

Nov. 10, 1936.

P. D. V. MANNING ET AL

2,060,232

FISH COOKING METHOD

Filed Jan. 13, 1932

11 Sheets-Sheet 1

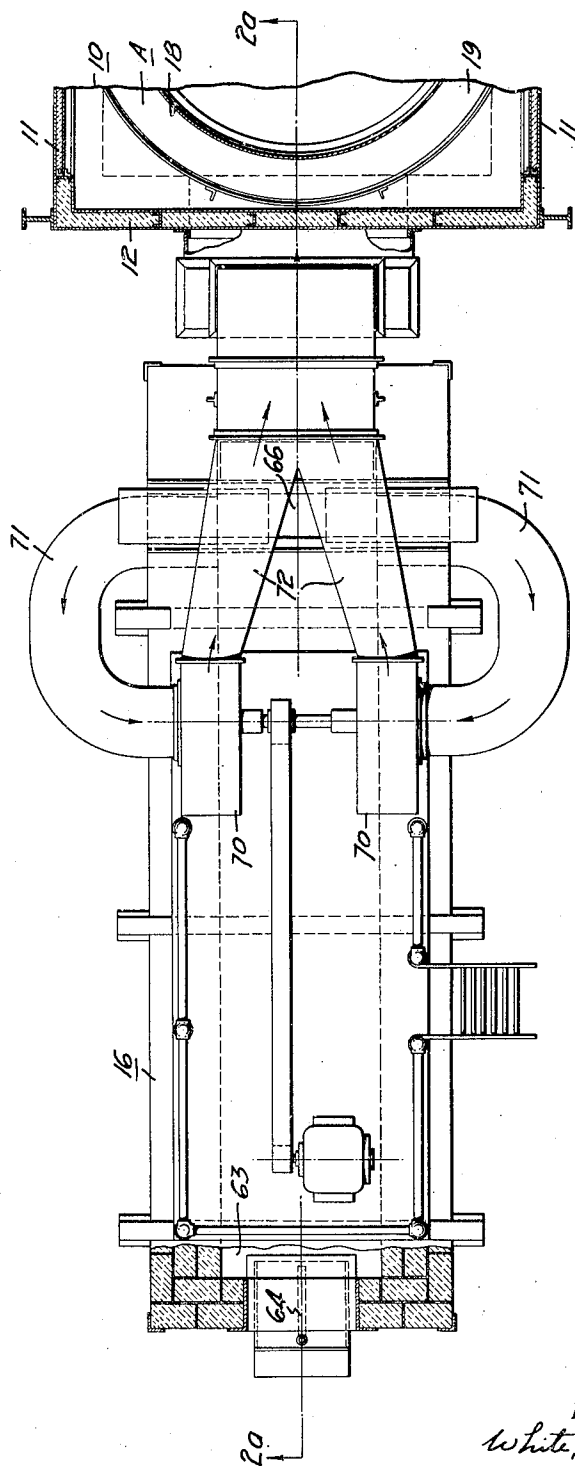


FIG. 1A-

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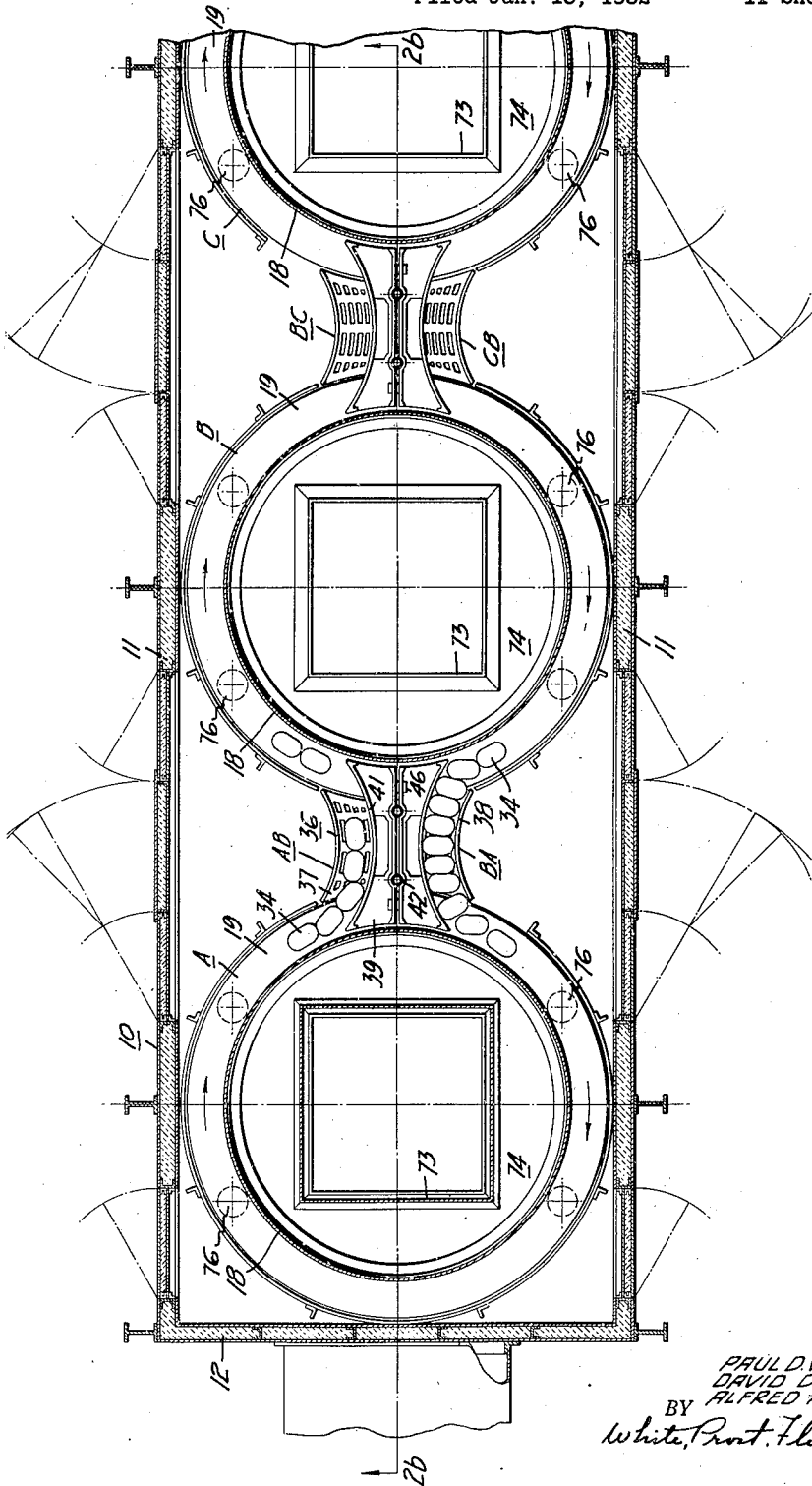
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2,060,232

