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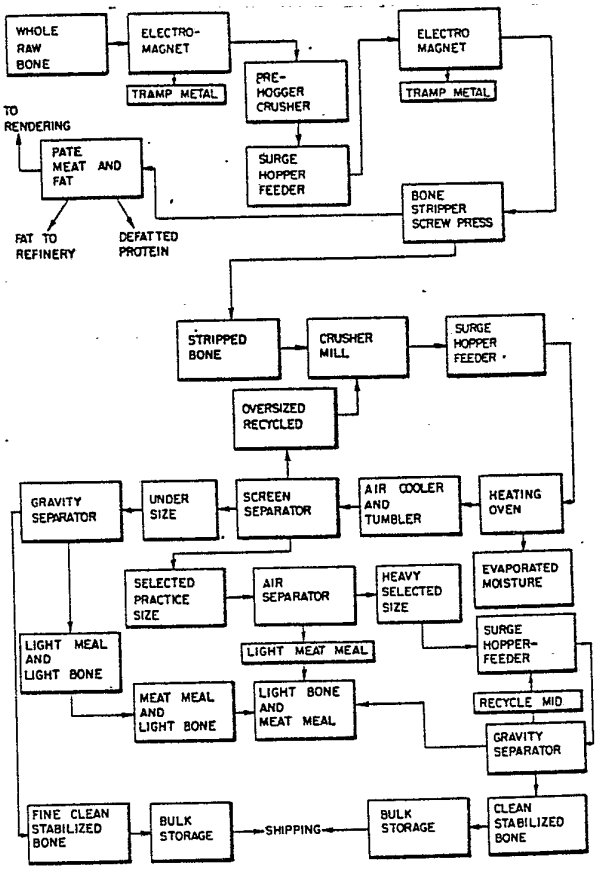
(54) Title: LOW FAT STABILIZED BONE AND METHOD OF PRODUCING

(57) Abstract

Process for preparing low fat stabilized bone which can be used for producing high quality gelatin. Trimmed raw bone is fed continuously to a screw type press, mounted within a cage having a choke and perforations in the wall of the cage through which soft non-bone material is extruded. The pressed bone is heated in an oven to crisp the fat and meat tissue adhering to the pieces of bone such that the crisp fat and meat tissue is readily separated from the bone during the heating, tumbling and screening thereof. The baked crushed bone is subjected to dry separation by first passing it over a sizing screen and then passing the exiting material having a selected particle size range to a gravity separator. The above enables production, in an economical manner, of a clean low-fat bone in which the bone protein is not degraded.



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LOW FAT STABILIZED BONE AND METHOD OF PRODUCING

The invention relates generally to cleaning and stabilizing bone for producing gelatin, glue and similar proteins, and, more particularly, to a continuous process of preparing low fat stabilized bone of improved quality which gives increased yields of high quality gelatin and glue.

Bones from cattle and hogs contain substantial amounts of collagen and have long been used for making gelatin, glue and other protein products. An important source of bone useful for making high grade gelatin and glue is trimmed raw bone from meat packing plants and boning plants where carcasses are trimmed to remove most of the useful meat tissue and fat. The trimmed raw bone, however, contains considerably more fat and meat tissue than can be tolerated when the bone is used for making gelatin or glue and the bone must be separated from most of the fat and meat tissue before being used for making gelatin or glue.

Heretofore, the most common method of separating fat and meat tissue adhering to raw trimmed bone has been to heat the bone material while in contact with water or liquid fat until the residual fat on the bone is liquified and the adhering meat tissue separates from the bone. When the bone is contacted with a hot aqueous solution for a period sufficiently long to effect separating the fat and meat from the bone, a significant portion of the protein in the bone is degraded and the quality of the gelatin or glue produced is reduced. Also, when the bone is heated in contact

with liquid fat the pores of the bone become saturated with fat so that the quality of the gelatin or glue made therefrom is also reduced.

