July 10, 1934. T. K. LOWRY 1,966,181

PROCESS OF RENDERING

Filed March 17, 1930 2 Sheets-Sheet 1

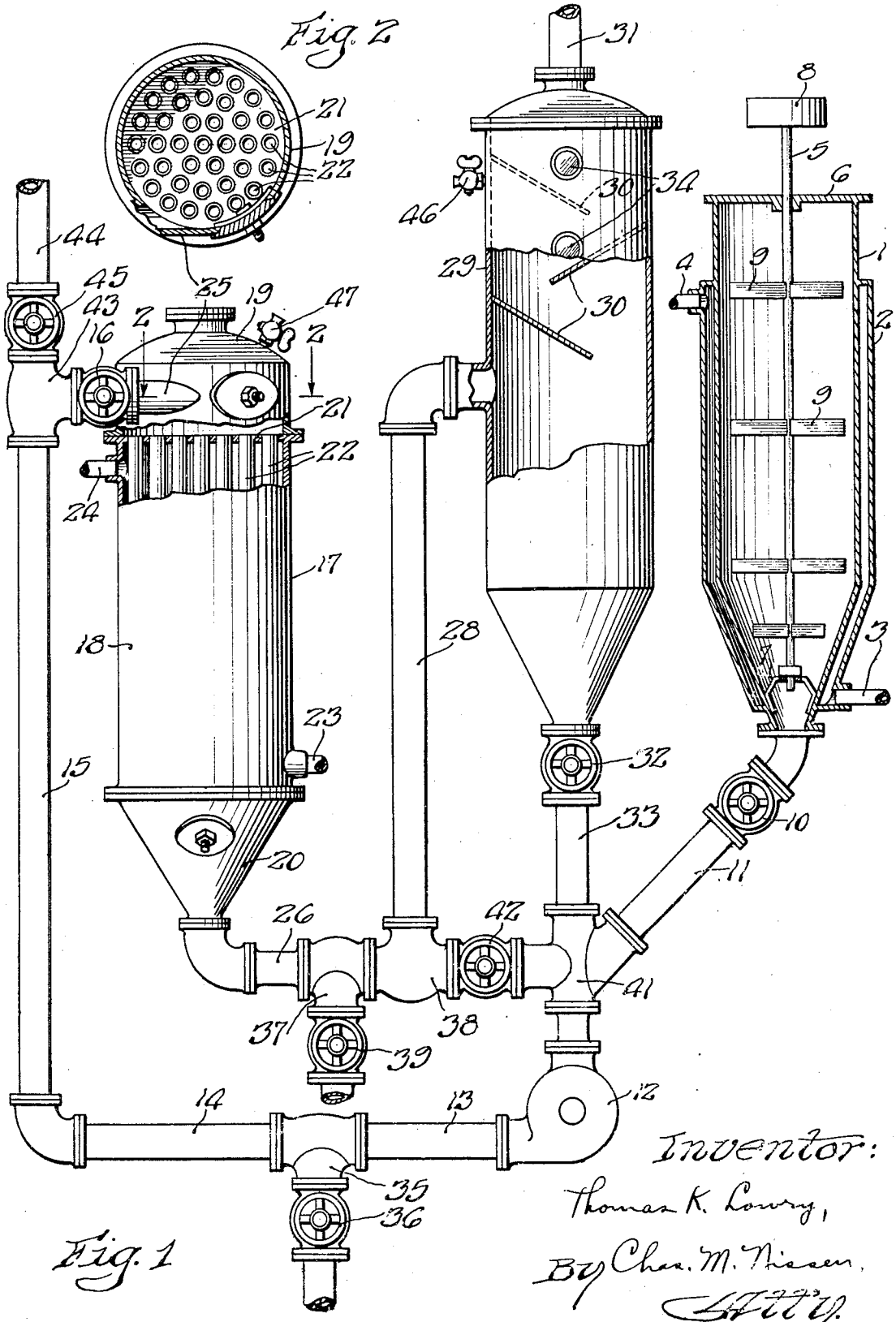

Fig. 1

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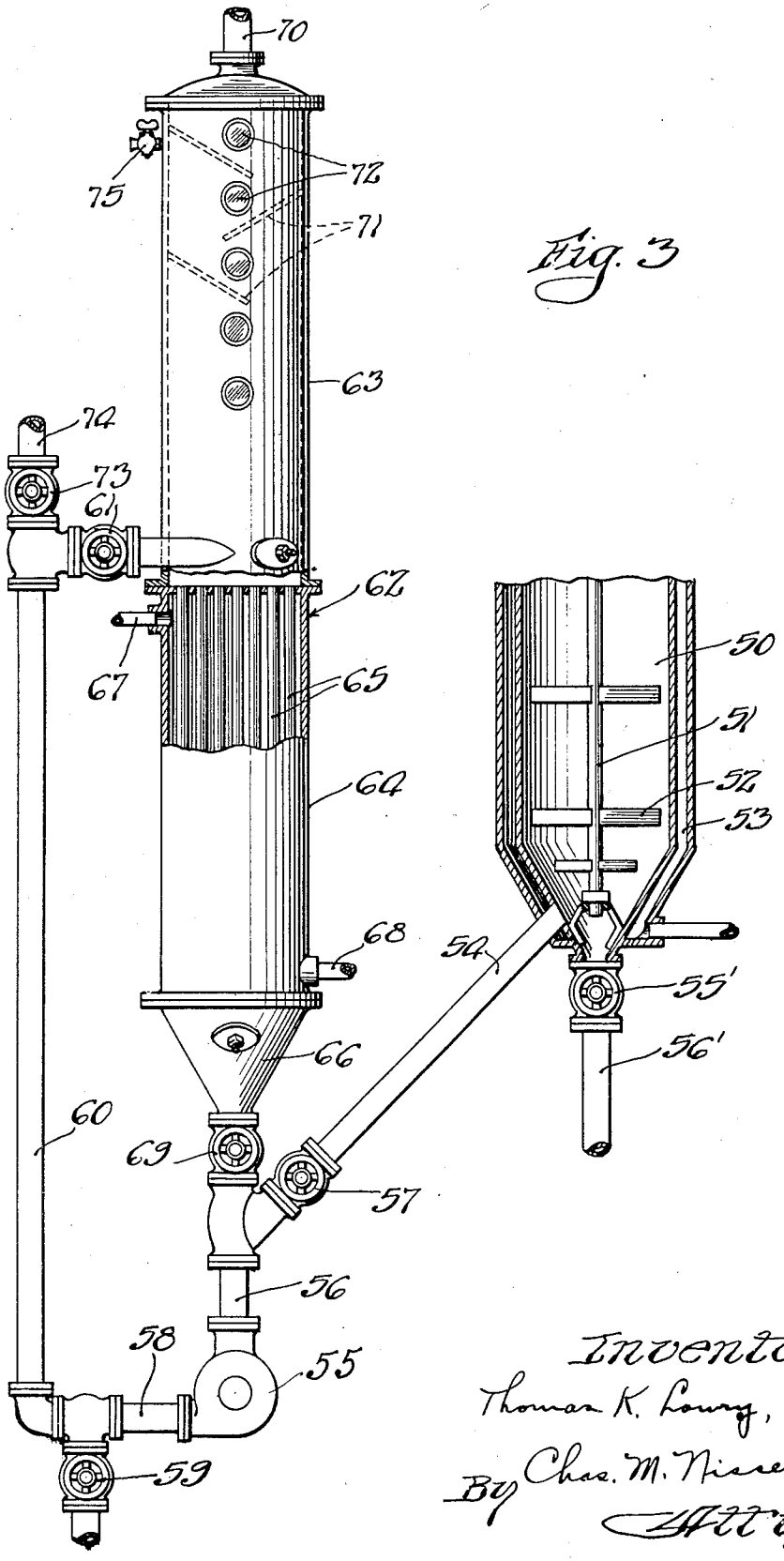

Fig. 3

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UNITED STATES PATENT OFFICE

1,966,181

PROCESS OF RENDERING

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Application March 17, 1930, Serial No. 436,401

23 Claims. (Cl. 87—13)

This invention relates particularly to the rendering of materials such as meats, fats, garbage, bones and the like, and has for one of its objects the cooking of the material to drive off the moisture therein and to separate the substances forming the material, from each other.

Another object of this invention is to provide a heating unit which employs a maximum amount of heating surface, thereby making it possible to use a heating medium at a lower temperature than is necessary with apparatus now in use.

Another object of this invention is to provide means for circulating the material being rendered through a heating unit and for passing the heated material into a separator wherein the vapors are drawn off the heated substance.

Another object of this invention resides in causing the material being rendered to flow over the heating surface so that a rapid transfer of heat results as the material flows thereover.

Another object of this invention is to provide a continuous circuit for the material to be rendered which will enable the same to be passed successively through the heating unit and the separator as many times as desired.

Another object of this invention is to provide a heating unit having longitudinal passages therein for the material being rendered, the passages being sufficiently large to permit the passage therethrough of the material without any serious clogging effect on the passages. Means is provided for permitting ready access to the passages to clean the same if they should become clogged.