FISH COOKING METHOD

Filed Jan. 13, 1932

11 Sheets-Sheet 2



FISH

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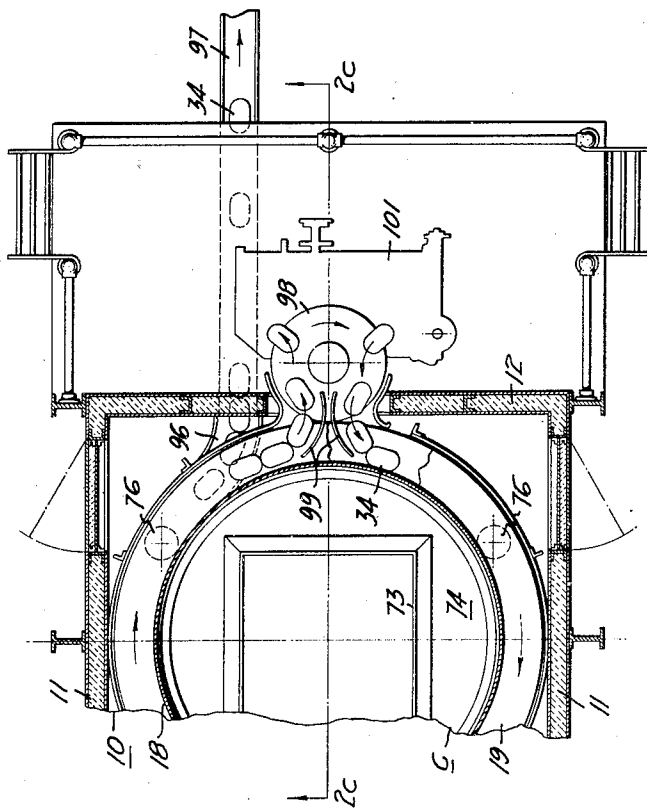
2,060,232

FISH COOKING METHOD

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11 Sheets-Sheet 3

FIG. 10



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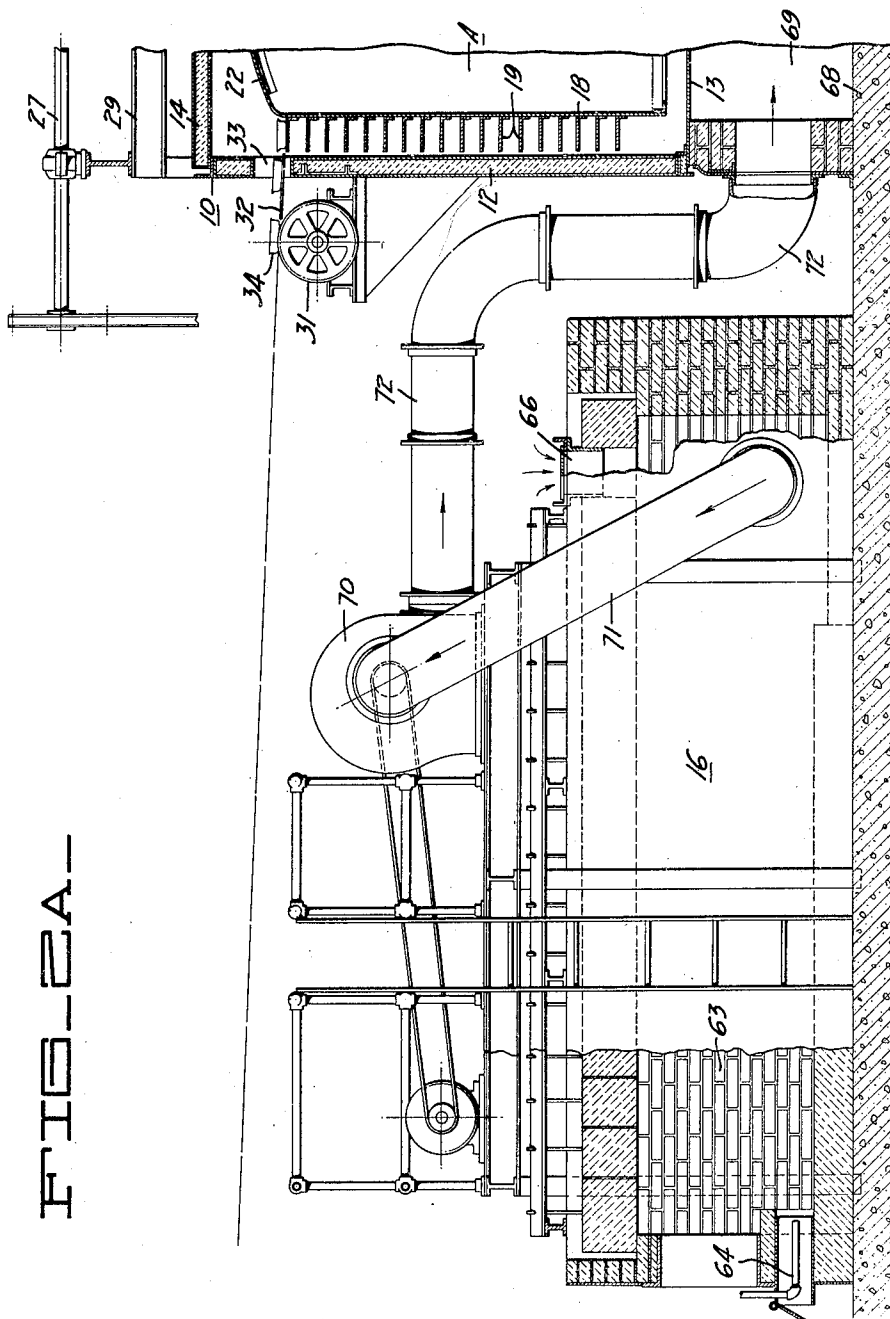
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FISH COOKING METHOD

