

May 27, 1930.

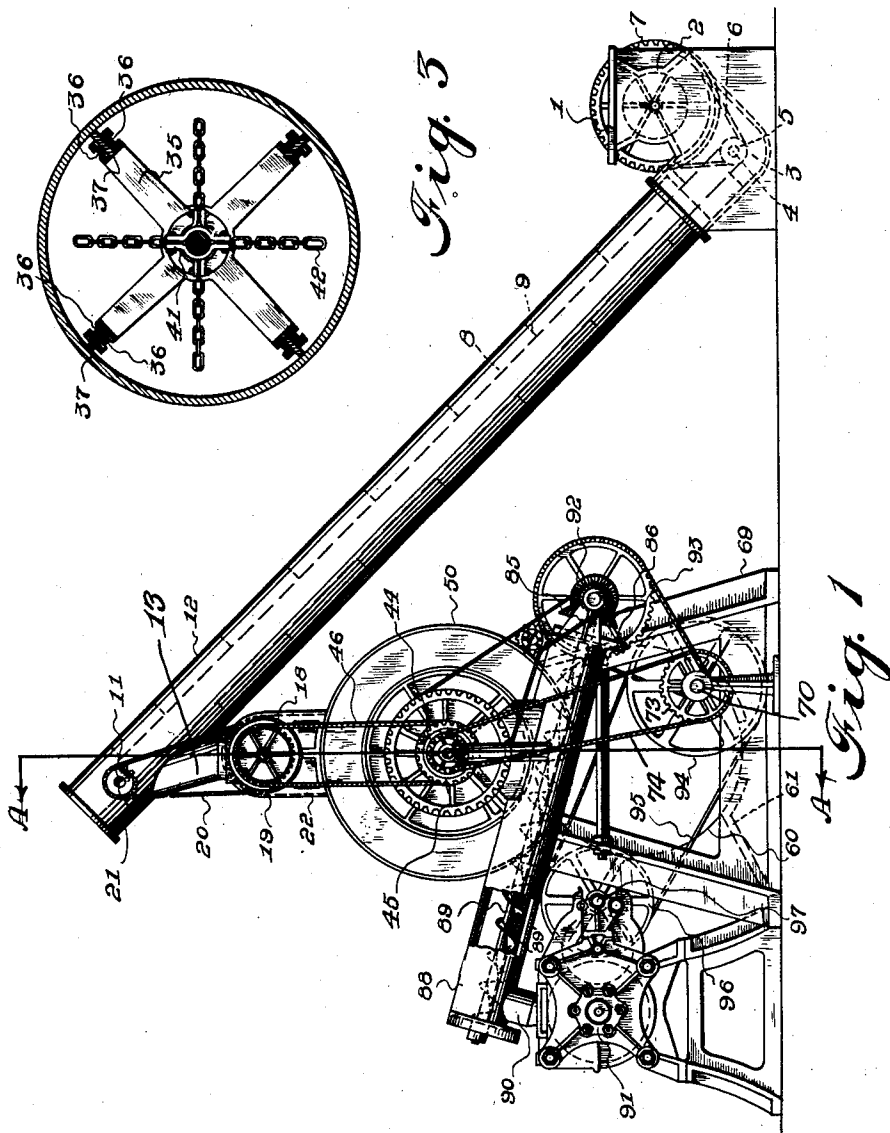
S. HILLER

1,760,059

RENDERING PROCESS

Filed Nov. 24, 1924

3 Sheets-Sheet 1



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May 27, 1930.

