

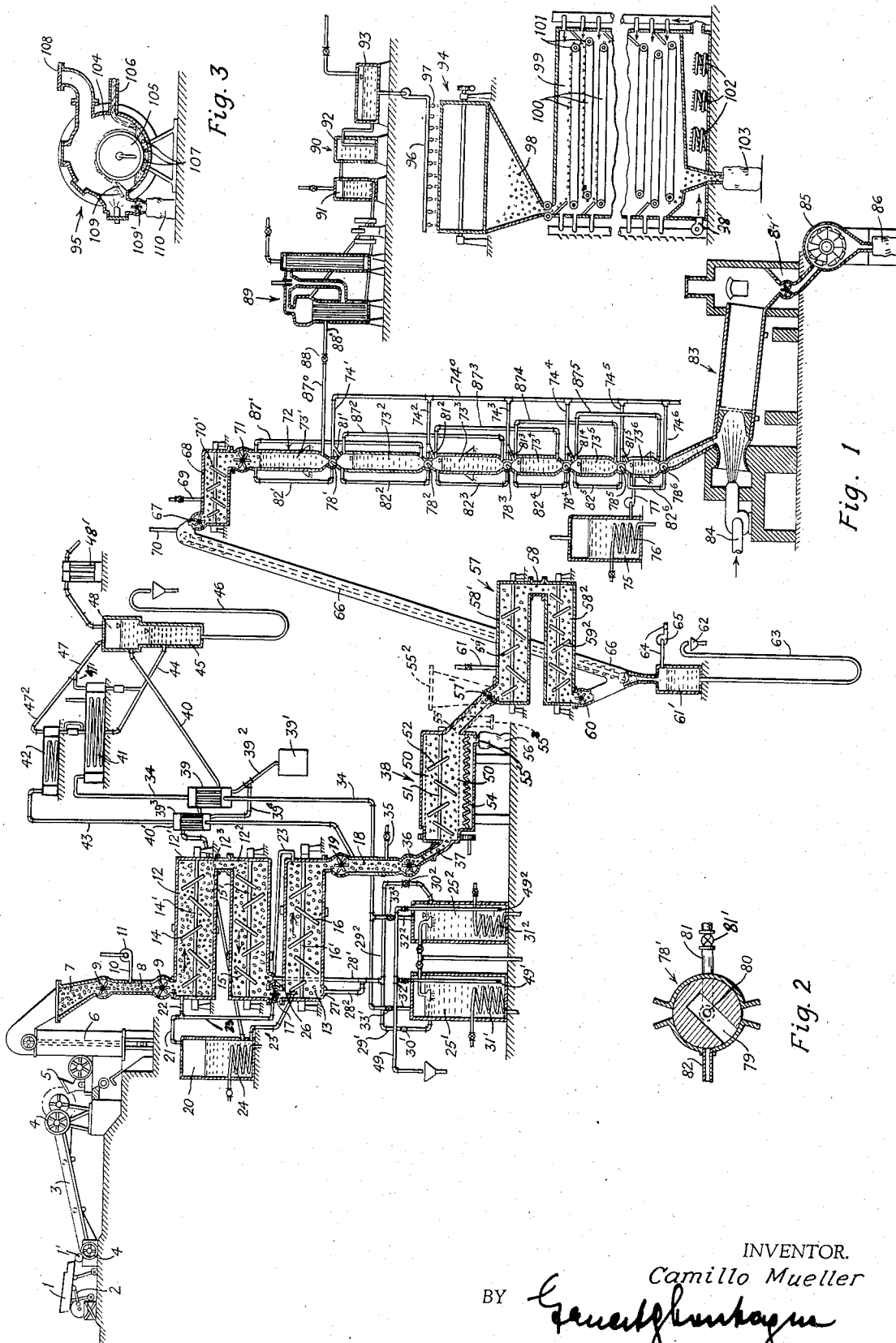
April 9, 1946.