The residual fat and meat tissue on raw trimmed bone has also been separated from the raw bone during the recovery of useful meat in the form of pate by compressing the bone in a screw type press mounted within a perforated casing having a choke mounted in the discharge end of the casing so that fat and meat tissue are forced through the perforations in the casing. The pressed bone which is discharged from the choke end of the casing has a wide range of particle sizes and contains considerable fat and meat tissue. Heretofore pressed bone has not been considered suitable as a source of low fat stabilized bone for producing high quality gelatin or glue, because of the expense of properly sizing and removing the residual fat and meat tissue from the pressed bone.

It is an object of the present invention to provide a more economical process of producing a clean and stabilized bone product utilizing pressed bone material.

It is also an object of the present invention to provide a clean and stabilized bone product from pressed bone material in a more economical manner.

Other objects of the present invention will be apparent from the detailed description and claims to follow when read in conjunction with the accompanying drawing comprising a block flow diagram illustrating the preferred process of the present invention.

Generally, the continuous process for producing

low fat stabilized bone of improved quality in accordance with the present invention comprises depositing raw trimmed bone as received from a meat packing plant or boning plant into a receiving bin and continuously conveying the bone material by screw conveyor means from the bin to a pre-hogger where tramp metal is removed and the bone is crushed and reduced in size from its natural state to pieces ranging between about 1 and 6 inches in length. The crushed bone leaving the pre-hogger is in the form of a flowable mixture containing crushed bone, bone marrow, blood, fat, meat tissue and moisture. From the pre-hogger the crushed bone and adhering fat and meat tissue is then fed continuously into a screw type press mounted within a perforated cage or casing which has a choke mounted at the discharge end for controlling the pressure applied to the crushed bone within the cage. By adjusting the choke sufficient pressure is applied to the raw bone by the screw to force a substantial amount of the soft non-bone material, such as the fat, meat tissue and liquid in the crushed bone material through the lateral openings in the cage and continuously discharging pressed bone at the choke end of the press. The pressed bone as discharged from the screw press has a substantially uniform composition regardless of the amount of fat, meat tissue and moisture in the raw bone material. The pressed bone stripped of a substantial portion of the fat, meat tissue and moisture is then preferably conveyed by suitable means to a crusher mill, such as a hammer-mill, which further reduces the size of the bone particles.

The pressed bone is then continuously fed into an oven in which the particulate material is heated to a maximum temperature of about 250°F (121°C) until the pieces of fat and meat tissue adhering to the bone particles are crisp so that the pieces of fat and meat tissue will be readily fractured and separated from the bone particles. The baking oven is preferably an oven from which air is excluded and in which a positive pressure is maintained as a result of heating the vaporized moisture in the feed material to a temperature of about 250°F (121°C). The bone particles and adhering pieces of crisp fat and meat tissue are then subjected to a dry separation treatment in which the material is screened to provide a selected particle size range.

The selected particle size range material from the screen sizer is next deposited onto a gravity separator comprised of an inclined vibrating screen air table on which the high density clean bone particles substantially free of fat and meat tissue climb to the upper end section and are collected separately from the particles of low density fat and meat tissue which are unable to climb to the upper end of the air table. The dry separation treatment comprising screen sizing and gravity separation removes substantially all of the residual fat and meat tissue and produces a clean stabilized bone which yields gelatin of the highest quality in a very economical manner.

The following is a more detailed description of the process of preparing low fat stabilized bone in accordance with the present invention.

Raw Bone Material

The bone material which can be processed in accordance with the present invention can be any raw boned material but preferably is trimmed beef carcass bones or trimmed hog carcass bones. Preferably the raw trimmed bones are deposited in a material receiving pit or bin with beef bones processed separately from hog bones when producing low fat stabilized bone for high quality gelatin. The degree to which the bones are trimmed to remove fat and meat tissue is not critical, since the present process is capable of handling bones having a large amount of residual fat and meat tissue. The raw bone receiving bins or pits are equipped with screw conveyor means which carry the raw bones to a pre-hogger in which the bones are reduced to a size suitable for processing.