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3 Sheets-Sheet 2

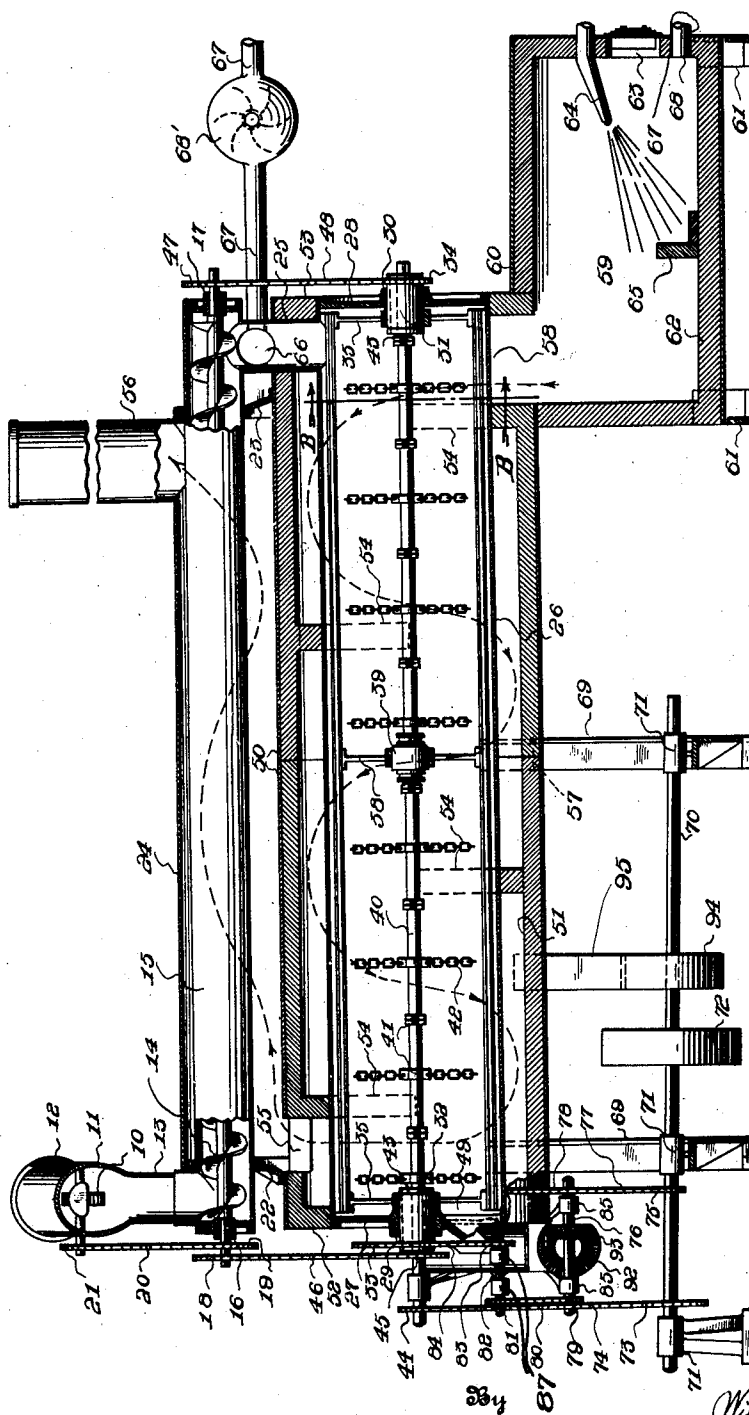


Fig. 2

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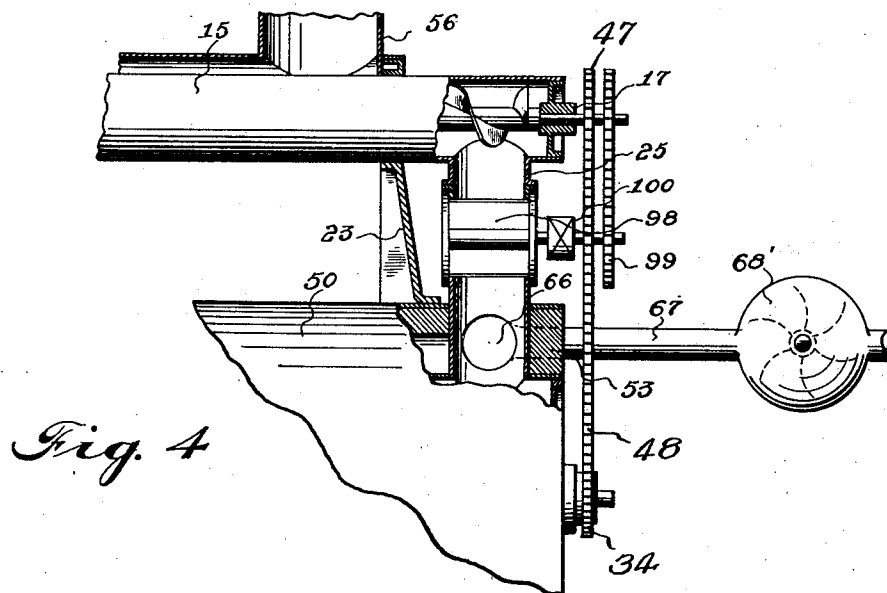
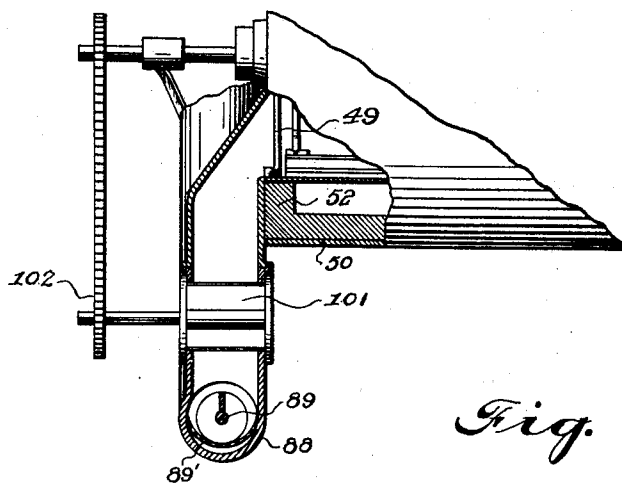
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RENDERING PROCESS

Filed Nov. 24, 1924

3 Sheets-Sheet 3



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RENDERING PROCESS

Application filed November 24, 1924. Serial No. 752,030.