Another object of this invention resides in dividing the mass to be rendered into a plurality of smaller masses and subjecting each of these smaller masses individually to the action of heat.

Another object of this invention resides in flowing the entire mass to be rendered and dividing the same into small streams each of which is surrounded by a heating medium.

Another object of this invention resides in flowing the entire mass to be rendered in a parent stream, dividing said parent stream into smaller streams all flowing substantially in the same direction, heating the smaller streams by a heating means surrounding each stream, and again reuniting the smaller streams after they have been heated.

Another object of this invention resides in the continuous circulation of a quantity of material to be rendered in a closed path, and subdividing the stream of material being circulated into smaller streams at a point in the path of travel of said material to be rendered, and heating each of the smaller streams after which the smaller streams reunite and are carried along their path of movement to a chamber in which the moisture liberated during the heating operation is removed by means of a vacuum, or in any other desired manner, the residue continuing its movement along said closed path to the point wherein the material is again subdivided into smaller streams and heated while in that state.

Another object of this invention resides in the agitating of the mass over the entrance ends of the tubes through which the material is flowed during the heating of the material.

More specifically the heating unit comprises a tank having a plurality of tubes arranged longitudinally thereof, the tubes being surrounded by a space into which the heating medium is introduced, and which tank is provided with means for distributing the material being rendered to the various tubes.