The Pre-Hogger

The pre-hogger has associated therewith an electromagnet which removes tramp metal before the raw bone is fed into the pre-hogger and can be of any conventional design comprising a rotating cylinder having a plurality of spaced teeth on the surface which pass through spaced bars mounted in a fixed backing plate. The teeth co-act with the plate to crush the raw bone and adhering material to form relative uniform sized pieces. For example, the pre-hogger used when producing low fat stabilized bone for making high quality gelatin preferably is adapted to produce pieces which range in size between about 1 inch by 1 inch to 1 inch by 6 inches. The crushed raw bone is then conveyed to a surge-hopper-feeder

which is adapted to hold a large quantity of crushed bone material (i.e. 40,000) in order to insure a continuous supply of raw bone material for further continuous processing in a bone stripper means when the raw trimmed bone is intermittently delivered to the receiving pits. The crushed bone material as discharged from the pre-hogger has an approximate composition all on a weight basis of 30-40 percent moisture, 30 percent meat tissue, 20-30 percent fat and 20 percent bone with a bulk density of about 56 pounds/ft^3.

Raw Bone Stripper

Conveyor means carry the raw crushed bone preferably from the surge-hopper over a second magnetic separator which removes any remaining tramp metal and continuously feeds the raw crushed bone into a screw type press mounted within a cage which preferably has lateral slots therein spaced a distance less than the minimum size desired in the final product (i.e. about 0.095 inches) and a choke mounted axially therein at the discharge end of the cage adapted to maintain a pressure on the raw crushed bone within the cage of from about 250 to 500 psi. A satisfactory raw bone press of the foregoing type is a 10" "Duke Pressor" manufactured by the Dupps Company of Germantown, Ohio. The 10 "Duke Pressor" has a capacity of about 20,000 pounds per hour and employs an interrupted screw flight to prevent forming a mass of bone particles along the wall of the cage. With the 10" "Duke Pressor" a choke pressure of preferably about 300 psi is applied to the bone material using 75-80 percent power in a 200 horsepower

electric motor for efficiently separating the soft tissue and fat from the raw trimmed bone material. The pressed bone material as discharged from the raw bone stripper at a rate of about 11,000 pounds per hour has a size ranging from about 1/8 inch to 1-1/2 inch and an average size ranging between 1/4 inch and 1-1/4 inches. Regardless of the raw bone composition the pressed bone material as discharged from the screw press contains between about 20 to 25 percent moisture, 10 to 12 percent meat tissue and about 2 to about 6 percent by weight fat. The density of the pressed bone material is about 56 pounds per cubic foot. As discharged from the stripper the pressed bone has a temperature of between about 110°F to about 120°F. It will be evident that the screw press is very effective in removing fat and meat tissue from the crushed bone material without contacting the bone with a hot aqueous solution or molten fat.

The soft tissue and fat which is discharged through the slots in the cage are further processed to provide valuable products, such as pate, meat flavors, and rendered fat.

The Crusher Mill

The pressed raw bone from the stripper when producing low fat stabilized bone for gelatin is then preferably fed into a conventional hammer mill without using a bottom screen to further reduce the size of the pressed bone material to an average size of about 1/2 inch without forming more than a minor proportion of bone particles less than 1/8 inch in diameter. A crusher mill suitable for use in reducing

the bone to the foregoing particle size can be any conventional hammer mill, such as the Prater Mill manufactured by the Prater Hammer Mill of Chicago, Illinois. The crushed raw pressed bone is preferably stored in a large surge-hopper-feeder bin in order to provide a continuous supply of material to the baking oven.