The present invention relates to novel processes for rendering oil and fat containing solids, such as fish, fish waste, animal fats, meat scrap, packing house offal, tankage, dead animals, rejected or condemned carcasses, grains, seeds, olives, nuts, garbage and the like.

More particularly the invention relates to a continuous process of dry rendering materials of the character mentioned by the use of a novel combination of apparatus especially adapted to the efficient rendering of said materials.

The present case is a continuation of the common subject matter disclosed in Patent No. 1,518,926, issued December 9, 1924, and copending application Serial Number 731,146 filed August 9, 1924. In carrying out continuous rendering processes such as set forth in the copending applications, I have utilized a novel rendering dehydrating or drying unit in combination with well known mechanical cutting, feeding and expressing units. The preferred form of my dehydrating or rendering unit comprises a fixed heated cylinder in which beaters, paddles, or impacting members revolving at high speed, strike the material and dash, splash, throw, and impact the same against the heated cylinder. A set of revolving lifters, wiping members, or scrapers moving at slower speeds than the beaters immediately remove the material from the heated surface, lift it upward and permit it to shower or drop downward into the path of the beaters to be mixed with other material again dashed and impacted against the heated surface. The impacting of the material by the beaters and the throwing or dashing thereof against the heated surface effects a breaking of the solid structure of the material. I have discovered that in order to effect successful continuous dry rendering, certain critical relationships of moisture content, rendering temperatures, time of treatment and expressing pressures exist. If the material is not treated to attain these various limits and in accordance therewith, the presses will not handle the material satisfactorily to express the oils, fats, tallows and the like from the solid residue. The limits

for moisture content range below 20 percent and ordinarily from 5 to 20 percent, while the preferred ranges are from 8 to 12 percent. Within these moisture limits I have found that by applying pressure exceeding 500 pounds per square inch up to many thousand pounds per square inch, preferably in well known high pressure continuous screw presses, the oils, fats tallows and the like are separated from the solids. Screw presses such as are shown in U. S. patents numbered 836,701, 829,315 and 1,049,834 and preferably as shown in my copending application Serial No. 724,662, filed July 7, 1924, may be utilized for this purpose. This condition is apparently due to the fact that with the moisture content reduced to the range indicated, the mucilaginous or sticky character of the material is substantially eradicated at the temperature range at which pressing occurs, so that with the high pressures indicated, ready separation of the fats, and tallows free from mucilaginous substances is effected. To effect satisfactory expressing and at the same time to produce a high grade rendered product, I have found it essential to maintain the temperatures of the material under 212 degrees F. and have found the preferable range to be from 110 degrees F. to 190 degrees F.

A further highly important relationship for efficient operation exists in the speeds of operation and relative capacities of the presses, dehydrating and heating units and the feeding means for the dehydrator which must be so timed as to permit continuous and effective functioning of the apparatus as a whole. Due to the necessity for maintaining the moisture limits within the definite range, the material must be positively and mechanically fed to the dehydrator at a predetermined and uniform rate and in proper quantities with relation to the rate of advance of the material through the dehydrator, otherwise the material will be too wet or too dry, and cannot be handled by the press and the proper temperature range is not maintained. In order to bring the material within the moisture limits of 5 to 20 percent, while maintaining the temperature of the material between 110 degrees F. and 212 degrees

F. I have discovered that the quantities of material handled and time of treatment become important. With my improved apparatus I have been able to effectively render materials within a time range of from 5 to 30 minutes and to produce a superior product while in prior dry rendering methods the time of heating ranges from two to five hours, and the product is of inferior grade. I am enabled to reduce the heating time to this relatively short range by treating relatively smaller quantities of material at a time and gaining the capacity through rapidity of operation. The method of heating materials to a range of 110 degrees F. to 212 degrees F. for a period of time ranging from 5 to 30 minutes in such small quantities in such manner that the moisture content is reduced to from 5 to 20 percent and expressing while hot at pressures above 500 pounds per square inch is a radical departure in rendering practice, and introduces a new and highly valuable principle in the art.

A further feature of my improved method of simultaneously heating, beating, and mechanically breaking the oil and fat containing material is that that material is discharged from the dehydrator as a mixture of free hot melted fats, oils and finely divided solids, and for efficient operation of the press a drain for the free liquids between the dehydrator and the press is an essential feature.