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2,397,973

METHOD FOR PRODUCING GLUE FROM BONES

Filed March 4, 1942



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UNITED STATES PATENT OFFICE

2,397,973

METHOD FOR PRODUCING GLUE FROM BONES

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Application March 4, 1942, Serial No. 433,252

2 Claims. (Cl. 260—118)

This invention relates to a process for producing glue from bones and has for its object to provide a new continuous, improved method by subjecting the bones to a continuous chemical and mechanical treatment automatically during their steady movement through the apparatus.

The most important object of the present invention is to treat continuously small quantities of bones in the time unit and to expose the bone material the least time to the heat influence.

A further important object of the invention is to reduce the manufacturing cost at least 30%, which object may be achieved by carrying out the process automatically with an improved apparatus.

Another object of the present invention is the raise of the glue output for at least 6% of the output achieved with the old methods, that is at least 1% more than the former yield of glue out of the bones, together with a remarkable improvement in the quality of the glue. These objects are achieved in connection with a considerable reduction of time in the entire extraction, diffusion and drying process.

Still another object of the present invention is to reduce the investment for the plant to about one fourth of that hitherto used.

A further object is to provide a method for producing in a highly economic way glue out of bones in connection with industries which deliver bones as byproducts, as slaughter-houses, plants producing canned meat, or the like.

The invention will be more clearly understood with reference to the accompanying drawing which illustrates by way of example one preferred construction for carrying out the method of the invention.

Figure 1 is a partly sectional front view of the entire apparatus.

Fig. 2 shows a special construction of a valve and

Fig. 3 shows a variation of a drying device for the glue solution.

According to this preferred construction a device for the mechanical dressing of the bones is arranged, consisting of a moving board 1, which is driven by a crank 2 and is provided with a magnet wheel 1', and of a separating band 3 running over wheels 4, one of which is driven by a suitable source. Thus, after cleaning the bone material from nails and other parts, it is conveyed to a bone-breaker. The dressing device provides equal feeding and conveying of the

bones over the magnet wheel 1'. The front part of the magnet wheel only is magnetic, whereas the back part throws off the iron particles automatically. The bone material which moves over the magnet wheel 1', falls down to the separating band 3 and during the transport of the material on the band 3 paper, cardboard, horn, and other materials can be taken out. At the upper end of the band 3 the bones fall into the bone-breaker 5. Though any convenient bone-breaker can be used, preferably two of them, one after the other, are arranged, in order to assure the breaking-up of the bones into small parts. The broken bones are taken up by an elevator 6 from the breaker 5 into a charger 7 of the extraction device.

The charger 7 conveys the bones into a sluice-chamber 8 on the entrance and exit of which sluices 9 are arranged. The chamber or their sluices 9 are connected with a suction pump 11 through a pipe 10 in order to remove the air from the bones inside of the chamber 8.

The continuously rotating sluices 9 transport the material into the extraction vessels 12 and 13. The vessel 12 consists of two parts 12' and 12'' connected by a wide tube 12³. Each of the vessels 12', 12'', and 13 is equipped with a feeding device 14, 15, and 16, respectively, which feeding devices are mounted upon axles 14', 15', and 16' and assure a continuous flow of the material. The vessels 12', 12'' are connected by a sluice 17 with the vessel 13. The bone material is transported from the vessel 13 to a chamber 18 by a sluice 19 arranged at the end of the vessel 13.

A solvent vapor for fat is provided from a vaporizer 20 for treatment of the slowly moving bone material in the vessels 12 and 13. Preferably in the vessel 12 the solvent vapor passes in the moving direction of the bone material, whereas in the vessel 13 it passes against the moving direction of the material. In order to achieve the stream of the solvent vapor in different directions in the respective vessels 12 and 13, a pipe 21 is provided with two branches 22 and 23, one of which ends in the first vessel 12' at its entrance side and the other branch 23 ends in the second vessel at its exit side. The vaporizer 20 may have also a pipe 23' connecting said vaporizer 20 at its bottom with the vessel 13 introducing liquid solvent into the latter. Furthermore on the bottom of the vaporizer 20 a heating coil 24 is arranged in order to vaporize the solvent. Whereas the bone material is trans-