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11 Sheets-Sheet 4



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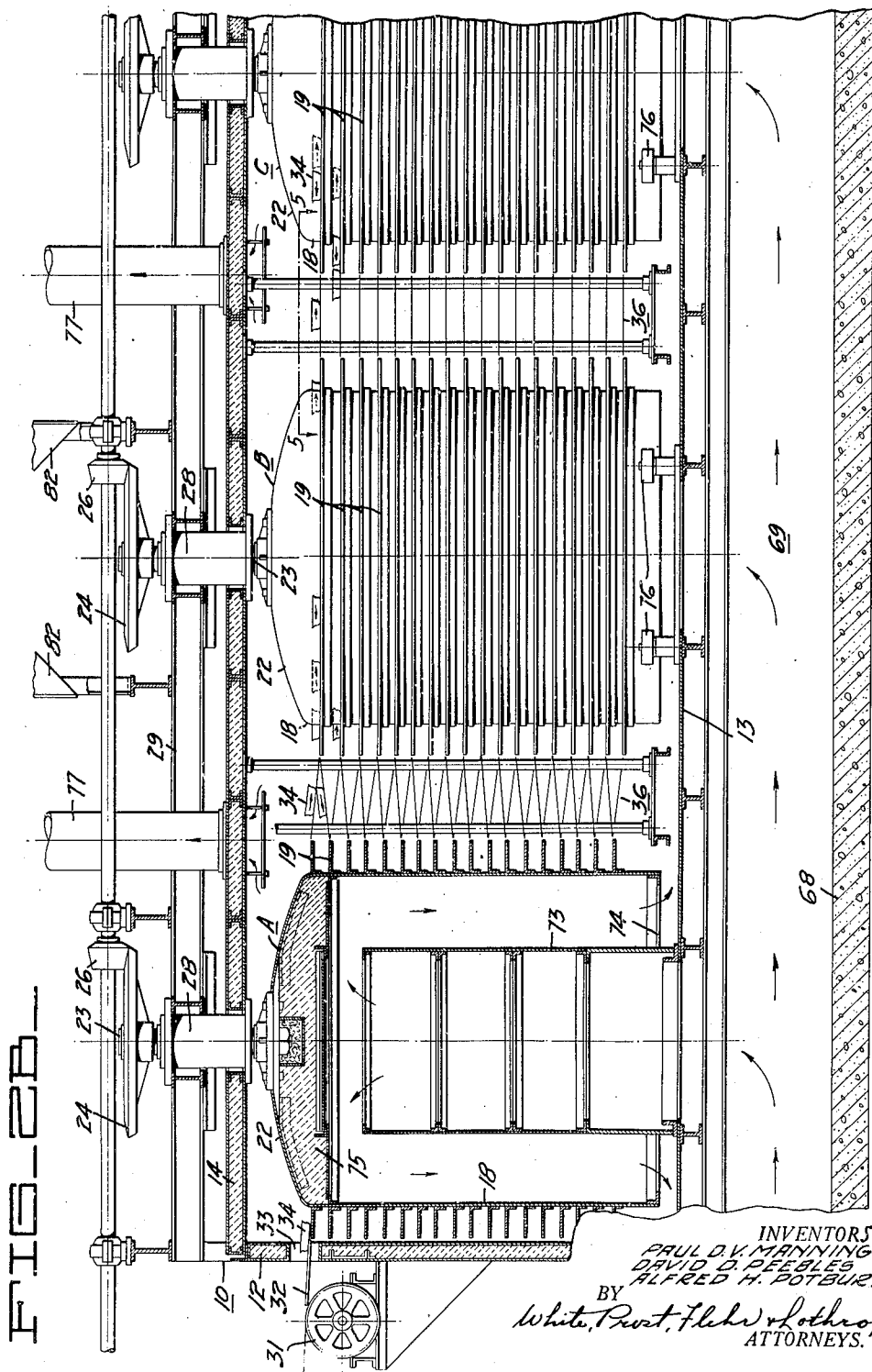
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FISH COOKING METHOD

Filed Jan. 13, 1932

11 Sheets-Sheet 5



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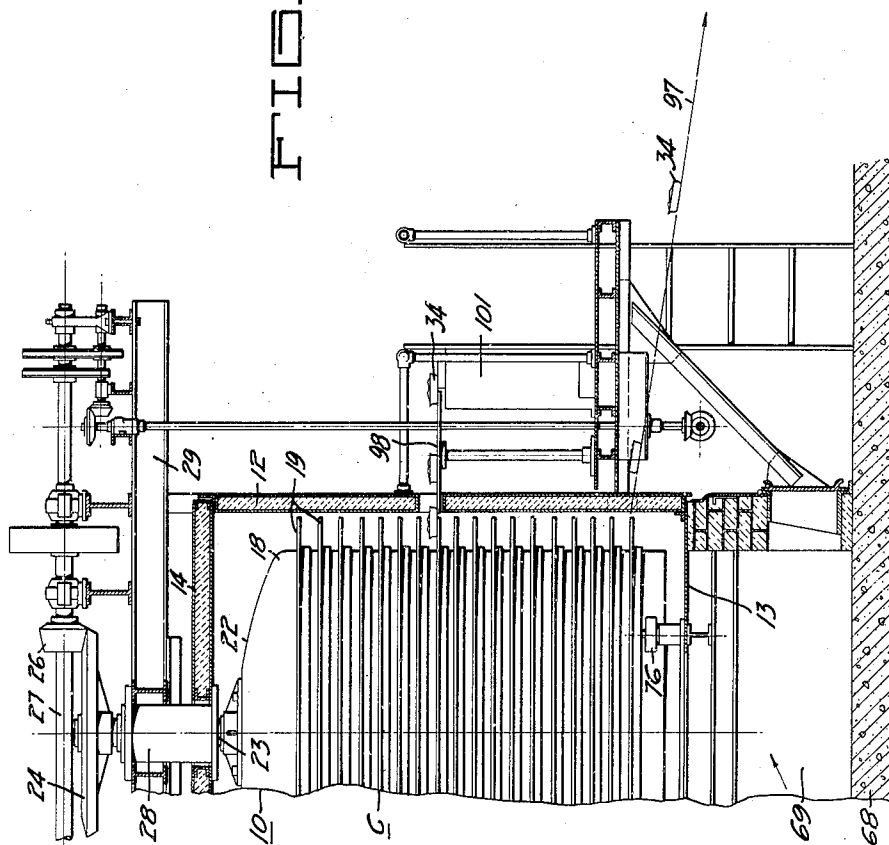
2,060,232