In the packing industry various grades of fats known as oleo-fats, edible fats, and inedible fats are produced from the various parts of the animals. In addition to driving off the water or moisture where large percentages are present, it is necessary to heat the tallow or fat to a point where it will melt to a liquid state and separate from the meat parts, and to break down the cellular structure in which the fats and tallows are confined. The higher grade of fats are obtained at the lower temperatures, and as the temperatures are raised the grade of fats procured is lowered, due to discoloration and chemical changes caused by the action of the heat on the fats. The present method is to treat the high grade material, such as the caul and ruffle fat first by placing in a tank which is heated by water jacket to temperatures of 120 to 140 or 150 degrees F. and agitating. At these low temperatures only a portion of the fat in the material can be liberated, even though the heating is carried on for hours. Because of the length of time required to effect a reasonable degree of separation at these low temperatures, decomposition, and the development of fatty acids proceeds, which causes some deterioration in the rendered product. After the first low temperature treatment, the materials are removed from the water bath and placed in rendering apparatus in which higher temperatures are utilized to effect further rendering to pro-

duce lower grade fats. Finally the residue is removed and pressed. Every time a batch is opened at the end of a step, access of air, cooling of the material, and the generation and escape of offensive odors occurs. A long period of time is required in the handling of the material and deterioration of the product proceeds progressively. Manual labor is required to handle the batches. Before a batch can be started a sufficient quantity to fill the tanks must be accumulated, and rendering tanks must be available. The delays after the animals are killed in rendering by the batch process are largely responsible for the offensive odors in the vicinity of packing houses.

By the application of the present invention to the rendering of high grade or oleo-fats it is possible to effect a substantially complete and continuous separation in very rapid manner and at temperatures ranging as low as 110 degrees F. The apparatus for this use includes a suitable cutter to reduce the fat to relatively small particles preferably uniform in size, the continuous rendering and beating or pulverizing unit as hereinafter set forth with a suitable water heating jacket, a separating drain arrangement to remove the free liquid fats from the residue or cracklings, and a high pressure press to press the cracklings dry and remove the remaining free fats. At this point the cracklings may be ground if sufficiently cool to be brittle, or they may be first cooled and then ground to be used for food or fertilizer. The temperature of the water bath is carefully maintained at a temperature where no discoloration or deterioration of the rendered product occurs, and the actual temperatures of the material may be held as low as 110 degrees F. The rendering goes on continuously rather than in a batch process, and a rapidly changing layer of material is thrown and impacted against the heated surface and then immediately scraped or wiped off. The continuous beating and impacting divides and breaks down the cellular structure, and contacting with the heated surface reduces the freed fats to a liquid stage. All of the caul or ruffle fats or those parts of animals containing about 60 to 75 percent tallow and five to twenty percent moisture may in this manner be rendered at low temperatures in a single operation, and within a time of as low as five to thirty minutes in passing through the apparatus. Freshly killed fats can be rendered within a very short time and before decomposition or deterioration sets in.

A further highly important feature is that all vapors given off in rendering are confined and drawn through one or more pipes so that they may be wholly deodorized and purified by burning in a combustion chamber, passing through beds of activated charcoal, chlorination, or they may be treated in any other

well known manner to effect purification and deodorization.

For the lower grade of animal parts containing more than 15 to 20 percent water, and less than 60 to 75 percent of tallow or fats, the same type of my apparatus is utilized as for the caul and ruffle fats except that higher temperatures are utilized for the rendering shell against which the material is impacted and the cells shattered. Steam heating or direct heating jackets may be utilized for medium grade parts from which the edible fats, such as lard, shortening and the like are produced, and rendering temperatures of this material are maintained at from 110 degrees F. to 212 degrees F. The driving off of the moisture consumes more heat energy than the melting of the tallows, and for this reason the temperatures are higher resulting in a lower grade of fats. By the present process of treatment it is possible, however, to step up the grade of fats obtainable because of the lower temperature ranges at which rendering is possible due to the mechanical shattering of cells and impacting of the materials on the heated surfaces. By lengthening the time of treatment and lowering temperatures, as by slowing the feed of the material through the rendering unit and increasing the rapidity of beating and scraping substantially all of the fats in the lower grade animal parts may be removed at temperatures of from 110 to 190 degrees Fahrenheit and high grade products obtained. The treatment may be carried out in batteries of rendering units to lengthen the time of treatment, and each successive unit may run the material at slightly higher temperatures if desired until the percentage of moisture has been reduced to the range of 5 to 20 percent, and preferably below 12 percent in the residue. By using the vacuum form of rendering unit to lower the pressures, a speeding of the dehydrating process and lowering of heat requirement due to lowering pressure is attained.

For rendering of inedible parts of animals, such as the lungs, livers, entrails and like parts or offal, a washer of well known type is added to the above mentioned rendering equipment, and the parts are washed before being rendered. These parts have the highest percentage of moisture and are at present rendered at temperatures above 212 degrees F. In my improved process, direct heat is applied to the rendering shell which may be far above 212 degrees. Due to the rapid beating and scraping or wiping action, and the latent heat of vaporization of the moisture content, the material does not go over 212 degrees F. and may be held materially under 212 degrees when the percentage of moisture is reduced to within the range of 5 to 20 percent, and preferably ranging from 8 to 12 percent. By using the vacuum apparatus the maximum temperature of the mass may be lowered to

the boiling point of water or below for the particular pressure used.