A still further object of this invention is to provide means for mixing a quantity of tallow or other rendered fat with the meat to be rendered before the meat is heated to extract the tallow therefrom. Meat is not sufficiently fluid to flow through the system by itself ordinarily, and therefore I prefer to use the tallow to act as a vehicle to carry the meat through the rendering apparatus. Furthermore, by providing the tallow, scorching of the meat is prevented and a more uniform cooking of the meat results. The tallow and meat are preferably heated in a jacketed mixer so that the mixture of tallow and meat will more readily flow through the system. It is possible to have the system operate by means of gravity by making the mixture sufficiently fluid although I prefer to use some form of circulating means to circulate the material through the system. When rendering certain substances containing a high percentage of grease or fat it is unnecessary to use any vehicle such as tallow, lard or grease to carry the substance being rendered through the system since these substances are sufficiently fluid after a slight heating to carry the same through the entire process of rendering.

Other objects of this invention will be apparent as the description of the embodiments shown in the drawings proceeds.

In the drawings—

Fig. 1 shows more or less diagrammatically an embodiment of my invention as applied to the rendering of meats;

Fig. 2 is a cross-section taken along the line 2—2 of Fig. 1; and

Fig. 3 shows a modified arrangement of the rendering apparatus.

I shall proceed to describe my process as applied to the rendering of meats but I wish to have it understood that the same system may be used in rendering other substances such as those previously mentioned.

At the present time there are three different types of rendering systems used for the rendering of meats and the like. The oldest of these systems is known as the "open kettle system" in which the substance to be rendered is heated in an open kettle to drive off the moisture. This is not very satisfactory but is still used to some extent. Next in importance is the "wet rendering system". This requires the use of a vertical pressure tank in which the material is placed, and live steam at a pressure of approximately forty pounds per square inch is turned directly into the material which is in the tank. The mixture is cooked for a period of approximately eight or ten hours during which time there is a considerable condensation of steam so that when the material is cooked the tank contains considerable water in addition to the solid substances and the tallow. After the steam is turned off the tallow rises to the top and is drained off as is most of the water and the water and solid substances which are left in the tank are dropped into what is known as a "slush box". From this point, the water, which is known as tank water, is drained off and this water is evaporated. The concentrated liquors from the evaporator resulting after the evaporation and draining off of the water is known to the trade as "stick". This "stick" has to be further dried in order to be usable. The solid substance known as "tankage" is pressed in hydraulic presses in order to eliminate as much moisture and grease therefrom as possible and thereafter the same is dried.

The other system known as the "dry rendering system" which is the most recent development, is supposed to be an improvement on the wet rendering system inasmuch as the heating of the steam is transmitted to the meat through a jacketed tank, and the steam does not itself come into direct contact with the meat. The tanks which contain the meat to be treated must be provided with means for agitating the meat while it is being heated in order to bring the meat into contact with the heating surface and to prevent scorching. When the material is cooked in this manner, only two products result, tallow and the residue which is known as "cracklings". This process eliminates tank water and the necessary operations in evaporating and drying the material after it is cooked. This process, while saving some in steam, necessarily consumes a considerable amount of power which is required in order to stir the material while in the tank. In dry rendering systems it is customary to "hash" or grind the material to a comparatively uniform size before cooking the same.

A disadvantage of the dry rendering processes which are now known is that the amount of heating surface is small as this heating surface usually comprises only a steam jacket. In order to compensate for the relatively small amount of heating surface, it is necessary to use steam under high pressure (sometimes as high as 50#). If lower pressures or corresponding lower temperatures were used it would cut down the capacity of the machine and lengthen the time of cooking, whereas with the high pressure steam which is necessary in order to get the desired capacity, a portion of the material generally scorches and causes a discoloration of the tallow. By the use of low pressure steam and cooking the material over a longer period of time there would not be as much scorching but the length of time that the material would take to cook would result in a discoloration of the tallow. In other words, if high pressure steam is used, the material scorches due to the fact that the temperatures are too high for proper cooking of the material without scorching and if low pressure steam or low temperatures are used, the process requires such a long period of time as to result in the discoloration of the tallow due to the slow cooking of the material. If sufficient heating surface is provided the material will cook in a much shorter time.

The most important factor in the dry rendering process is the question of heating surface, and in the apparatus which I have disclosed, I show means whereby a great amount of heating surface is obtained within a limited space, and in which the moisture is driven off in a chamber which is separate from the space in which the material is heated. Not only that, but I have provided means for circulating the material through the system as many times as desired, the material being removed from the system as soon as the mixture has been properly cooked and the moisture driven therefrom. Another advantage resulting from the use of my process is that I can obtain a rapid circulation of the material over the heating surface so that I obtain a rapid transfer of heat from the heating surface to the substance. Also if necessary I may provide means for recirculating the material through the system as many times as necessary.

In the present process, the material or mass to be rendered, which may comprise such materials as meat, garbage, animal matter, fish, etc., is circulated in a parent stream along a predetermined path to a heating unit at which point in the path of movement thereof, the parent stream is subdivided into a plurality of smaller streams which are each surrounded by a heating medium which is preferably out of direct contact with the material in the streams. After the heating of the material is accomplished, the streams are thereafter reunited into a single flowing stream forming the parent stream, flowing to a separator 29 where the material is subjected to a high degree of vacuum for the purpose of drawing off the vapors which were liberated from the material during the heating of the streams. The material thereafter continues its path of movement as a single stream through suitable conduits back to the point in the path where the parent stream is subdivided into the smaller streams, the process being continued until substantially all of the moisture has been removed from the material and the tallow freed from the residue although still associated therewith in the mixture. At the point where the material is subdivided into the smaller streams, the material is agitated so that the means which divides the parent stream into a plurality of streams is not clogged by the accumulation of large particles of the material to be rendered or by bones, etc., straddling the dividing means which in this case consists of a perforated plate having a plurality of openings communicating with the passages through which the streams flow after divided from the parent stream. This agitation is accomplished in the present instance by the substance being flowed in

the proper direction to agitate the material adjacent the dividing means as will appear hereinafter.