FISH COOKING METHOD

Filed Jan. 13, 1932

11 Sheets-Sheet 6

FIG. 20



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FISH COOKING METHOD

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11 Sheets-Sheet 7

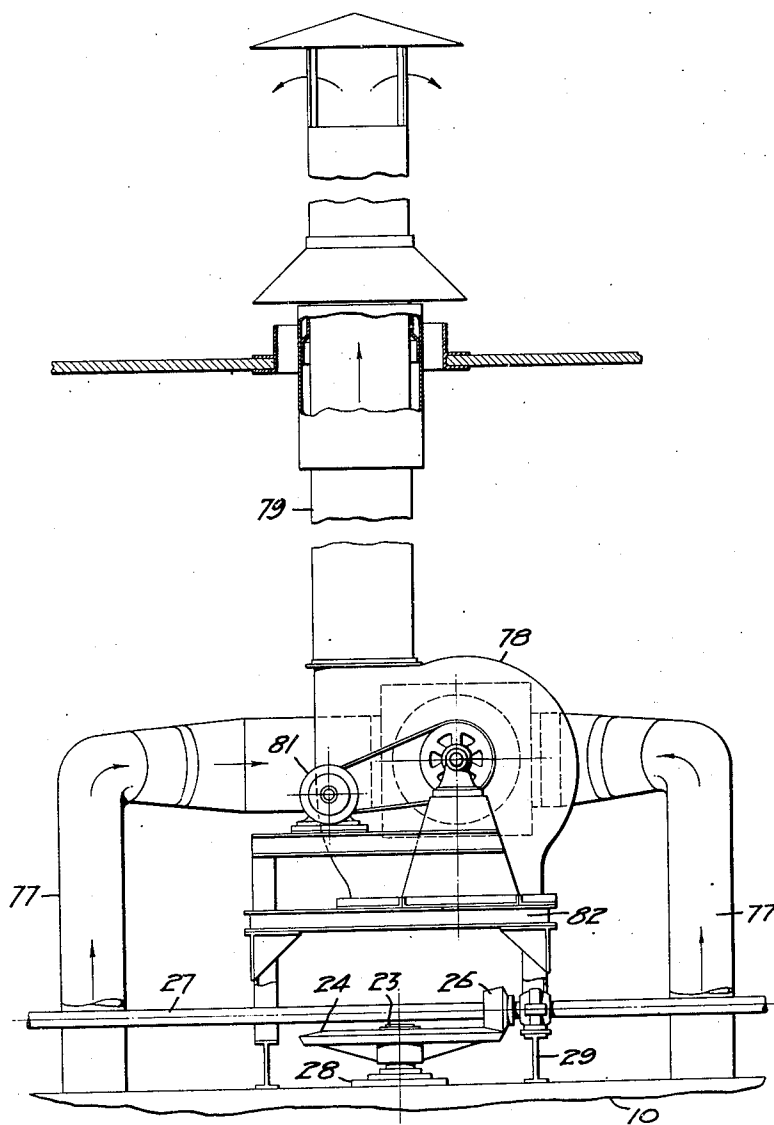


FIG. 3.

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FISH COOKING METHOD

Filed Jan. 13, 1932

11 Sheets-Sheet 8

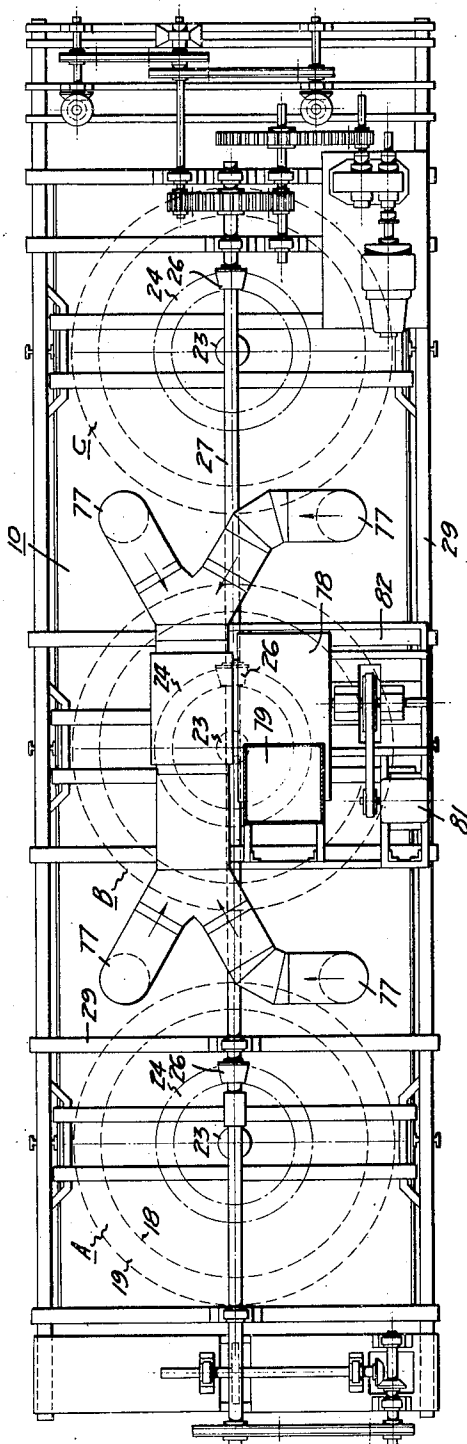


FIG. 4

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2,060,232

FISH COOKING METHOD

Filed Jan. 13, 1932

11 Sheets-Sheet 10

FIG. 6.

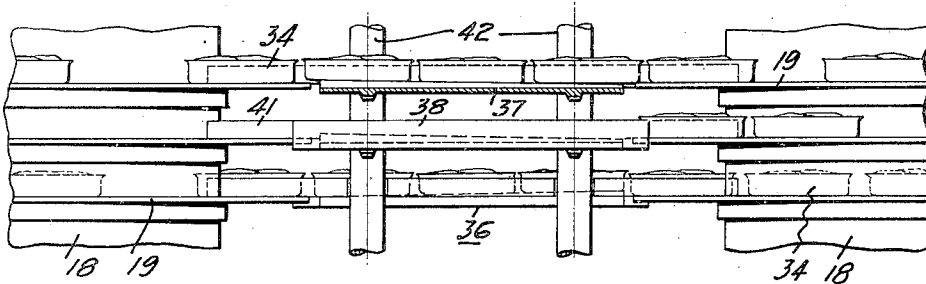
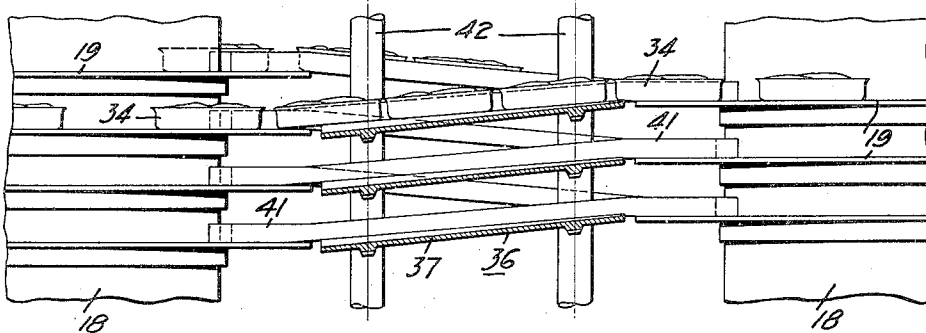


FIG. 7.