In the whaling industry, as at present practiced, the rendering of the blubber and oil bearing parts of the whale are necessarily carried on in particularly offensive manner. Usually the whale parts are in an advance state of decomposition when rendered, resulting in highly offensive odors and deterioration in the rendered product. By applying my rendering processes as set forth in connection with the packing house problems, and applying the rendering limits of 110 degrees F. to 212 degrees F. and reduction to 5 to 20 percent moisture, the blubber may be disposed of continually while fresh and in sanitary manner. The unit is of sufficiently small size to enable batteries to be installed on ship-board and rendering to be carried out without the necessity of towing the dead whales back to a base. The entire oil bearing whale parts may be rendered and reduced to meal rapidly and in continuous manner.

In the rendering of cod livers, an advanced state of decomposition usually exists before the livers are rendered. This results in a putrid mass which yields a tainted oil, from which it is impossible to remove the unpleasant taste with refining methods. By utilizing my rendering apparatus the cod livers may be handled continuously and while fresh, and the oil produced in this manner is palatable and entirely devoid of the unpleasant taste commonly associated with cod liver oil. The apparatus may be made miniature in size to suit the requirements for economical continuous operation in small amounts or of larger capacities for larger plants. In like manner special capacity units may be readily made to render shark livers, and other fish livers or parts from which special oils may be obtained.

Referring to the drawings—

Fig. 1 shows a more or less diagrammatic arrangement of apparatus for carrying out the more important steps of my process as above set forth.

Fig. 2 is a sectional view taken substantially along line A—A of Fig. 1 with parts shown in elevation.

Fig. 3 is a sectional view taken along line B—B of Fig. 2, showing the wipers and lifters or beaters.

Fig. 4 shows a modified form of feeding arrangement.

Fig. 5 shows a modified discharge arrangement.

The material to be treated, for example, fish or fish waste is fed into a hopper 1 of a cutter of the meat grinder type or of an impact pulverizer 2, and is there reduced to a substantially uniform mass of finely divided, crushed and mashed particles. This type of cutter is preferably such as to pass the material therethrough at a uniform rate regard-

less of how it is piled in hopper 1, so that the feed of material out of the cutter is at a constant rate. This aids materially in smooth and efficient operation of the plant as a whole.

5 From cutter 2, the material passes preferably under cover into a conveyor boot 3. Journaled in 3 is a conveyor foot shaft 4 carrying a sprocket 5. Cutter 2 may be driven from shaft 4 by means of sprocket 5 carried
10 thereby through a chain 6 and sprocket 7, as diagrammatically indicated in Fig. 1, or in any other suitable manner. Sprocket 5 is driven by and supports an elevating conveyor chain 8, carrying flights 9. Chain 8 is supported at its upper end and driven by a head sprocket 10, supported on a head shaft 11.
15 This elevating conveyor is preferably enclosed in a casing 12 which joins with boot 3 at its lower end, and with an enclosed discharge hopper 13 at its upper end. Hopper 13 communicates with the feed end of a preheater comprising a feed screw 14 surrounded by a cylindrical casing 15 and suitably journaled in end plates 16 and 17 (Fig. 2).
20 Screw 14 is driven by a sprocket 18, and has mounted thereon a sprocket 19 which drives conveyor-head shaft 11 through a chain 20 and a sprocket 21 mounted on shaft 11. Cylinder 15 is supported in and extends through supporting end plates 22 and 23 which in turn support a heating jacket or encasing sheet 24 in a manner to form a heating jacket for preheater cylinder 15.

At its discharge end cylinder 15 communicates with a passage 25 which in turn communicates with the feed end of dehydrator cylinder 26. Mounted in end plates 27 and 28 are ball or roller bearing units 29 and 30, in which scraper, wiper or lifter drive sleeves
30 32 and 31 are rotatably journaled. Secured to sleeves 31 and 32 are driving sprockets 34 and 33 therefor. Fastened to and rotatable with sleeves 31 and 32 are split scraper or wiper supporting spiders 35. Supported
35 from the arms of spiders 35 are scraper or wiper bar guide and supporting channel irons 36 between which scraper or wiper bars 37 are guided and supported. Bars 37 are mounted on springs or other suitable device, not shown, in a manner to be forced outward from the spiders to scrape against the interior of cylinder 26 as sleeves 31 and 32 are rotated. A central supporting spider 38 is secured to channels 36, and is mounted on a
40 suitable roller or ball bearing center 39, in which a beater or paddle shaft 40 is rotatably mounted. Shaft 40 is suitably journaled in sleeves 31 and 32 and has secured thereto at regular intervals a series of collars 41 to which sections of beating chains, paddles,
45 hammers or like devices 42 are secured. Collars 43 secured to shaft 40 limit the end movement thereof. Shaft 40 is extended and has secured thereto a drive sprocket 44 through
50 which it is driven at a high rate of speed,