ferred to the chamber 18 the condensed vapors and the solution of grease are taken to the receivers 25' and 25², respectively, by arranging an exit 26 at the bottom of the vessel 12² and an exit 27 at the bottom of the vessel 13. It is possible of course to arrange more than one such exit in each vessel or to adapt additional exits (not shown) for the solvent vapor and steam on the top of the vessels 12² and 13. Both exits 26 and 27 are connected by pipes 28' and 28² with another pipe system 29' and 29² in which valves 30' and 30² are mounted, so that just one of the receivers 25' or 25² are connected with the vessels 12 and 13 at a time. The receivers 25' and 25² are equipped with heating coils 31¹ and 31² and on the top of each of the receivers are arranged exits for pipes 32' and 32² which are equipped with relief-valves 33' and 33² and are connected with a pipe 34 connecting the said receivers with a solvent vapor regeneration device.

The degreased and demoiatured bone material is treated in the chamber 18 with steam to 120° C. and for this purpose a steam pipe 35 is arranged with the chamber 18. By this operation the solvent, as benzene, which still might be in the bones will be vaporized. At the bottom of the chamber 18 another sluice 36 is arranged which transports the bone material through a channel 37 to the polishing cylinder 38.

As said before, the solvent vapor is regenerated and taken by a pipe 34 to the regeneration device. The pipe 34 connects the receivers with a condenser 39 which serves to warm up the solvent back to the vaporizer 20 through the pipe 40. The solvent vapor moves through the continued pipe 34 to another condenser 41 and the solvent condensed in the condenser 39 is moved through the pipe 39² to the container 39'.

The top of the chamber 18 is connected with a condenser 42 by a pipe 43. In this pipe 43 another condenser 39³ is arranged which serves to further warm up the solvent moved through the condenser 39 and then moved back to the vaporizer 20 through the pipe 40. The solvent vapor which is condensed in the condenser 39³ is moved through the pipe 39⁴ to the container 39'. A pipe system 44 connects both condensers 41 and 42 with the separator 45 in which the solvent, as benzene, swims on the water. There the condensed vapor is collected and the liquid solvent is held there on such a level that the return of it to the vaporizer 20 is assured by gravity. The balance for the solvent pile is achieved by a water pile 46.

The cooling medium in the condensers 39 and 39³ is liquid benzene moving back to the vaporizer 20, whereas that in the condensers 41 and 42 is advantageously water.

Both condensers 41 and 42 are connected with the air space 48 of the separator 45 through pipes 47' and 47² which end into a pipe 47 in order to remove the false air from the said condensers. The air space 48 of the separator 45 is connected with at least one safety cooler 48' in order to condense the last rest of the solvent vapor.

The grease removed from the bones is collected in the receivers 25' and 25², respectively, and when one of the said receivers is filled up, the fat is pushed out by steam pressure through the pipe 49' and 49², respectively, and through a pipe 49 taken to a container, in which it may be transported. The valves 33' and 33², respectively, are closed automatically, when a predetermined level is achieved in the receivers 25' and 25², respec-

tively, by known means. Special hand valves (not shown) may be adapted in the pipes 32' and 32² connecting said receivers 25' and 25² with the condensers, which hand valves are closed up some time after steaming the content and thus after having vaporized the last parts of the solvent by means of steam.

The bone material is conveyed from the chamber 18 to the polishing cylinder 38. This polishing cylinder 38 serves to clean the broken, degreased and dried bones from the dirt what seems essential to produce a good, clear glue. The polishing cylinder 38 consists of a drum 50 which rotates upon an axle 51. The drum 50 is preferably made of perforated sheet metal and the perforations 50' of the periphery of the drum 50 are tapered (not shown) extending outside of the drum 50 in order to assure the exit of the dirt removed of the bone particles. On the inside of the drum a feeding device 52 is arranged to assure the moving of the material to the outlets 55 of the polishing cylinder 38. The bone dust and dirt which falls through the perforations of the drum 50 is conveyed to the outlet 55' by a worm 54 to be filled up in sacks 56.