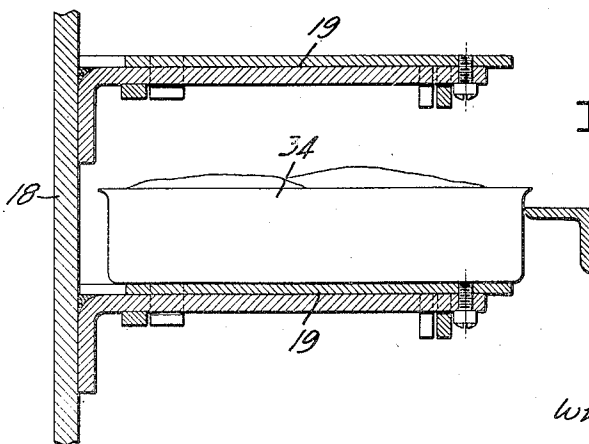


FIG. 12.

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FISH COOKING METHOD

Filed Jan. 13, 1932

11 Sheets-Sheet 11

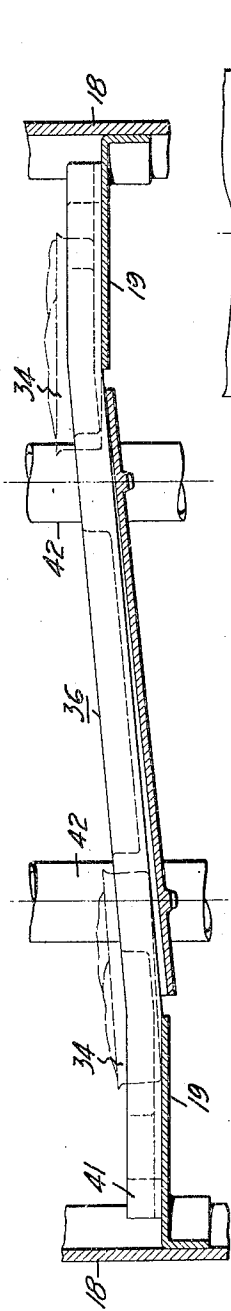


FIG. 8

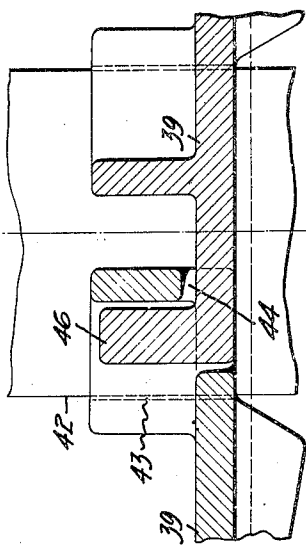


FIG. 9

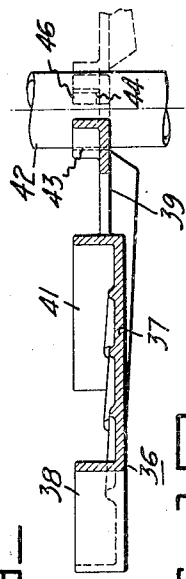


FIG. 10

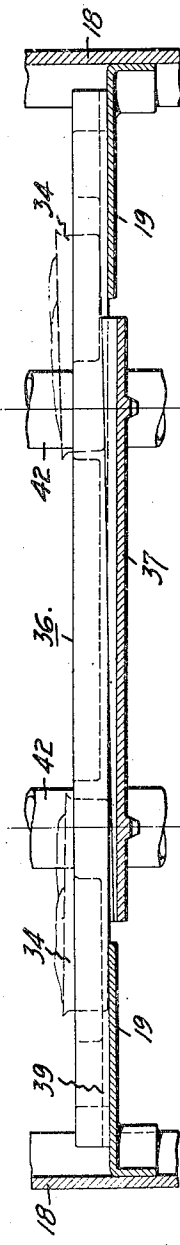


FIG. 11

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UNITED STATES PATENT OFFICE

2,060,232

FISH COOKING METHOD

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Application January 13, 1932, Serial No. 566,434

3 Claims. (Cl. 99—188)

This invention relates generally to methods for cooking fish for canning purposes, particularly fish of the smaller varieties commonly known as sardines.

5 The principal cooking methods which have been utilized in the past in sardine canneries, can be grouped into three general types or classes. In the first, and probably the oldest type, the fish are fried in various oils. The second type can be termed a boiling or steaming process, in that the fish are either boiled in water or are exposed to the action of steam. The third can be termed a broiling process, in that a substantial amount of the cooking is effected by directly absorbed heat of radiation. It is generally considered by the trade that sardines cooked by a broiling process are of highest quality, mainly because they are more palatable and digestible. The use of direct radiant heat as a substantial factor in the cooking of sardines for canning purposes is disclosed and claimed in Peebles Pat. No. 1,677,364. Apparatus capable of generally carrying out the invention of Peebles Patent No. 1,677,364 is disclosed in copending applications, Serial Nos. 473,178 and 565,010.

In operating the apparatus disclosed in the above mentioned copending applications, we have made the discovery that the skin of the fish is apt to be mutilated during the cooking operation. Mutilation of the skin of the fish materially detracts from marketability of the product, because the fish present an unattractive appearance when a can is opened. Mutilation of the skin may either be in the form of cracking away from the fins, or may be a general disintegration and softening of the skins so that the skins will either fall away before the cans are sealed, or while the cans are in shipment. We have made the discovery, that by maintaining proper conditions within the cooking chamber, the skin of the cooked fish will be retained intact, and will stand shipment to such an extent that when the cans are opened, the fish will present an attractive appearance.

In view of the above, it may be stated that the general object of the present invention is to provide a method of cooking fish for canning purposes which will serve to preserve the skin of the fish in good condition, particularly where the cooking is promoted or accelerated by directly absorbed heat of radiation.

Further objects of the invention will appear from the following description in which a preferred embodiment of the invention has been set forth in detail in conjunction with the accompanying drawings.

Referring to the drawings, Figs. 1a, 1b and 1c, taken together illustrate in cross-section and plan an apparatus which can be utilized in conjunction with the purpose mentioned.

Figs. 2a, 2b and 2c taken together, form a cross-sectional side elevational detail of the apparatus illustrated in Figs. 1a, 1b and 1c. Figs. 2a, 2b and 2c are taken respectively along the lines 2—A, 2—B and 2—C of Figs. 1a, 1b and 1c respectively.

Fig. 3 is a side elevational detail showing the blowers and the conduit connections to the same for exhausting gas from the cooking chambers.

Fig. 4 is a plan view on a reduced scale illustrating the structure forming the cooking chamber and the driving mechanism mounted upon the top thereof.

Fig. 5 is an enlarged cross-sectional detail taken along the line 5—5 of Fig. 2b.

Fig. 6 is an enlarged detail partly in cross-section, showing the arrangement of the elements of transfer means A B, and B A.