causing the chains, hammers or beaters 42 to fly out and rapidly beat and impact the material in cylinder 26. Secured to shaft 40 is a sprocket 45 which drives sprocket 18 through a chain 46. As above set forth
55 sprocket 18 drives feed screw 14, which in turn at its opposite end drives a sprocket 47. Sprocket 47 drives sprocket 34 through a chain 48. Sprockets 33 and 34 drive sleeves 32 and 33 and accordingly scrapers or wipers 37, at a relatively slow rate to continuously remove the material from the interior of cylinder 26 as it is plastered, impacted or thrown thereon by the rotation of the beaters 42. In practice a speed of rotation of 500
60 R. P. M. for the beaters, and of 10 R. P. M. for the scrapers has given excellent results in the treatment of fish to produce fish meal and fish oil and speeds of 600 to 900 R. P. M. for the beaters has given excellent results for animal fats. It will be understood, however, that the speeds may vary widely in practice for the same materials and will be suitably varied to suit the conditions for each kind of material treated. It will also be understood that the relative directions of rotation of the scrapers or wipers and beaters may be the same or opposite by the provision of suitable drive arrangements.

To provide for feeding of the material continuously and progressively through cylinder 26, the cylinder is preferably given a slight downward pitch from the right to the left in Fig. 2, and the material when sufficiently dehydrated passes out of the cylinder through an opening 49 in end plate 27. This feed may, however, be effected by providing scrapers slightly helical in form to effect the advance of the material, or by providing fan-like beater blades shaped to throw the material slightly in advance towards the feed end as they rotate.

Cylinder 26 is supported in a cylindrical heat chamber or jacket construction comprising an outer metallic shell 50 lined with suitable fire brick concrete or fire brick 51, or like material. Supporting end walls 52 and 53 for the heat chamber are formed for the ends of cylinder 26, and baffle projections 54 are formed to extend partially around and to support cylinder 26, as shown in Fig. 2. End plates 22 and 23 of the preheater jacket are supported from shell 50 and an opening 55 is formed in the dehydrator heat chamber through which the hot gases may pass into the preheater jacket and may then escape to the atmosphere through stack 56. The lined dehydrator heat chamber is preferably divided, as shown at 57 to permit the complete manufacture of the dehydrator, in portable sections, and to avoid the necessity of pouring the lining at the location where the plant is to be installed. This type of construction gives a readily portable and economical struc-
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ture which may be manufactured and erected at a minimum cost.

The dehydrator heat chamber is constructed with an inlet opening 58 for entry of hot gases from the combustion chamber 59 of a furnace constructed and arranged to nest with the inlet end of the heat chamber, as shown in Fig. 2. The furnace preferably consists of a metallic shell 60 cylindrical in section, supported on castings 61, and having a suitable lining 62 of fire brick or other material formed therein. A fire door and draft opening 63 of suitable construction is provided, and a burner 64 is provided for the burning of a suitable fuel supply, as for example, oil. The burner 64 is arranged so that the flame therefrom impinges on suitable fire brick 65 or other refractory material piled in the combustion chamber 59. A gas outlet opening 66 in passage 25 for gases from cylinder 26 is provided, and is connected by means of a pipe 67 to opening 68 in the furnace. Gases evolved from the material are drawn through opening 66 by the furnace draft. In order to assist the draft and create a vacuum in the chamber 26 an exhaust or suction fan 68' may be introduced in pipe 67 to draw the gases out through opening 66.

Heat chamber shell 50 is supported from suitable castings 69. A line shaft 70 supported from journals 71, and driven from a pulley 72 or in any suitable manner, has mounted thereon a sprocket 73 which drives sprocket 44 on shaft 40, through a chain 74. A sprocket 75 on shaft 70 drives a counter shaft 76 through a chain 77 and a sprocket 78. Carried on counter shaft 76 is a sprocket 79 which through a chain 80 and a sprocket 81 drives a counter shaft 82, and shaft 82 through sprocket 83 and chain 84 drives the scraper drive sprocket 33. Shaft 76 is supported in journals 85 extending from the end plate 86 of a press feed conveyor, and shaft 82 is supported in journals 87 from press feed conveyor casing 88.

