used it is necessary to refrigerate the containers and contents and the thin flat metallic member may be used alone without additives. In any event the amount of calcium disodium (EDTA) and other additives may be reduced or even eliminated entirely by proper use of the foil.

While a preferred embodiment of the invention has been described using specific terms, such description is for illustrative purposes only, and it is to be understood that changes and variations may be made without departing from the spirit or scope of the following claims.

What is claimed is:

1. A package containing white lump crab meat in a processing liquid containing copper or iron ions including: a tin plated steel can having a top for containing the crab meat; said can having a protective interior enamel coating; a quantity of said crab meat and liquid substantially filling said can; a disc of aluminium foil contacting and substantially entirely covering said meat on one side thereof between the crab meat and the top of the can; said crab meat and aluminum foil disc being substantially entirely surrounded by a parchment cup, said aluminum foil being more active in order of reducing potential than the metal of the ions of the processing liquid; and calcium disodium EDTA, a soluble sequestering compound and a buffer as additives in the processing liquid; whereby discoloration of the white lump crab meat is avoided.

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99—158, 181 C, 181 R