The Baking Oven

The baking oven is adapted to heat and meat tissue and fat tissue adhering to the bone particles which is continuously supplied to the oven through an air lock to a temperature which effects crisping the pieces of fat and tissue adhering to the bone particles so that fat and meat tissue are more frangible and more readily fractured and separated from the particles of bone during passage through the oven and during the subsequent processing of the bone material. The preferred type of oven excludes air from the heating chamber in order to minimize the risk of scorching or burning the meat tissue and reduce the value of the organic material adhering to the bone particles while heating the material to a temperature of between 210°F to 250°F (99°C to 121°C). It is also preferred that the moisture which is vaporized during baking be retained within the interior of the oven so that the pressure within the oven chamber will rise above atmospheric pressure and provide an oxygen-free atmosphere of superheated steam. An oven which has been found suitable for baking the crushed pressed raw bone material at a rate of about 7000 pounds per hour is a continuous

rotating tray type vertical transfer dryer, such as a Wyssmont "Turbo Dryer" manufactured by the Wyssmont Company, Fort Lee, New Jersey. In the Wyssmont "Turbo Dryer", the crushed bone material is moved through the oven which has a plurality of vertically spaced trays continuously rotating about the vertical axis of the oven by being wiped off each tray onto a tray below by stationary wipers while continuously circulating a heated gas around the trays. Other types of heaters, however, can be used for crisping the fat and meat tissue adhering to the bone particles, such as a rotary hot air direct fired rotating drum, but care must be exercised to avoid using such elevated temperatures or prolonged retention times which result in burning or scorching of the feed material, particularly with particles of about 1/2 inch in diameter or larger.

The crisped bone material from the baking oven is preferably air cooled to about ambient temperature after it is discharged from the baking oven and while being transported on a tumbling conveyor means by enclosing the conveyor within an air cooled jacket to further increase the fragility of the crisped pieces of fat and meat tissue adhering to the bone particles before depositing the baked bone material onto a screen separator or sizer which separates out material having a selected range of particle size desired in the final low fat stabilized bone product.

Vibrating Screen Separator

When preparing low fat stabilized bone for high quality gelatin a particle size range of from about

1/8 inch to about 3/4 inch is preferred. An apparatus suitable for separating material having the foregoing selected particle size range is a vibrating two deck gravity screen separator adapted to remove particles of bone and organic tissue which are larger or smaller than desired in the final product. The upper of the two spaced vibrating screens preferably is a 2-mesh screen which retains particles in excess of about 3/4 inches in diameter and the lower screen is a 6-mesh screen which retains particles larger than about 1/8 inch so that the selected middle fraction which is recovered for further processing has a size ranging between about 3/16 inches and 5/8 inches diameter. The oversized material is preferably recycled to the crushing mill and the undersized material having a particle size below 3/16 inches is conveyed to a gravity separator preferably of the same type used for the selected particle size material which recovers clean heavy fine bone material which can be used for preparing gelatin or glue of high quality. A suitable screen separator or sizer for use in the process is a 34-4800 "Screenaire" vibrating screen separator manufactured by Forsbergs, Inc. of Thief River Falls, Minnesota, which has a capacity of about 12,000 pounds per hour.

The selected sized material from the screen separator is preferably passed through an air separator before transfer of the material to a gravity separator to remove the very low density particles in order to increase the efficiency of the gravity separation.

The Gravity Separator

The selected sized material is continuously conveyed to a dry gravity density separator which is adapted to remove the low density non-bone particles of fat and meat tissue and provides a clean high density bone fraction which forms the desired low fat stabilized bone product having a particle size within the selected range. The density separation is carried out by continuously depositing the selected sized material from a surge-hopper by means of a vibrator feeder onto the dry gravity separator table which in the preferred form comprises a reciprocating inclined air table having a 10-mesh screen deck. The particles of bone having a high density move upwardly over the screen deck and are collected at the upper end separately from the low density particles of fat and meat tissue along with a small amount of light bone remaining in the selected particle size material. The very low density material which concentrates at the bottom of the inclined separator table is discharged as culls and can be used in meat meal. The intermediate density particles are preferably recycled through the gravity separator. A suitable gravity separator for use in the process is a Forsbergs Model 200-V gravity separator manufactured by Forsbergs, Inc. which has a capacity of about 4000-5000 pounds per hour. The air pressure, the rate of reciprocation as well as the inclination of the screen deck of the Forsbergs gravity separator can be varied to provide the desired degree of density separation and final product.