Fig. 7 is an enlarged cross-sectional detail similar to Fig. 6, but of transfer means B C and C B.

Fig. 8 is an enlarged cross-sectional detail similar to Fig. 6, but omitting all but one of the transfer structures.

Fig. 9 is an enlarged cross-sectional detail taken along the line 9—9 of Fig. 5.

Fig. 10 is an enlarged cross-sectional detail taken along the line 10—10 of Fig. 5.

Fig. 11 is an enlarged cross-sectional detail taken along the line 11—11 of Fig. 5.

Fig. 12 is an enlarged cross-sectional detail illustrating the construction of the shelves on top of the drums of the cooker.

The apparatus illustrated in the drawings is substantially identical with that disclosed in application No. 565,010, filed Sept. 25, 1931, now Patent No. 1,942,830. A description of this apparatus will facilitate an understanding of the present invention.

Referring to Figs. 1a, 1b and 1c and also Figs. 2a, 2b and 2c of the drawings, the chambers in which the cooking of the fish takes place is formed by a structure 10. This structure includes side walls 11 and 12, bottom wall 13 and top wall 14. It is evident that these walls may be formed in any suitable manner. For example as indicated the side, and top walls can be made of suitable structural members carrying spaced metal plates, the plates being separated by heat insulating material. As a means for supplying heat to the cooking chamber, there is shown a suitable furnace indicated generally at 16, which will be presently described in detail.

The means illustrated within structure 10 to handle and store canned fish during a cooking period, provides relatively high capacity for a given amount of space. Thus, within the cooking chamber there is an arrangement of shelving incorporated with a plurality of units identified as A, B and C. Each of these units consist of a drum 18, made of suitable material such as sheet metal,

having a plurality of spaced shelves 19 mounted upon the periphery of the same. This shelving extends about the drum as shown in Fig. 1b, and is made of material having good heat conductivity, such as metal.

As shown in Fig. 2b, units A, B and C are mounted to rotate about straight vertical axes. Thus each drum 18 is provided with an upper end wall or head 22, to which a shaft 23 is secured. The shafts 23 extend upwardly thru the upper wall 14 and are operably connected to suitable drive means, such as represented by bevel gears 24 and 26, driven by a counter shaft 27. With this drive connection, rotation of counter shaft 27 drives the units A, B and C in synchronism. Shafts 23 carry the weight of their respective rotatable units, and they are therefore shown associated with suitable journals 28, these journals being supported by a structure 29 over-lying the upper wall 14. Journals 28 can be water cooled so as not to be detrimentally affected by heat.

In order to supply cans containing fish to the shelves 19 so that the apparatus can operate automatically and continuously, conventional means is illustrated such as an endless conveyor, one end of which is carried by a sprocket 31, (Fig. 2a). A small chute 32 serves to deliver cans from the end of this conveyor to the uppermost shelf of unit A, thru an opening 33. As will be presently explained, when in operation open cans in which fish are packed, are delivered thru opening 33 and are disposed one behind the other on the uppermost shelf 19 of unit A, as shown in Fig. 2b.

In order to utilize the available shelf space 19 of the different units A, B and C, and in order to extend the cooking period and make it continuous, there is shown transfer means which serves to transfer cans 34 between the different units A, B and C, and which serve to transfer the cans to the different shelves of these units. As shown in Figs. 1b and 2b the transfer means are divided into a plurality of units or groups, these units in the present instance being identified as A B, B C, C B and B A. The unit A B serves to transfer cans between the rotatable units A and B, unit B C transfers from unit B to unit C, unit C B transfers from C to B, while unit B A transfers from B to the original unit A.

Referring to Fig. 5, each of the units B C and C B consists of a plurality of superposed metal structures 36 which can be formed as castings. Each of these castings affords a curved trackway or slide 37 for passage of cans, which is bounded on its outer edge by a curved upstanding flange 38. Each structure 36 is also formed to provide end webs or plates 39 which are adapted to over-lie and rest upon corresponding shelves 19 of the units A and B with which the particular can slide cooperates. An upstanding flange 41 extends along the inner edge of the trackway 37, and also extends to the end of plates 39. In order to retain structures 36 in one general position, and at the same time permit individual adjusting movement thereof, each structure is also loosely retained by the spaced upright columns 42. These columns 42 are arranged along the line of centers between the units A and B and have their upper and lower ends fixed to the general structure 10. The inner edges of structures 36 have arcuate recesses or pockets 43 whereby they partially embrace the columns 42. Adjacent structures 36 of two transfer means B C and C B are also loosely linked together by means such as shown in Figs. 5 and 11. Thus the inner edge of each structure is provided with an opening 44 and also with a pro-

jecting L-shaped lug 46. Each L-shaped lug 46 of one structure 36 loosely engages thru the aperture 44 of a corresponding adjacent structure 36, whereby the corresponding structure 36 of the two transfer means B A and A B are loosely interlocked together.

It will be noted that the shelves of unit B are staggered with respect to the unit A, while the shelves of units B and C are on substantially the same level. Therefore, the trackway slides 37 for transfer means B C and C B are substantially level as shown in Fig. 9, while the trackway slides 37 for transfer means A B and B A are oppositely inclined, as shown in Figs. 6 and 8. Accordingly, for the structures 36 of transfer means B A and C B, the inter-lock connection illustrated in detail in Fig. 11, provides two points of connection between the structure 36 on the same level. However, in the case of transfer being A B and B A, the inter-lock connection is serially between the structure 36 as designated in Fig. 6, that is one structure 36 of one transfer means, say transfer means A B has one inter-lock connection with the structure 36 of transfer means B A which is inclined downwardly, and another inter-lock connection with another structure 36 of transfer means B A which is inclined upwardly.

To clarify the apparatus thus far described, it may be explained at this time that the path of cans moving over the units A, B and C is as follows:—As the cans are received one after the other on the uppermost shelf of unit A, they are carried about one side of this unit as indicated by the arrows in Fig. 1b. They are then carried across the can slide 37 of the uppermost structure 36 of this unit, and are delivered to the uppermost shelf of unit B. After being carried about one side of the axis of unit B the cans are slid over the uppermost can slide 37 of transfer unit B C to the uppermost shelf of unit C. After moving substantially about the axis of unit C, the cans are slid over the uppermost can slide 37 of the transfer unit C B, back to the uppermost shelf of unit B, and upon this shelf they are moved about the axis of unit B to the uppermost can slide 37 of transfer unit B A. The transfer unit B A serves to discharge the cans to the second shelf of unit A. The cans delivered to the second shelf of unit A move substantially entirely about the axis of unit A until they are delivered to the second can slide 37 of transfer unit A. From this second can slide, the path of the cans can be traced along the second can slide 37 of unit B C, the second shelf of unit C, the second can slide of transfer units C B, the second shelf of unit B to the second can slide of transfer unit B A which then delivers the cans to the third shelf of unit A. Therefore, a given can travels from one shelf of unit A to unit C and then back again to the next lower shelf of unit A. Within a given time, it is apparent that a can entering the cooking chamber upon the uppermost shelf of unit A, will reach the lower-most shelf of unit C, and it is from this lower-most shelf that the can is finally discharged from the cooking chamber. Likewise, assuming that the cans are delivered from the upper-most shelf of unit A in slow succession, in time all of the shelves of units A, B and C will contain cans, and therefore the cans can be continually removed from the lower-most shelf of unit C. Movement of cans across the can slide 37 is effected by pushing the cans in close succession as indicated in Fig. 1b. In this connection note that the distance between

the curved flanges 38 and 41 should be sufficient to accommodate the cans in any position, that is this distance should be at least slightly greater than the length of the cans.