The process can be broken up now when merely broken, degreased, dried, and cleaned bones are to be achieved. On the other hand, the process can be started here by using already broken, degreased, dried, and cleaned bones which are exposed immediately to the maceration process. In the first case an outlet 55³ (dotted lines) is adapted to move out the so treated bones and in the latter case an entrance 55² (dotted lines) is arranged to charge the maceration device.

When the process prescribed before is continued the bone material is exposed to the maceration process in the bleaching and conserving device 57. The bleaching device 57 consists of two vessels 58' and 58² which are connected by a tube 58. A sluice 57' is arranged at the entrance of the bleaching device 57 and a feeding device 59' and 59², respectively, moves the bone material to the sluice 60 arranged at the outlet of the vessel 58². A special pipe 61 introduces the bleaching means into the vessel 58' and said bleaching means move in the same direction as the bone material. The treated bone material and the bleaching liquid exit together through the sluice 60. The liquid is collected in a container 61' and from there taken to a discharging hole 62. In order to provide the balance for keeping the level of the liquid a pile of water 63 is arranged. Above the level of the liquid a pipe 64 provides the connection with the suction pump 65. The suction pump 65 serves to achieve a vacuum in the elevator 66 which conveys the bone material to the glue producing device.

By this method the bleaching means, which still exist in the bone material, are removed and at the same time air and all other gases are removed from the bones and the latter are made ready for the following treatment. The bone material is conveyed by the elevator 66 through a sluice 67 to a smaller container 68 and it is treated with water through a pipe 70 before entering said container 68.

In the container 68 the first hydrolysis takes place by treatment of the bones with steam through a pipe 69. In this way the bone material is hydrolyzed and is now solvable in hot water. A feeding device 70' moves the bone material from the container 68 through the sluice 71 to the degluing device 72.

The degluing device 72 consists of a number of

progressively smaller containers 73', 73², 73³, 73⁴, 73⁵, and 73⁶, which number will depend upon the degree of the glue solution to be achieved. The diminution of the volume of the said containers is adapted to the shrinking of the bone material by the extraction process. The whole unit 72 of containers is under pressure, which pressure declines from the last to the first container and hot water, serving as extracting liquid, moves in countercurrent to the movement of the bone material, from the last container 73⁶ to the first container 73'. A steam pipe 74⁰ introduces steam through branch pipes 74', 74², 74³, 74⁴, 74⁵, and 74⁶ which enter into the said containers above the liquid level diminishing its pressure from the last container to 73⁶ up to the first container 73' by proper means and is also adapted to the height of the respective container in order to assure the continuous stream of the liquid from the last container 73⁶ to its associated container 73⁵ through the pipe 87⁵, from the container 73⁵ to container 73⁴ through the pipe 87⁴, and so forth, until the liquid flows under pressure continuously from container 73² to container 73' through pipe 87'. The glue solution moves then through the pipe 88' from container 73' to the evaporator 89. The balance in the pressure from the last container 73⁶ to the first container 73' is supported by the vacuum prevailing in the evaporator 89, whereby all containers may be exposed to a vacuum and the first container 73' to a vacuum of higher degree than that of the last container 73⁶. Thus the whole extraction process can be performed without any damage to the bone material.

As stated before, hot water is introduced into the last container 73⁶ from a vessel 75 with a heating coil 76 by means of a pump 77. Each one of the containers is only partly filled with liquid, though entirely filled with crashed bone particles and thus contains a gas space and a liquid space. The bone material moves continuously from the first container 73' through all associated containers 73², 73³, 73⁴, 73⁵, until it reaches 73⁶ and is then moved to the desiccator 83. Thus the bone material is forced to move first into the gas space of the first container 73', exposed there to steam hydrolysis until it reaches the liquid space of container 73'. A valve device moves the bone material into the next associated container 73² and reaches the gas space of the latter first, to enter the liquid space (diffusion space) of the same container 73² later. This process continues through all containers until the bone material moves through gas space and liquid space of the container 73⁶. The bone material is thus exposed to the hydrolysis process changing to the extraction process in each container.