The high density material which is collected at the upper end section of the gravity separator table in the foregoing process is high quality clean, stabilized ossein bone material. The low fat stabilized bone product produced in the above described manner from raw trimmed beef bones when shipped has a typical composition: 4.65 percent moisture, 29.05 percent protein, 2.49 percent fat, 1.98 percent soluble ammonia and 61.68 percent ash, all on a weight basis. The low fat stabilized bone product is capable of being used for making high quality gelatin.

The yield of clean stabilized bone having the foregoing analysis in the herein disclosed process is about 15.6 percent by weight based on 100 percent of the raw trimmed bone deposited in the receiving pits. About 46.4 percent of the raw trimmed bone fed to the screw press is recovered as stripped pressed bone. The selected particle size fraction having a particle size range between about 3/16 to 5/8 inches comprises about 29.47 percent by weight of the original raw bone material. And, the clean stabilized fine bone material or "rice bone" obtained from the undersized material recovered from the screen separator comprises about 2.6 percent by weight of the original raw trimmed bone material and is of substantially the same high quality as the high density gravity separated material from the selected particle size fraction.

It will be understood that the process of the present invention provides a continuous and essentially automated process of producing clean and stabilized bone of high quality from raw bone material

from various sources and having varying amounts of fat and organic tissue adhering thereto or admixed therewith. It will also be evident that modification can be made in the type of apparatus used in the system without departing from the inventive concept disclosed herein. For example, two or more heating ovens, screen separators or gravity separators can be used so that surge-hoppers for storing the bone material between processing steps can be eliminated. Also, where the desired low fat stabilized bone product must have a particle size larger or smaller than that required for the production of gelatin, apparatus for crushing and sizing of the particles of bone can be varied to produce the required particle size in the final product. Other modifications will be obvious to those skilled in the art without departing from the scope of the herein disclosed invention and accompanying claims.

The term "stabilized gelatin bone" is a recognized standard term in the gelatin and glue arts meaning that the bone is able to withstand prolonged storage under ambient conditions without development of odor, discoloration or bug, bacteria, or fungal infectation; and that the bone must have a moisture content not in excess of 10 percent by weight after oven drying at a temperature over 180°F which is a kill temperature for any bacteria in the bone and a fat content below 3 percent by weight to prevent rancidity.

CLAIMS

1. A continuous process for cleaning and stabilizing raw bone comprising;

a reducing raw bone from its natural state to a size suitable for passing the raw bone into a press and continuously feeding said raw bone having moisture fat and meat tissue associated therewith into a said press with said press mounted within a cage having at least one wall provided with apertures smaller than the minimum size desired in the bone product.

b applying pressure by means of said press to said raw bone within said cage to force fat and meat tissue through said apertures in the cage,

c discharging pressed raw bone material from the cage separately from said fat and meat tissue discharged through said apertures with said pressed bone material having a particle size ranging between about 1/8 inch and about 1.5 inches and stripped of a substantial portion of said moisture, fat and meat tissue associated with said raw bone,

d continuously feeding pressed raw bone material having a particle size between about 1/8 inch and about 1.5 inches and having moisture and residual fat and meat tissue associated therewith into an oven dryer without heating said raw bone material in contact with liquid fat and heating said pressed raw bone material therein without scorching to reduce the moisture content and effect crisping fat and meat tissue remaining on said pressed bone

material whereby the fat and meat tissue remaining on said pressed bone material are adapted to be separated from the pressed bone material by fracturing during said heating and subsequent screening and gravity separation treatment,

e passing said bone material continuously through a screen separator means which removes all but a selected range of particle size from said bone material, and

f continuously feeding said bone material having the selected range of particle size to a gravity separator means from which high density clean stabilized bone product suitable for making high quality gelatin is recovered separately from low density material.