Conveyor casing 88 communicates with opening 49 in dehydrator end plate 27, and the arrangement is such that the dehydrated material will drop under cover into casing 88, and will be carried by conveyor screw 89, to the left in Fig. 1, and discharged through passage 90 into press 91. Screw 89 may be driven from shaft 76 through bevel gears 92 and 93. As the material coming from the dehydrator contains a large quantity of hot free oil, casing 88 is inclined and screen or drainage plate 89' is preferably provided in the bottom of the casing 88. As the material passes over the screen the free oil contained therein passes through the screen, flows downward in casing 88 and is withdrawn through suitable connections provided for this purpose. In order to provide a low pressure seal for the discharge end of the dehydrator so that a vacuum may be caused there-

in by the furnace draft, and by fan 68' when used, screw 89 may be made relatively close fitting in casing 88, so that when the conveyor is filled with material it will act as a low pressure seal. It will also be noted that the preheater may serve in the same way for a low pressure seal at the feed end, so that a partial vacuum may be established in the dehydrator when this is desirable.

Press 91 may be of any well known form of high pressure expressing device in which the oil is continuously and thoroughly pressed out of the materials. Pulley 94 on shaft 70 may drive press 91 through belt 95, pulley 96, shaft 97, and suitable gearing at a properly timed rate, or any other convenient drive means may be provided.

In view of the importance of establishing a proper feed relation, a feed valve 98 of a structure such as is used for the cooker feed valve in Patent 1,489,940 may be utilized and interposed in passage 25 above opening 66, as shown in Fig. 4. Valve 98 may be driven by a sprocket 99 from the preheater conveyor shaft to positively feed the material into cylinder 26 at a properly measured and uniform rate with relation to the advance of the material through the cylinder 15. The preheater conveyor and parts may obviously be eliminated if desired and the material may be fed directly into valve 98 which will feed it uniformly into the cylinder 26. To regulate the rate of feed of valve 98 a suitable speed changing arrangement of any well known construction and indicated diagrammatically at 100. For the handling of high grade fats, the heating jacket may be altered to utilize hot water or steam as a heating medium in obvious manner, in which case the combustion chamber and furnace is eliminated and suitable steam or water inlet and outlet connections are made, as for example, in the arrangement of Fig. 9 of copending application, Serial Number 731,146.

If it is desired to operate with a relatively high vacuum in cylinder 26, a discharge valve 101 similar in structure to the feed valve 98 is interposed between discharge opening 49 and conveyor casing 88, as shown in Fig. 5. Valve 101 is driven by a sprocket 102 in any suitable manner and in properly timed relation to maintain the continuous operation of the apparatus. Valves 98 and 101 are constructed to permit the feed and discharge of the materials without substantially affecting the internal pressures in cylinder 26, and the desired vacuum is maintained by the operation of fan or pump 68'. The structure of the beaters and wipers is the same as shown in Figures 2 and 3. The use of steam jackets is especially desirable in packing houses and other places where heating by the direct products of combustion increases the fire hazard and insurance rates in the buildings where used. When steam heat is used

the cylinder 26 is heated uniformly along its length. A decided advantage exists in the utilization of steam as a heating medium for the reason that automatic pressure regulating devices may be utilized to maintain uniform cylinder temperature and less skilled attendants may operate the apparatus. The efficiency of drying of both the steam jacketed form and the direct heat form of apparatus is materially increased by passing heated currents of air through the interior of the cylinder 26. They may be conveniently effected by admitting the heated currents through end plate 27 or in any other suitable manner. A convenient method of heating this air is to provide a second jacket surrounding the direct heat or steam heating jacket as the case may be, through which the air is drawn before it passes into cylinder 26. In this case the fire brick lining 51 in the direct heat jackets may be eliminated as the shell will be air cooled, and the air will be heated by radiation and conduction from the exterior of the heating jacket shell. The heated air will then be drawn through the cylinder and discharged with the evolved gases.

Operation

In operation the apparatus is driven at proper relative speeds, preferably by a single prime mover so that each part will operate in definitely timed relation to perform its individual function at a proper rate for the automatic treatment of the materials.

Fuel supplied through burner 64 is ignited and heated gases of combustion pass upward from chamber 59, through opening 58 and are circulated through the dehydrator heating chamber around the exterior of cylinder 26, passing to the left around baffle walls 54 and cylinder 26, as shown by the broken line arrow until they pass through opening 55 into the preheater jacket. In the preheater jacket the gases pass to the right and out through stack 56. It will be noted that the hottest gases contact with cylinder 26 at the right or feed end in Fig. 2, and as they pass to the left they are progressively cooled by the transfer of heat to the cylinder 26 and the contents thereof so that by the time they reach cylinder 15, the temperature has been reduced to a point where burning of the materials passing therethrough will be avoided.

The material to be treated, for example fish, or fish waste, is piled in more or less irregular quantities in hopper 1, and is reduced by cutter or pulverizer 2 to a mass of fine crushed pulplike particles of substantially uniform size, and is fed into conveyor boot 3 at a uniform rate. It is then carried upward at a uniform rate by the elevating conveyor and discharged through hopper 13 into the preheater and is carried by screw 14

to the right in Fig. 2 through cylinder 15 where it is heated due to the action of the gases surrounding this cylinder. From 15 the preheated materials drop into valve 98 when used, and then through passage 25 into dehydrating cylinder 26. When valve 98 is not used the material passes directly into passage 25 from casing 15.