Each container is connected with its associated container through a valve 78', 78², 78³, 78⁴ and 78⁵, respectively. The valves have such a construction that the bone material is moved from one container to its associated container. Any glue solution which is removed from that container together with the bones is returned to that container by means of steam pressure.

It can be learned from Fig. 2 that the valves 78', 78², 78³, 78⁴, and 78⁵ are constructed with a hollow part 79 and are equipped with an axial boring 80 ending into that hollow part 79. A steam pipe 81 with a valve 81', opened and closed by a cam (not shown) is connected with the boring 80 and besides the valve chamber is connected with a pipe 82 ending into the same container

from which the bone material and the liquid has been removed. The valves rotate constantly and when the hollow part 79 is open to the upper container, bone material and liquid will enter. Upon continuous rotation of that valve counterclockwise the opening of the hollow part 79 will come across the open end of the pipe 82. At the same moment the valve 81' is automatically opened and steam pressure introduced into the space 79. Branches 81', 81², 81³, 81⁴, 81⁵ are arranged from the pipes 74', 74², 74³, 74⁴, and 74⁵, respectively which feed the respective valves. The pipes 82', 82², 82³, 82⁴, and 82⁵ guide back into the containers from which the liquid has been removed and end near the top of the container above the liquid level. After removing the liquid from the hollow part 79 of the valve the bone material alone remains and upon further rotation of the valve that material will be delivered to the next lower container.

The so treated material, after having removed all the glue, is moved into a desiccator 83, in which the heating gases from the boiler may be used as heating source. A blower 84 is used in usual manner and the desiccator 83 is arranged in oblique position in order to move the dry material through a sluice 84', which closes up the desiccator 83, into a mill 85. After passing the mill 85 the bone material is filled up in sacks 86 and can be used as fertilizer or the like.

The about 15% solution of glue is passed through a pipe 87 with a throttle-valve 88 to a vacuum evaporator 89 consisting in usual manner of a heater and condenser in order to concentrate the glue solution to about 50%.

The so concentrated glue solution is transported to the bleaching device 90 which consists of three containers. The glue solution is treated in the first container 91 with bleaching and conserving means, as sulfurous acid, in the second container 92 with amorphous zinc, when sulfurous acid has been used, and the third container 93 serves to remove the sulfurous acid by providing a vacuum in the container 93.

The glue solution passes from the bleaching device 90 to a pearl producing device 94, a flake producing device 95 (Fig. 3), or some similar device.

The pearl producing device 94 which is arranged as a whole in a container cooled to about 10° C. consists of a tube 96 from which the glue solution exits in form of drops to a rotating drum 97. A scraper (not shown) takes the drops from drum 97 and after the drops have been collected in a container 98 they pass to a chamber 99 containing a number of endless bands 100 which move over rolls 101. The chamber 99 is heated by coils 102. From the chamber 99 the pearls are filled up in the sacks and the glue in shape of pearls is now ready for use. An air stream is achieved in the container 99 by a ventilator 99'.

Fig. 3 shows a device 95 for making glue in flake shape. The device consists of a container 104 in which a rotating drum 105 is arranged, the latter being heated by steam. The glue solution enters into the device through the pipe 106 and moves to the lower part of the container 104 in which vacuum is provided. In order to avoid the foaming of the glue solution cooling coils 107 are arranged on the bottom of the container 104. The drum 105 turns partly in the solution and parts of the latter are taken out by turning the drum 105. The vaporizing water is removed through the exit 108. After making one turn the glue is removed from the drum 105 by a knife

109 and the glue is moved in the shape of flakes through a sluice 109' into sacks 110 and is then ready for the market.

The herein described apparatus is designed particularly for a method of producing of glue from bones in a full automatic way by introducing the bones by means of a conveyor into the apparatus and receiving the glue and all other by-products without needing any service.