Referring more particularly now to the drawings, the numeral 1 represents a mixing tank having a steam jacket 2 surrounding a portion thereof. The steam jacket 2 is provided with an inlet 4 and an outlet 3. A rotatable shaft 5 is journaled in suitable bearings in the brackets 6 and 7 secured to the sides of the mixing tank 1. A pulley 8 on the upper end thereof may be connected by means of a suitable belt to a source of power so that the shaft 5 may be rotated when desired. However, this shaft may be rotated in any other suitable manner, and I do not wish to limit myself to a pulley and a belt drive therefor.

The rotatable shaft 5 carries mixing paddles 9. A quantity of material is placed within the mixing tank 1 along with a quantity of tallow, and as the shaft 5 is rotated paddles 9 stir the tallow and material to thoroughly mix the same. The mixture is then heated slightly by means of the steam in the jacket 2 and the tallow acts as a vehicle for carrying the material through the system and for transferring the heat from the heating surfaces to the material itself. I prefer to use about equal quantities by weight of the material and tallow, but it will be understood, of course, that the proportion of meat and tallow may be varied in order to make the mixture of the proper consistency. After the meat and tallow have been thoroughly mixed, the valve 10, which up until this time has been closed, is opened to permit the mixture to drain out of the hopper by gravity through the pipe 11 and downwardly towards the pump 12. The pump 12 is of the centrifugal type and is capable of handling large pieces of solid material as well as liquids. Such pumps are of a well known variety and are commonly used for pumping sewage and the like. The pump 12 forces the material through the conduits 13, 14 and 15 through the valve 16 which is open at this time and into the heating unit designated generally as 17. The heating unit comprises an outer shell 18 which is cylindrical in cross-section and heads 19 and 20 are fitted over the end of the shell 18. A plate such as 21 is made integral with the end of the shell 18 at each end thereof, or if desired, this plate may be made separate from the shell. Tubular members 22 have their open ends fitted within suitable openings in the plates 21 and form passages communicating with the interiors of the heads 19 and 20. A second plate at the other end of the shell and similar to the plate 21 receives the other ends of the pipes.

Steam is introduced into the heating unit 17 between the plates 21 and around the tubular members 22 by means of an inlet conduit 24. The condensation escapes through an outlet 23. The material is forced through the tubular members 22, which are of sufficient diameter to permit the solid substances to pass therethrough without clogging the tubular members. Due to the arrangement of the tubes within the heating unit 17, I may secure a maximum amount of heating surface for the heating unit. In other words, practically all the steam which passes through the heating unit comes into intimate association with the outer surfaces of the tubular members and due to the fact that the tallow which is mixed with the meat comes into intimate association with the interior surfaces of said tubular members and conveys the heat from the tubular members to the meat, a very rapid transfer of heat between the steam and the meat is accomplished. As stated before, the material is introduced through the conduit 15 and valve 16 into the heating unit 17. A short section of pipe 25 connects the valve 16 with the head 19 and is so arranged that the material enters the head 19 at a tangent causing the mixture to be thoroughly circulated within the head 19 transversely of the longitudinal dimensions of the pipes and causing the mixture to be evenly distributed to all of the tubular members 22 and preventing the clogging of the pipes by bones or large pieces of meat which might otherwise come to rest straddling the open ends of the tubes and remain there thus preventing other material from passing into the pipes. The pressure exerted on the mixture by means of the pump 12 forces the mixture through the tubular members 22 downwardly into the lower head 20, and the mixture escapes through the bottom of this head through the conduits 26 and 28 to the separator 29.

The separator 29 is in the form of a hollow chamber and contains the baffles 30 arranged in the manner illustrated. The pipe 31 communicating with the upper end of the separator is adapted to be connected with any suitable source of vacuum or may be in communication with a suitable condenser of any well known construction. The purpose of the separator is to remove the vapors from the mixture. As the material passes through the heating unit 17, the mixture of course is heated or cooked, and this rise in temperature liberates a certain amount of moisture when the mixture reaches the separator 29 due to the fact that the degree of pressure within the separator causes the moisture to change into a vapor and be carried off through the conduit 31. The baffles 30 are for the purpose of preventing entrained particles from being drawn out of the separator through the conduit 31.

By the time the mixture which is drawn from the mixer 1 has been circulated as far as the separator, practically all of the mixture has been drawn out of the mixer, and, as soon as this is done, the valve 10 is closed so as to cut out the mixing tank during the cooking operation. The mixture within the separator 29 communicates by means of a valve 32 and conduit 33 with the pump 12, and with the valve 32 open the pump circulates and re-circulates the substance through the conduits 13, 14 and 15, valve 16, conduit 25, heating unit 17, conduits 26 and 28, separator 29, valve 32 and pipe 33, and forms a closed circuit through which the substance is or may be repeatedly circulated. Generally speaking, a single circulation of the mixture through the circuit just described is not sufficient to drive all of the moisture out of the mixture and therefore it becomes necessary to circulate the mixture through the circuit several times.