2. A process as in Claim 1, wherein said pressed bone material is subjected to a crushing means to further reduce the average particle size thereof to about 1/2 inch before feeding the pressed bone material into said oven.

3. A process as in Claim 2, wherein said heated bone material having a particle size above the selected range of particle size is recycled to said crushing means and again heated in said oven dryer.

4. A process as in Claim 1, wherein the heated bone material is cooled before passing said bone material into said separator means.

5. A process as in Claim 1, wherein the heated bone material having a particle size below said selected range is fed into a gravity separator means which recovers clean heavy fine bone material suit-

able for use in producing gelatin and glue products.

6. A process as in Claim 1, wherein bone material of the said selected range is subjected to an air separation treatment to remove the lowest density fraction therefrom prior to feeding said bone material to said gravity separator means.

7. A process as in Claim 1, wherein the lowest density material from said gravity separator means is recovered for producing bone meal material.

8. A process as in Claim 1, wherein a fraction of said selected particle size material intermediate said high density material and said low density material is recycled through said gravity separator means.

9. A process as in Claim 1, wherein said pressure is applied to said crushed raw bone material by feeding said raw bone material into a screw type press having an interrupted screw flight and a choke axially mounted at the discharge end of said cage which is adapted to provide pressure on said crushed raw bone material of between about 250 and 500 psi.

10. A process as in Claim 1, wherein said pressed bone material is baked in an oven dryer which has an oxygen-free atmosphere.

11. A process as in Claim 1, wherein said pressed bone material is baked in an oven dryer which has a dry atmosphere of superheated steam.

12. A process as in Claim 1, wherein said pressed bone material is baked in an oven dryer having a plurality of vertically spaced trays

continuously rotating about the vertical axis of the oven dryer with the bone material being moved through the oven dryer by being wiped off each tray onto a tray below by stationary wipers while continuously circulating a heated gas around said trays.

13. A process as in Claim 1, wherein said pressed bone material is heated to a temperature of about 250°F in an atmosphere of superheated steam to effect crisping in said pressed bone material.

14. A process as in Claim 1, wherein said selected particle size material is separated into essentially high density bone particles and essentially low density non-bone material by means of an inclined vibrating air table.

15. A process as in Claim 1, wherein the said pressed bone material which is fed into said oven dryer has a fat content of about 4 percent by weight of the bone material.

16. A high density clean stabilized bone product adapted for producing high quality gelatin when made from raw bone by the process of Claim 1.