As the wet heated material enters cylinder 26, the beaters or paddles 42 strike it and throw, impact and splash it against the very hot interior surface of 26. As the wet material contacts with the heated surface, a protective cushion of vapor forms which prevents immediate burning thereof and sticking of the material to the surface, and before this protective cushion is dissipated, scrapers or wipers 37, remove the material off the heated surfaces and fresh material is immediately splashed, thrown or impacted thereon by the beaters. The removed material is lifted upward by the wipers or lifters and channels 36 and 37, falls through the cylinder, is mixed with the remaining material and again splashed or thrown and impacted against the heated surface. This action is repeated many times a minute and results in constantly changing surfaces of the material being contacted with the very hot cylinder surface, and the result is a very rapid evaporation of moisture contained in the materials and melting of the fat.

Due to the inclination or pitch of cylinder 26, the material is continuously advanced to the left in Fig. 2, as it is splashed, impacted, heated, scraped or wiped and thoroughly mixed, and as it advances the moisture is progressively removed, until the material is discharged through opening 49 with a moisture content between 5 to 20 percent through valve 101 when used, or directly into press feed conveyor casing 88. As the material is advanced and becomes dehydrated it is contacted with progressively cooler areas of cylinder 26 when direct products of combustion are used in the jacket, so that burning of the material is avoided as it dries, but the temperatures are such as to give a more rapid rate of heat transfer and evaporation than could be attained if cylinder 26 were uniformly heated. The heating, beating, impacting and scraping or wiping action results in a thorough breaking down of the oil bearing cellular structure, frees the oil from the cells so that when the material is discharged into the press feed conveyor it is a mixture of hot free oil or melted fat and fine solids. The action of the scrapers or wipers and beaters in dividing and breaking down the material is comparable to that which would be attained in a relatively low speed impact pulverizer.

The vapors and gases driven from the materials in cylinders 15 and 26 are drawn through opening 66 in connection 25, through pipe 67, and opening 68 by the furnace draft.

This action is assisted by fan or pump 68' when used, and when valves 98 and 101 are used, the evaporation or dehydration may be carried out in a relatively high vacuum with correspondingly increased efficiency. The combustile elements of the gases are completely oxidized and consumed, and then pass with the gases of combustion through the jackets and out of the stack. This results in a substantially complete deodorization of the gases discharged from the treated materials, utilizes the heating value of the combustile elements thereof, and makes the process substantially odorless, so that it may be operated in the vicinity of residences, food canneries and like locations where objectionable odors constitute a serious nuisance.

In conveyor casing 88, the hot free oils or melted fats are drained off, and the solid residue is continuously conveyed by conveyor 89 to press 91. In press 91 the remaining free oils are removed from the dehydrated solids by expressing.

Having described a preferred embodiment of my invention, what is desired to be secured by Letters Patent and claimed as new is:

1. The process of rendering fat and oil containing solids which comprises the steps of simultaneously mechanically impacting and disintegrating the solid structure, melting the fats and oils therefrom, and partially dehydrating the partially disintegrated mass to a point where the moisture content of the solid residue is reduced to from 5 to 20 per cent while maintaining the materials at temperatures between 110° and 212° Fahrenheit; and continuously expressing the dehydrated solid residue.

2. The process of rendering fat and oil containing solids which comprises the steps of continuously melting the fats and oils therefrom and simultaneously impacting and partially dehydrating the mass until the moisture content of the solid residue is reduced to the range of 5 to 20 per cent while maintaining the materials at temperatures between 110° and 212° Fahrenheit; and continuously expressing the partially dehydrated solids.

3. A process of rendering fat and oil containing solids with a natural moisture content of more than 20 percent which comprises finely disintegrating the fat and oil containing solids; heating the disintegrated solids by the application of indirect heat thereto to render the same; and removing the evolved vapors to remove moisture therefrom until the moisture content of the solid constituents thereof has been reduced to the range of 5 to 20 percent while maintaining the materials at temperatures between 110° and 212° Fahrenheit; and thereafter pressing the solid constituents to separate residual oil and fats therefrom.

4. A process of rendering fat and oil con-

taining solids of animal origin which comprises reducing the same to a disintegrated mass; applying indirect heat thereto to render the same and removing the evolved vapors to reduce the moisture content of the solid constituents thereof to from 5 to 20 percent while maintaining the materials at temperatures between 110° and 212° Fahrenheit; draining the free hot liquids from the solid constituents thereof; and thereafter expressing the solid constituents thereof at 500 pounds per square inch or more to separate a substantial part of the residual fats and oils therefrom.

In testimony whereof, I affix my signature.
STANLEY HILLER.

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