The material as it enters the separator begins to froth and tends to rise in the separator and the amount of froth may be determined by looking through the transparent openings 34 in the wall of the separator. When the frothing lessens to a predetermined degree the operator may determine when the rendering has been carried on a sufficient length of time.

Between the conduits 13 and 14 I arrange a T 35 which communicates with a valve 36. Similarly I arrange a T 37 between the conduits 26 and T 38 which latter has one branch thereof communicating with the conduit 28, and another communicating with the T 37. The T 37 also communicates with a valve 39. The cross 41

communicates with the pump 12, conduit 11 and conduit 33. The remaining connection of the cross communicates with the T 38 by means of a valve 42. A T 43 is arranged between the conduit 15 and valve 16 and one branch thereof communicates with the conduit 44 by way of the valve 45.

During the normal circulation of the mixture through the circuit, the valves 36, 39, 42 and 45 remain closed, whereas the valves 32 and 16 remain open, it being understood of course, that the valve 10 is also closed immediately after the mixture has all been introduced into the circulating system.

After the material has been circulated the desired number of times and the moisture driven therefrom it is necessary to remove the residue from the system and I may do this in either of two ways. I may open the valves 39 and 36 and permit the material to drain out of the system and in order to break the vacuum within the separator 29 and heating unit 17, I provide pet cocks 46 and 47 communicating with the atmosphere and with the interiors of the separator 29 and heating unit 17 respectively. By this method I am enabled to drain most of the residue out of the system by gravity but generally a small quantity of the residue remains in the system. However, no harm is done by permitting a small amount of the residue to remain in the system as this can be carried along with the next quantity of the mixture which is cooked.

The method which I have just described for removing the residue from the system is fairly satisfactory for ordinary purposes, and if it is desired merely to drain the residue into suitable hoppers or receptacles in which the same are transferred to suitable apparatus for extracting the tallow from the meat. Such apparatus may be of any of the well known types, and forms no part of the present invention. In practice however, I find it advisable to convey the residue to a point above the apparatus as installed or to the top of the apparatus which separates the tallow from the residue. For this purpose I provide the valves 45 and 42 and use the pump 12 which circulates the mixture during the normal operation of the machine to force the material out through the valve 45 and conduit 44 to the desired place.

When ejecting the residue by means of the pump 12 I leave the valves 39 and 36 closed and close valve 16. I also open valves 42 and 45 and permit the valve 32 to remain open. Pet cocks 46 and 47 are also opened so that the interior of the heating unit 17 and the separator 29 communicate with the atmosphere. As the pump 12 is operated the residue is drawn from the heating unit 17 and separator 29 and is forced through the conduits 13, 14 and 15, T 43, valve 45 and conduit 44 to any desired position. In this manner practically the entire system is cleaned out and the apparatus is now ready for the cooking of a new batch of the mixture of meat and tallow. This new batch may be mixed while the cooking of the previous batch is taking place, so that as soon as the residue is driven out of the system the valve 10 may be opened to permit the mixture to be drawn into the system for circulation, thereby reducing the amount of time necessary for the carrying out of the process.

I will now proceed to enumerate some of the advantages of my improved system over the prior art constructions. With a system arranged according to my invention, a great amount of heating surface within the heating unit 17 is utilized in view of the fact that no agitating means is necessary within the heating unit. Furthermore, the arrangement of the heating unit is such that none of the mixture is ever a very great distance away from a heating surface, and therefore more or less is in a position to receive by a very short route the heat which is transferred from the heating surface to the mixture. This results in heating the substance more quickly due to the fact that every particle of the mixture is receiving heat from the heating surface practically at all times and in considerable quantities, whereas in the previous rotating drum type, the material only came into contact with the heating surface occasionally, and therefore it was necessary to maintain the heating surface at a higher temperature in order to compensate for the small amount of time which the material was in contact with, or in close proximity to the heating surface. The system which I have described, furthermore has the advantage of speeding up the time required for the complete cooking of a given quantity of meat. This is made possible by the fact that the pump circulates the meat and tallow through the passages 22 very rapidly and this causes a very quick transfer of heat from the heating surface to the tallow and the meat. Furthermore, each time the material passes through the heater, there is less moisture in the mixture and consequently that moisture which remains is much more readily heated and driven off therefrom.

The arrangement of the conduit 25 is such as to provide a rather uniform distribution of the meat to the various tubular members 22, and insures that the material will be forced through all of the tubular members at substantially the same rate.

Another advantage of this system is that the tallow which is used in conjunction with the material being rendered to flow the material through the system also acts as a heat exchanging medium which distributes the heat from the heating surfaces of the tubes and causes a more even distribution of the heat to the material being rendered whereby there is less tendency for the material to be scorched. By preventing the scorching of the material, the general appearance of the tallow is improved and is rendered more saleable. The tallow produced in this manner is also of a higher quality than the tallow which has been scorched even slightly during the cooking operation.

With devices of the prior art if a high temperature were not used for the heating surfaces, it would be necessary to continue the process for a considerable period of time, and thus cause a discoloration of the tallow due to the length of time necessary for the cooking process. With a system such as I have illustrated however, the cooking process is speeded up due to the fact that I have provided a greater amount of heating surface per quantity of material cooked than has been hitherto possible with devices constructed according to the teachings of the prior art. In other words, while I may use exhaust steam with my process, I am able to finish the cooking process in a much shorter time than is possible with even the prior known apparatus using steam under high pressure and superheated steam. The tallow which is obtained from my system is not discolored and therefore is more desirable than ordinary commercial tallow.