From the above, it is apparent that the shelf 19 serves the function of supporting and carrying the cans thru a non-linear and circuitous path, thru the interior of structure 10, whereby a large number of cans are stored within the cooking chamber during a cooking period. These shelves also serve the useful purpose of effecting transfer of heat to the fish within the cans, as will be presently described, and to enable them to perform this function, they are heated to such a degree that a substantial amount of heat is dissipated from the same in the form of heat of radiation. In order to impart heat to the shelves 19, hot gases are passed thru each drum 18, this gas being produced by the furnace 10. The particular form of furnace illustrated in Fig. 2a, consists of a combustion chamber 53 formed by suitable refractory walls. Suitable means such as a natural gas burner 54 supplies the combustible mixture to the combustion chamber. A refractory structure 53 extends beneath the units A, B and C and forms a passageway 69 communicating with the combustion chamber 53, and thru which hot gaseous products of combustion are passed thru glow. The hot gases of combustion from chamber 53 are introduced into the passageway 69 by means of two blowers 70, these blowers having their intake connected to the combustion chamber of the furnace by the conduits 71, and their outlets connected to the passageway 69 by conduits 72. Air from the atmosphere flows in thru the openings 66 and serves to dilute and lower the temperature of the products of combustion into the cooking chamber to the desired level, thus enabling high combustion efficiency and a lower temperature of the gas exhausted. Air introduced at this point also has an effect upon the humidity of the resulting diluted gases, as will be further explained.

Extending upwardly within each drum 18 and concentrically with respect to the axis of the same, there is a conduit 73, this conduit having an open upper end and having its lower end fixed to the bottom wall 13. The lower end of each drum 18 is open, and is spaced from the bottom wall 13, thereby forming an annular passage 74 for the flow of gas from the drum to the space surrounding the same. Thus hot gas flows from passage way 69 upwardly thru each conduit 73, then downwardly between this conduit and the inner wall of the drum 18 and then into the space surrounding the drums, thru passageways 74. In order to avoid undue heating of the top walls 22 of the drums, which would result in a heat wastage, the inner surfaces of walls 22 are covered with heat insulating material 75.

To provide means for guiding and steadying the lower portions of the drums, there are rollers 76 mounted upon the bottom wall 13 and arranged to engage the lower edge of each drum 18 at circumferentially spaced points.

In order to effect continual removal of gases from the space surrounding the drums 18, a plurality of exhaust conduits 77 are provided, which communicate thru the upper wall 14. As shown in Fig. 3, these exhaust conduits 77 communicate with the intake of a blower 78, the outlet of which is connected to an exhaust conduit 79. The blower 78 can be operated by a small electric motor 81 which is of variable or adjustable speed, and the

motor and blower can be carried by a suitable frame 82 mounted upon the upper wall 14.

With circulation of hot gas thru the drums, and thru the space surrounding the same and out thru exhaust conduits 77, it is evident that a portion of the heat of gases passing thru each conduit 73 is absorbed, and the walls of these conduits are heated to such a degree as to cause a transfer of heat to the side walls of the surrounding drums 18 by radiation. Likewise, the side walls of drums 18 are heated by transfer of heat from direct contact with the hot gases as well as by heat of radiation received from conduits 73. The heating of the side walls of the drums 18 cause this heat to be transferred by conduction to the metal shelves 19 and the temperature at which these shelves are maintained is also sufficient to effect radiation of a substantial degree of heat to the fish as well as conduction of heat through the bottom of the cans. The gases leaving the drums and flowing into the space surrounding the same are necessarily at a relatively lower temperature than the gases in passageways 69, but are at a temperature sufficiently high to aid in the cooking operation, as will be presently explained.

As previously mentioned, the cans at the end of a cooking operation can be conveniently removed from the bottom shelf of unit C. As representative of suitable means for effecting automatic removal of the cans, there is shown a suitable guide chute 96, (Fig. 1c) which serves to divert the cans from the lowermost shelf of unit C to deliver them through a suitable opening in the end wall of structure 10, from which they can be picked up by suitable conveying means 97. The cans delivered at this point are introduced into a suitable machine which applies and seals the lids to the cans. However, before the cans are sealed, it is preferable to drain oil and other liquid from the same, which can be accomplished by suitable means well known in the art.

If the maximum recovery of oil from the fish is desired, oil can be drained from the cans as an intermediate step in the cooking operation, in addition to effecting drainage after the cans leave the cooker. Thus, as shown in Fig. 1c, a transfer disc 98 is provided which cooperates with one of the intermediate shelves of unit C, say a shelf located about half way down the corresponding drum 18. A suitable guide means 99 serves to divert and shunt the cans carried by this particular shelf upon one side of disc 98, and from this disc, the cans are successively delivered to a machine 101, which serves to invert the cans and thus drain oil and liquid from the same. From machine 101, the cans and drainage are re-delivered to the other side of disc 98, from which they are again transferred back into the cooking chamber upon the same shelf of the unit C. The disc 98 is of course driven at a suitable rate in synchronism with the rotation of unit C. The drainage of the cans as an intermediate step, may be dispensed with where it is desired to produce canned sardines having a relatively high food value by virtue of the amount of fish oil retained.

To briefly review the operation of the complete apparatus, open top cans packed with fish to be cooked are continually delivered one behind the other to the uppermost shelf of unit A. Upon being delivered to the uppermost shelf of this unit, the cans are carried about in the arc of a circle and are then transferred by transfer unit A B to the uppermost shelf of unit B. After travelling thru the arc of a circle about the axis

of unit B, they are delivered by transfer means B C to the uppermost shelf of unit C. Unit C also carries the cans about the arc of a circle and reverses their direction toward unit B. After being delivered by the transfer device C B the cans are returned to the uppermost shelf of unit B and by transfer means B A, they are delivered to the second shelf of unit A. Thus the cans are successively delivered between the shelves of units A, B and C and are caused to pass back and forth over successively lower paths. During these movements of the cans, the fish are being cooked under particular maintained conditions, as will be presently described. At the end of the cooking operation, the cans are delivered to the conveyor 97.