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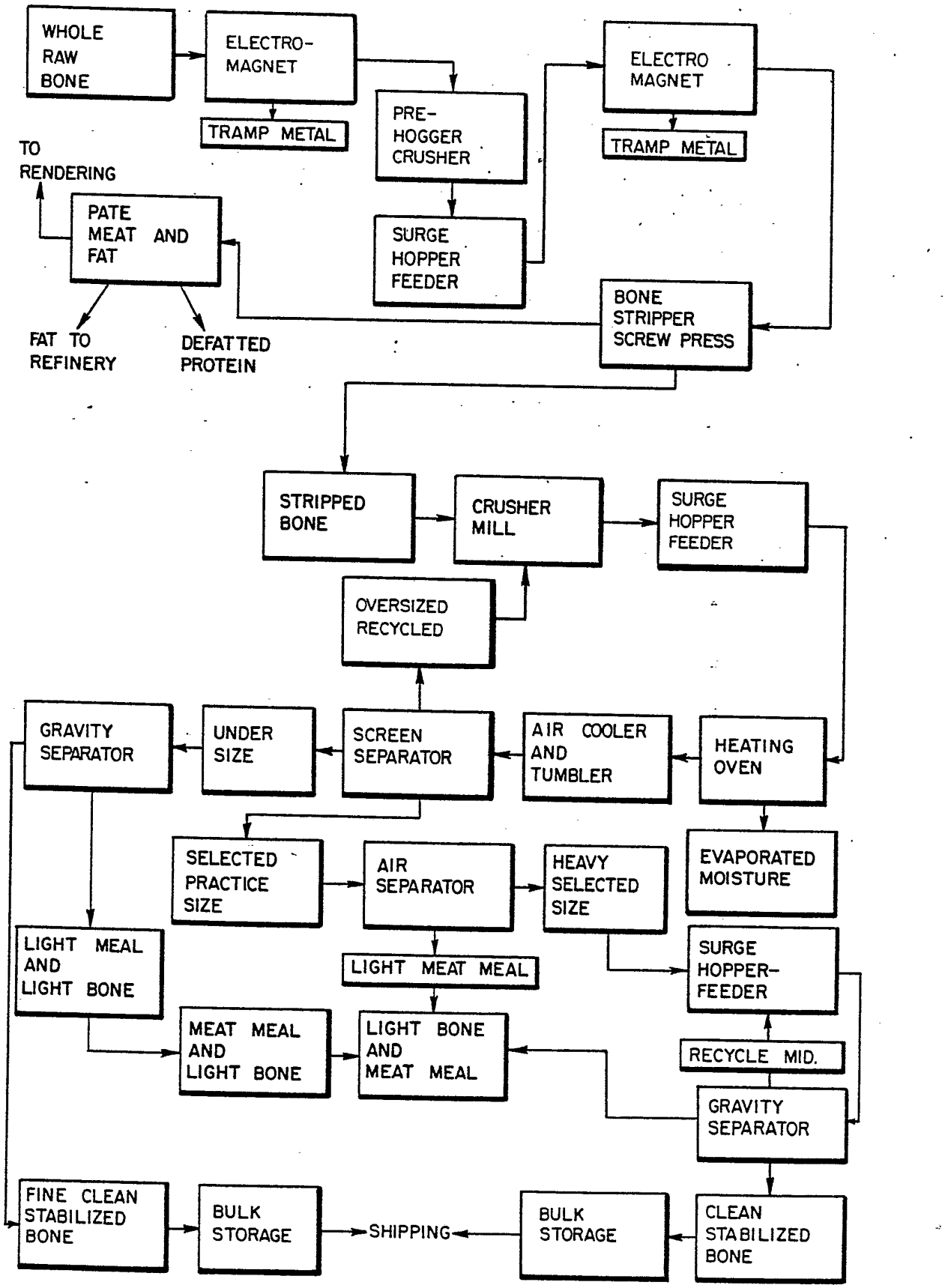

INTERNATIONAL SEARCH REPORT

International Application No PCT/US79/01032

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

INT. CL. A23L 01/31; A23P 01/00; B02C 23/08
U.S. CL. 426/480,646; 241/23,24; 17/46

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
U.S.	426/417,480,513,576,641,646,657;17/16,46;209/2,467; 241/23,24,29,65,68,69,74,76,77;260/117,118,412.6

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
X	US,A, 4,025,001, PUBLISHED 24 MAY 1977, YAREM ET AL.	1-16
X	US,A, 3,352,842, PUBLISHED 14 NOVEMBER 1967, LYON.	1-16
X	US,A, 3,352,841, PUBLISHED 14 NOVEMBER 1967, LYON.	1-16
X	SU,A, 502011, PUBLISHED 25 AUGUST 1976.	1-16
X	US,A, 3,180,880, PUBLISHED 27 APRIL 1965, HARRISON ET AL.	1-16
X	US,A, 2,875,222, PUBLISHED 24 FEBRUARY 1959, DORMITZER.	1-16
X	GB,A, 806705, PUBLISHED 31 DECEMBER 1958.	11,13
A	US,A, 3,906,118, PUBLISHED 16 SEPTEMBER 1975, McFARLAND.	1-16

* Special categories of cited documents: [15]

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"X" document of particular relevance

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
15 JANUARY 1980	25 JAN 1980
International Searching Authority [1]	Signature of Authorized Officer [20]
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