As stated before, the conduit 31 is connected to a suitable vacuum source which may be a vacuum

pump and a condenser such as a surface condenser or a jet condenser in case a high vacuum is necessary or it may be a condenser of any other type. Such condensers are common in the art to which this invention pertains and to the related arts, and no description thereof is deemed to be necessary for the complete understanding of the process and apparatus which I have described.

In Fig. 3 I have illustrated a modified apparatus for carrying out my process. In this form of the invention the steam jacketed mixer 50 similar to the mixer 1, as shown in Fig. 1, has a rotatable shaft 51 and mixing paddles 52, the mixer being surrounded by a steam jacket 53. In this form of the invention I have illustrated the conduit 54 as communicating with the interior of the mixer at a point above the bottom of the mixer. This is for the purpose of permitting any foreign solid particles such as crockery, pieces of metal, and the like which are often found in the raw material to gravitate to the bottom of the mixer and the same may then be drawn out of the mixer at any desired time through the valve 55' and conduit 56'. It will be seen by this arrangement that the heavy foreign solid substances are not apt to travel downwardly through conduit 54 to the pump 55 which corresponds to the pump 12 in Fig. 1. While these solid substances will pass through the pump 55 without clogging, still the same substances may clog other parts of the apparatus and it is desired to rid the material being rendered of any foreign solid substances before the same is carried into the heating unit. The mixer 50 therefore acts as a separator or classifier. It will be understood also that this form of mixer may be used with the apparatus illustrated in Fig. 1 in place of the mixer shown in that apparatus.

The material drawn from the mixer 50 passes through the valve 57 and downwardly through the conduit 56 into the pump 55. The pump pumps the material through the conduit 58, conduit 60 and valve 61 into the upper part of the casing indicated generally as 62. The upper part of this casing 62 forms a separator 63 and the lower part forms a heating unit 64. These parts correspond to the separator 29 and heating unit 17 illustrated in Fig. 1 and perform the same function although in perhaps a slightly different manner.

The heating unit 64 is provided with tubular members 65 extending longitudinally thereof, the upper ends of these tubes communicating with the interior of the separator 63 and the lower ends thereof communicating with the head 66 at the lower end of the heating unit. Steam is admitted into the space surrounding the tubes 65 through the conduit 67 and the condensation is drawn through the conduit 68. The material being rendered passes downwardly through the tubes 65 and into the head 66. The pump 55 draws the material downwardly from the head 66 through the valve 69 and conduit 56 and then recirculates the material through the conduit 58, conduit 60 and valve 61 to the separator 63.

A partial vacuum is maintained within the separator 63 by means of a suitable vacuum producing unit communicating with the interior of the separator by means of the conduit 70. Baffles 71 and transparent openings 72 similar to the baffles 30 and transparent openings 34 shown in Fig. 1 are provided for the separator 63 and perform the same functions as these parts 30 and 34.

After the material has been heated by means of the heating unit 64 and circulated by means of the pump back into the separator 63, the vapor escapes from the heated mixture and passes out through the conduit 70, the baffles 71 acting to separate the entrained particles from the vapor. The mixture is again passed downwardly through the tubes 65, is again heated and forced back into the separator by means of the pump 55 where again some of the moisture is driven off through the conduit 70. This process is continued until the operator determines that the mixture has been cooked a sufficient length of time.

After the mixture has been cooked a sufficient length of time, the operator desires to remove the material from the system, and in order to do this he closes the valve 61 and opens the valve 73 which communicates with the conduit 60. The pump 55 is thereafter used to pump the material through the conduit 60, valve 73 and conduit 74 to any desired place. It will be understood, of course, that the valve 57 is closed after the mixture has been drawn out of the mixer 50 and remains closed until it is desired to place a new quantity into circulation.

If desired, the material may be drained out of the system by gravity. This is accomplished by opening the valve 59 instead of the valve 73 and permitting the material to flow by gravity out of the heating unit 64 and the separator 63 in a manner similar to the way in which the material is drained out of the separator 29 and heating unit 17 shown in Fig. 1 through the valves 39 and 36. The pet cock 75 is used to break the vacuum within the separator to permit the material to be expelled by the pump or drawn off by gravity through the valve 59.

The operation of this form of the apparatus will be well understood after reading the description of Figs. 1 and 2, and therefore it is believed that no further description as to the operation of this apparatus is necessary.

With a system such as I have described, it is desirable, although not always necessary to "hash" or crush the raw material so that I may use comparatively small sized heating tubes. While I have shown straight tubes for conveying the material through the heating unit it will be understood of course, that these are merely illustrative of the type of tubes which I may use and if desired these tubes may be coiled instead of straight or the heating unit may be of a type different from the exact type of heating unit which I have illustrated in the drawings. The important feature of my invention is that the material is flowed rapidly over the heating surfaces and then recirculated if necessary to produce a rapid transfer of heat from the heating surface to the material.

If desired, the material may flow from the bottom of the heating tank to the top instead of from the top to the bottom as illustrated without departing from the spirit of this invention.

If the material itself is sufficiently fluid to permit it to flow through the system during the entire process no tallow or like substance is added. Some substances such as pork, beef, fat and the like become sufficiently fluid in the mixer due to the high grease content to flow through the system without adding other substances thereto to act as a vehicle. When rendering garbage a quantity of garbage grease is used since although garbage is sufficiently fluid at first (generally speaking) the same becomes less fluid as the moisture is driven out of the same and if additional grease were not used it would be very diffi-

cult to cause the garbage to flow through the system near the end of the rendering operation.