The method by which the fish are cooked by the above described apparatus, and by our particular method of utilizing the same, can be best explained by reference to Fig. 12. In this figure we have indicated an open can 34 containing fish, resting upon one of the heated shelves 19 and below another heated shelf above the same. Cooking of the fish is promoted in part by direct conduction of heat to the flesh of the fish from the heated shelf upon which the can rests, in part by direct absorption of heat radiated downwardly from the shelf directly above the same, and in part by direct contact with the hot gases to which the fish are being subjected.

As has been previously mentioned, without maintenance of certain conditions within the cooking chamber, the skins of the resulting cooked product will be in poor condition. For example if other factors are maintained substantially constant such as the initial condition of the fish, the temperature of the gases, and the length of the cooking period, the use of a hot gas or gases in the cooking chamber containing too much moisture results in a disintegration and softening of the skins, so that the skin tends to fall away from the flesh. On the other hand, the use of gas or gases which contain an insufficient amount of moisture tends to cause a hardening or cracking of the skin. It has also been found that an insufficient amount of moisture in the gases, coupled with a rate of cooking which is proportionately too slow, causes the skin to crack away adjacent the fins of the fish. To prevent such cracking away we have found that the rate of cooking of the flesh of the fish, which causes shrinkage of the flesh, should be commensurate with the rate of shrinkage of the skin.

While no special or mathematical formula can be given from which one can determine the optimum moisture content for other given conditions, examples can be given of practices which will result in poor skin condition, and practice which will result in good skin condition. The following table of data taken in actual operations of the apparatus described herein, affords a guide to secure the preferred results of the present invention.

No. of test	Cooking time, minutes	Td	Tw	Results
1	39	500	140	Bad.
2	46	450	135	Good.
3	40	500	139	10% spotted.
4	45	400	160	Bad.

Td and Tw represent dry and wet bulb temperatures, respectively, in the cooking chamber.

Test No. 1 resulted in poor skin condition be-

cause the moisture content of the gas was too high. Test No. 2 is an example of good practice to secure good skin condition. In test No. 3 the results were not altogether favorable because the moisture content was slightly too high, while in test No. 4 the moisture content was entirely too high.

In general it may be said that skin condition is fairly critical with respect to the upper moisture content limit. Under given operating conditions an increase of less than one percent of moisture above a given moisture content will result in poor skin condition. Therefore under given operating conditions the moisture content of the gases should be maintained just below that value above which poor skin condition will result. With the apparatus herein described this critical value can be determined by experimentation. Thus in operating this apparatus a gas temperature is selected in the cooking chamber, which with a given speed of operation of drums 18, will properly cook the fish in a minimum amount of time. The wet bulb temperature within the cooking chamber is then observed and the condition of the skin of the discharged product noted. If the skins are disintegrated or spotted, blower 78 is operated at a higher rate by increasing the speed of motor 81. This has the effect of further diluting the gases with atmospheric air drawn in through openings 66, and to remove evolved water vapor at a higher rate, to effect a corresponding decrease in moisture content. When the speed of motor 81 has been properly adjusted, the moisture content will be below the critical value referred to above, and the skin of the delivered fish will be in good condition. The wet bulb temperature observed from this proper adjustment of motor 81 together with the corresponding dry bulb temperature can be utilized as an index to secure proper skin condition under like operating conditions. Obviously over a considerable operating period motor 81 may require adjustment from time to time to maintain the desired moisture content and to compensate for other varying factors as for example the water content of the fish upon entry into the apparatus, the character of the fish, or the humidity of the atmosphere. There appears to be no distinct lower critical moisture content value below which poor skin condition will result, although as previously mentioned, extreme dryness is to be avoided such as will cause a cracking of the skin.

In the data given above with respect to particular tests, specific temperatures are given. In order to impart more comprehensive information concerning temperature values which will give good skin condition, it may be stated that good results can be obtained with a wet bulb cooking chamber temperature from 135° to 141° F., and a cooking period varying from 45 to 35 minutes. These ranges are given for the method when carried out with the apparatus described herein, utilizing natural gas in the burner 64. They are also cited for fresh fish stored in a 40° salometer brine from 40 to 60 minutes. In this connection it should be noted that in utilizing our method in a cannery the brine should be held as nearly constant as possible so that quality of the cooked product is substantially entirely under the control of the cooking method.

It is evident that our method must be intelligently supervised to insure maintenance of optimum cooking conditions. The wet and dry bulb temperature to secure best results are influenced

by many factors which cannot be anticipated with certainty, as for example, the freshness of the fish, the fat content of the fish which is partially rendered during cooking, the character of brining, and the humidity of the atmosphere. In this connection it should be noted that the moisture content of the gases within the cooking chamber consist mainly of moisture resulting from the combustion of fuel utilized, and moisture evaporated from the fish. Therefore changes in the character of fuel utilized must be taken into account, as well as changes in the water content of the fish entering the cooker.

We claim:

1. A method of cooking fish for canning purposes characterized by the use of a cooking chamber, the steps of maintaining a hot gaseous atmosphere within the chamber in contact with the fish within the same, and maintaining the temperature and moisture content of the atmosphere at values in accordance with the practice of providing a dry bulb temperature of about 450° Fahrenheit, and a wet bulb temperature of about 135° Fahrenheit, with a cooking period of about 46 minutes.

2. A method of cooking fish for canning purposes characterized by the use of a cooking chamber, the steps of maintaining a hot gaseous atmosphere within the chamber in contact with the fish within the same, and maintaining the

temperature and moisture content of the atmosphere at values comparable with the practice of providing a dry bulb temperature of about 450° Fahrenheit and a wet bulb temperature of about 135° Fahrenheit, with a cooking period comparable to about 46 minutes where the cooking is commenced with the fish in raw condition and continued until the flesh is substantially completely cooked.

3. In a method of treating fish, packing the raw fish in cans, subjecting the open cans to continuous heat treatment to substantially complete cooking of the flesh thereof, the heat treatment being by heat conducted through the cans simultaneously with enveloping the cans in a hot gaseous atmosphere and with subjecting the open faces of the cans to heat of radiation, maintaining the temperature and moisture content of the atmosphere at values comparable to the practice of providing a dry bulb temperature of about 450° Fahrenheit and a wet bulb temperature of about 135° Fahrenheit, with a cooking period comparable to about 46 minutes where the cooking is commenced with the fish in raw condition and continued until the flesh is substantially completely cooked, and then draining and sealing the cans after such heat treatment.

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30