The first step in treating the bones, after breaking them, is the degreasing process. This is achieved automatically by moving the bones through preferably at least two vessels 12, 13, whereby vapors of a solvent, as benzene, are introduced into the first vessel 12 or the second vessel 13 in the moving direction of the bone material, whereas the solvent moves in the other vessel in counter-current to the movement of the bone material. It is also quite possible to use just one vessel in which the vapor moves either against or in the direction of the movement of the broken bones though the counter-movement of the vapor is preferred. After subjecting the bones to vapor in order to drive out the last rest of the grease, which still might be in the bones, they are exposed to a mechanical cleaning process by means of a polishing device 38, the degreased bone material being moved through the polishing device 38.

After finishing the mechanical cleaning process, the broken, degreased and cleaned bones are exposed to a bleaching process by moving them through a bleaching device 57 in which the bones are treated with bleaching and conserving means as sulfurous acid, of hydrogen peroxide, or peroxyd of manganese. Afterwards the bones are subjected to a vacuum in order to remove all bleaching means. Now the bones are steamed after being treated with water and thus exposed to the first hydrolysis process.

Thereafter the bones are exposed to the degluing process. The degluing of the material is achieved by exposing it alternately to the hydrolyzing and to the diffusion process. For this purpose the bone material moves through a number of containers whereas hot water is moved in countercurrent from the last to the first container. In the gas space provided for in each of the containers the hydrolysis process takes place by introducing steam. The degluing process is completed when in the last container no more glue is removed from the bone material.

Since the degluing device delivers a solution of about 15% glue it is necessary to concentrate the solution to about 50% for the further treatment of the glue. This is done by means of a vacuum evaporator 89. The 50% glue solution is then exposed to a bleaching, conserving and deodorating process. According to the present invention this is achieved in three steps. First the solution is treated with sulfurous acid or equivalent means, in the second step it is treated with amorphous zinc, when sulfurous acid is used and in the third step the sulfurous acid and any other gases are removed by vacuum exposure.

Having thus finished the chemical process, the

glue has to be dried and shaped to pearls, flakes or the like and then is ready for use.

By means of the present invention the period of the entire glue making process is considerably shortened and by working full automatically and continuously small quantities in a time unit a considerable saving in working material and in wages is achieved.

The new process can be carried out for example in the following manner:

In a time unit 400 weight parts of bones and 1500 weight parts of benzene for the degreasing process, 4 weight parts of sulfurous acid for the bleaching process of the bones and 4 weight parts of sulfurous acid for the bleaching process of the glue solution are introduced into the apparatus and after drying of the glue solution about 60 weight parts of glue is achieved.

I have thus described specifically and in detail the method and apparatus embodying the features of my invention as example only in order that the manner of constructing, applying, operating and using the invention may be fully understood, however the specific terms are used descriptively rather than in a limiting sense, the scope of the invention being defined by the claims.

What I claim as new and desire to secure by Letters Patents is:

1. A process of producing glue from bone material, comprising the steps of passing the said bone material in small quantities through each one of a plurality of containers connected in one series, subjecting said bone material during its passage through each one of said containers in the series to the action of a glue extraction liquid flowing in a steady stream, passing the glue extraction liquid from one container in the series to the next in a direction counter to the direction of movement of the bone material, removing the said bone material from each of said containers to the next adjacent container in small quantities during the action of the glue extraction liquid and finally from the last container in the series containing the bone material from which the greatest amount of glue has been extracted.

2. A process of producing glue from bone material, comprising the steps of passing the said bone material in small quantities through each one of a plurality of containers connected in one series, subjecting the said bone material during its passage through said containers intermittently to the action of a hydrolysis fluid and a glue extraction liquid flowing in a steady stream, passing the glue extraction liquid from one container in the series to the next in a direction counter to the direction of movement of the bone material from one container to the next, whereby the container at one end of the series contains the bone material from which the greatest amount of glue has been extracted, while the extraction liquid in said container contains the lowest concentration of glue, and removing in small quantities said bone material from the said last mentioned container.

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