If desired, vegetable oils may be used as the vehicle for conveying the substance instead of fats. This is particularly desirable in producing compound lards. Cotton seed oil, which is often used in producing compound lards has to be deodorized before it will be found desirable for use in the compound lard. This deodorizing is ordinarily accomplished by placing the oil in a vacuum chamber and passing steam into the oil—the steam removing the foreign matter which gives the odor to the oil. If cotton seed oil were used in my circulating rendering system, the heated vapor released from the substance being rendered would have the same effect on the oil as the steam does ordinarily and the separator being under vacuum would remove the vapors along with the foreign, odor producing matter, thus simultaneously liberating the undesirable matter from the oil and rendering the fat to produce a compound lard.

This invention also can be used in the rendering of fish and sea animals and has found its application particularly in the rendering of whales in the whaling industry.

I do not wish to limit myself to the particular details of the apparatus which I have described as it is within the scope of one skilled in the art to which this invention pertains to change the position of the various units without departing from the spirit of this invention. The accompanying drawings are to be taken merely as illustrative of one embodiment of my invention and not as defining the limits thereof as I do not wish to be limited in my invention except as pointed out in the accompanying claims.

Having thus fully described my invention, what I desire to secure by Letters Patent of the United States is:

1. A process of rendering meats, garbage, and the like, comprising the steps of flowing the substance to be rendered simultaneously through a multiplicity of stationary heated passages arranged close together, maintaining said passages substantially filled with the substance to be rendered at all times, removing the volatile matter from said cooked material, passing said heated material through stationary heated passages after some of said moisture has been removed therefrom with a subsequent step of removing additional moisture from the heated material after said last mentioned step of passing the material through heated passages.

2. The process of rendering a substance containing material rendered fluid upon the application of heat thereto, which fluid acts as the only vehicle for carrying the substance to be rendered, flowing the substance along a predetermined path in a parent stream, subdividing the parent stream into similarly moving individual streams and flowing said streams simultaneously through separate narrow heated passages unobstructed by any mechanical means for flowing the substance therethrough with a fluid resulting from the rendering of that material, removing moisture from said material after it has been heated, and subsequently positively circulating the material being rendered through narrow heated passages and removing additional quantities of moisture therefrom while the material is carried by said fluid and until substantially only 5% moisture remains in the material being rendered.

3. A rendering process comprising the steps of flowing a quantity of the substance to be rendered simultaneously through a plurality of narrow heated stationary passages, the walls of which are not spaced substantially over six inches from each other, and drawing off the vapor liberated from the material being rendered during the flowing of the solid material through said passages, and collecting all of the material flowing through said passages and flowing all of the same through a common passage.

4. A process of rendering comprising the steps of flowing material to be rendered simultaneously through a plurality of stationary narrow substantially heated passages with the material being rendered conveyed through said passages solely by a fluid of the same character as that produced by heating the material, and removing the moisture from said material liberated by said heating process until only a small percentage of the moisture remains in said material.

5. A process of rendering comprising the steps of flowing material to be rendered simultaneously through a plurality of narrow stationary substantially unobstructed heated passages while cenveyed by a fluid which evaporates at a higher temperature than that used in the rendering process under the conditions in which the said material is rendered, heating the material to be rendered to a temperature to liberate the moisture therefrom, and removing the moisture from said material after it is liberated until only a small percentage of moisture remains in said material.

6. A process of rendering comprising the steps of mixing a quantity of solid material to be rendered with a quantity of fat, flowing parts of the mixture substantially simultaneously through a plurality of stationary unobstructed narrow heated passages, and continuously removing the moisture from said mixture as the same is liberated.

7. A process of rendering comprising the steps of mixing a quantity of solid material to be rendered with a quantity of fat, flowing parts of the mixture substantially simultaneously through a plurality of stationary unobstructed narrow heated passages, and continuously removing the moisture from said mixture under vacuum as the same is liberated.

8. A process of rendering comprising the steps of mixing a quantity of solid material to be rendered with a quantity of fat, flowing parts of the mixture substantially simultaneously through a plurality of stationary unobstructed narrow heated passages, continuously removing the moisture from said mixture as the same is liberated, and repeating each of the steps of flowing the mixture through stationary unobstructed narrow heated passages and removing the moisture as many times as necessary to remove the desired amount of moisture therefrom.

9. A process of rendering comprising the steps of flowing a substance through a plurality of stationary narrow heated passages, feeding said plurality of stationary heated passages simultaneously through a common supply passage and agitating the material to be rendered adjacent the ends of the passages to which the material is supplied to prevent the clogging of the material adjacent the ends of said passages.

10. A process of rendering comprising the steps of flowing a substance through a plurality of stationary narrow heated passages, feeding said plurality of stationary heated passages simultaneously through a common supply passage and agitating the material to be rendered adjacent

the ends of the passages to which the material is supplied by directing the material to be rendered through said common supply passage in a direction to cause a complete circulation of the material adjacent the ends of said passages as said material is supplied to the ends of said passages through said common supply passage to prevent the clogging of the material adjacent the ends of said passages.

11. The process of rendering which includes the steps of comminuting the mass to be rendered, then subdividing the mass into smaller masses and causing them to flow in separate individual streams, and surrounding said streams with, and subjecting them to, the action of heat.

12. The process of rendering meat, garbage, and the like consisting of the steps of causing the mass to flow in a continuous circuit, a part of said circuit branching into a plurality of small streams flowing in substantially parallel relation with each other, subsequently collecting said streams into the single stream of the main circuit, subjecting said smaller streams to heat by entirely surrounding each of them with a stationary heating element carrying a heating medium, and separating said streams from the heating medium to prevent direct contact therewith.

13. The process of rendering meat, garbage, and the like which includes flowing the mass to be rendered in a parent stream, subdividing the parent stream into a plurality of downward flowing smaller streams, imparting to the main stream at the point where it subdivides into the smaller streams, a rotary motion substantially in a plane perpendicular to the smaller streams to thereby agitate the mass and to distribute the larger particles of solid matter to prevent clogging of the smaller streams, and individually and simultaneously heating said smaller streams.

14. The process of rendering meat, garbage, and the like, which includes the steps of flowing the mass to be rendered in a parent stream, subdividing the parent stream into a plurality of downward flowing small streams, imparting a rotary motion substantially in a horizontal plane to the main stream at the point where it subdivides into the small streams to thereby agitate the mass and distribute the larger particles of solid matter to prevent clogging of the small streams, and individually and simultaneously heating said small streams.

15. The process of rendering which includes the steps of positively circulating the mass to be rendered in a single parent stream, then subdividing the mass into smaller masses and causing them to flow in individual similarly moving finer streams, and surrounding said streams with and subjecting them to the action of heat.

16. The process of rendering which includes the steps of positively circulating the mass to be rendered in a single stream, then sub-dividing the mass into smaller masses and causing them to flow in individual similarly moving finer streams, subjecting said streams from all sides to the action of a heating medium, and separating said streams from said heating medium to avoid direct contact therewith.

17. The process of rendering a mass composed of a mixture of a quantity of solid material to be rendered and a quantity of fat, which comprises the steps of sub-dividing the mass into smaller masses and causing them to flow in individual streams, and surrounding said streams with stationary heating elements and subjecting the streams to the action of the heat of the elements.

18. A process of rendering comprising the steps of mixing a quantity of solid material to be rendered with a quantity of fat, dividing the mixture into smaller masses and flowing the same simultaneously through a multiplicity of stationary narrow heated passages, removing the volatile matter from said mixture as the same is liberated therefrom, thereafter again passing the solid material and fat through said narrow heated passages and again removing the moisture liberated therefrom, and repeating these steps as many times as necessary to drive off the necessary amount of moisture from the material, without separating the heated fat and fluid products of rendering from the material, whereby said heated fat and fluid products of rendering will act as a vehicle to carry the material through the various steps of the process while the moisture is being liberated and withdrawn from the mixture.

19. The process of rendering comprising the steps of heating the solid material to be rendered to a temperature sufficient to release a portion of the fluid contained therein whereby said fluid acts as a vehicle to carry said material through the various stages of rendering, flowing said material and fluid simultaneously in a common stream, dividing said stream into a plurality of similarly moving finer individual streams, surrounding said streams with and subjecting them to the action of heat, thereafter again passing the said material while carried by said fluid back to the original common stream, removing the moisture liberated therefrom, and again dividing said stream into a plurality of finer individual similarly moving streams, and repeating these steps as outlined as many times as is necessary to drive off the desired amount of moisture.

20. The process of rendering meat and the like comprising the steps of pumping the material to be rendered in a parent stream, dividing the parent stream into a plurality of similarly moving finer streams, and surrounding said finer streams with and subjecting them to the action of heat.

21. The process of dry rendering fat and moisture-bearing materials such as meats, garbage and the like which consists in the steps of rapidly and positively circulating the material through an externally heated zone, being of a cross-section large enough to permit movement of said material through said zone without clogging and being small enough in cross-section to permit a rapid transfer of externally applied heat through said material, maintaining the temperature of the material included within the zone, through the agency of said externally applied heat, at a point sufficient to melt the fat and convert the moisture into steam, drawing off the steam during the circulating operation, and repeating the circulation of the material through the heated zone and the withdrawal of steam until said material is completely rendered.

22. The process of dry rendering fat and moisture-bearing materials such as meats, garbage and the like, which consists in the steps of rapidly and positively circulating the material through a plurality of externally heated passages, each of said passages being of a cross-section large enough to permit movement of said material therethrough without clogging and being small enough in cross-section to permit a rapid transfer of externally applied heat through said material, maintaining the temperature of the material included within said passages, through the agency of said externally applied heat, at a point sufficient to melt the fat and convert the moisture

into steam, drawing off the steam during the circulating operation, and repeating the circulation of the material through said passages and the withdrawal of moisture until said material is completely rendered.

23. The process of dry rendering fat and moisture-bearing materials such as meats, garbage and the like which consists in the steps of rapidly and positively circulating the material through an externally heated zone, being of a cross-section large enough to permit movement of said material through said zone without clogging and being small enough in cross-section to permit a rapid transfer of externally applied heat through said material, maintaining the temperature of the material included within the zone, through the agency of said externally applied heat, at a point sufficient to melt the fat and convert the moisture into steam, drawing off the steam during the circulating operation, and repeating the circulation of the material through the heated zone and the withdrawal of steam until said material is completely rendered, the application of the force for producing the above mentioned circulation being applied at a point removed from the heated zone.

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