June 11, 1946. F. H. REICHEL 2,401,774

PROCESS FOR TREATING PLASTIC TUBING

Filed Dec. 20, 1941 2 Sheets-Sheet 1

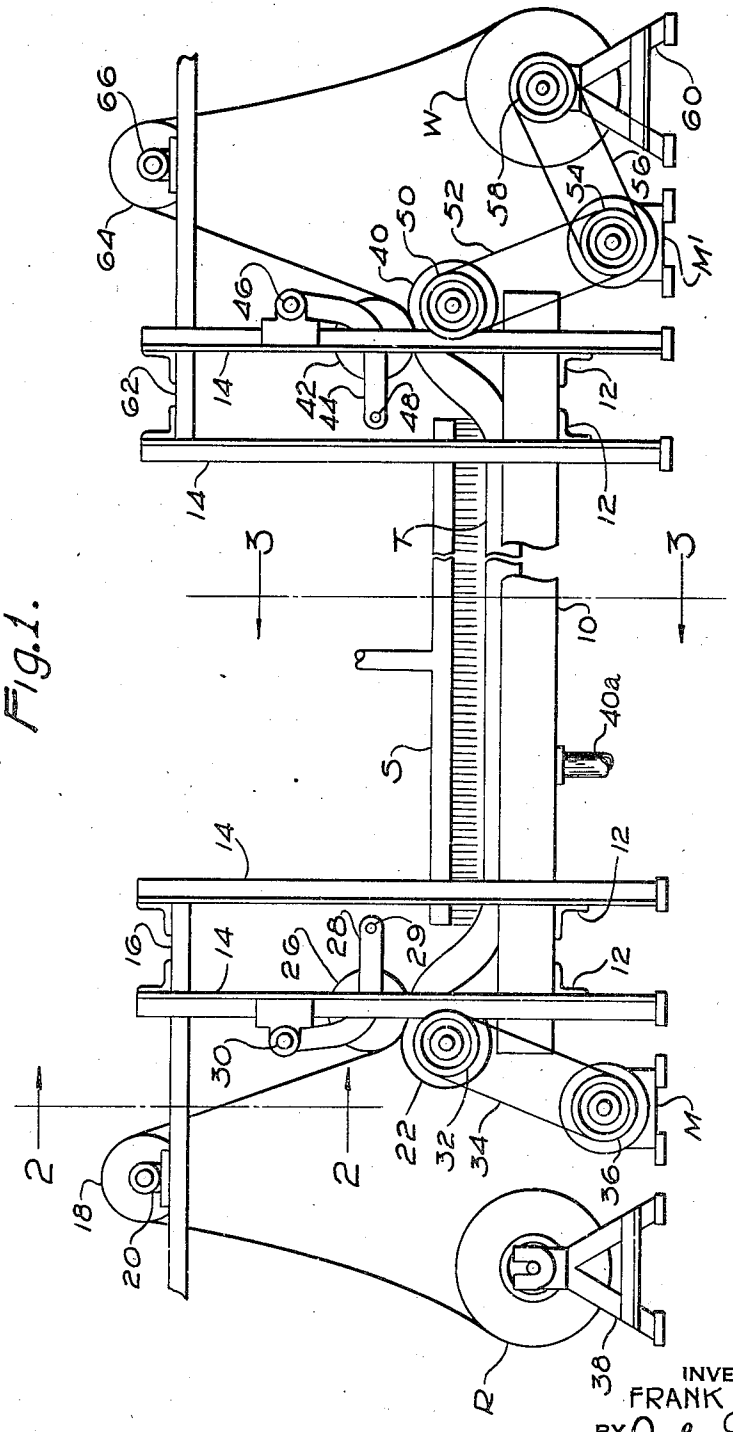

Fig. 1.

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Fig. 2.

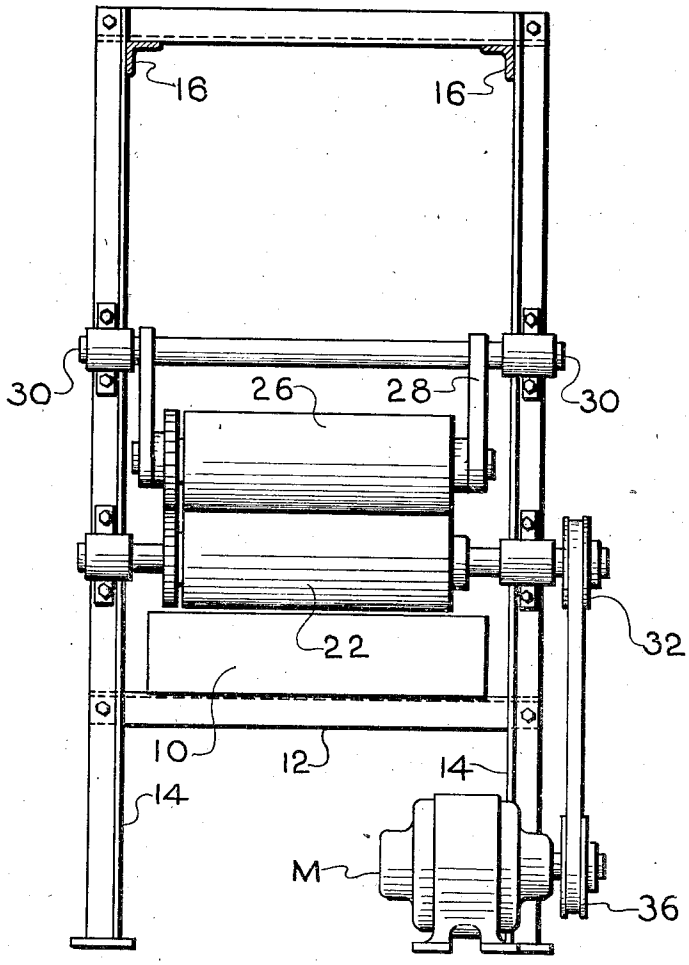
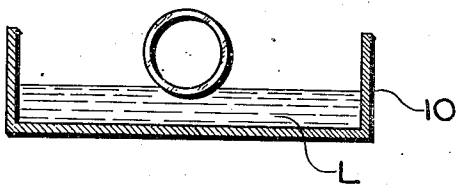


Fig. 3.



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PROCESS FOR TREATING PLASTIC TUBING

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12 Claims. (Cl. 18—57)

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The present invention relates to the production of tubing. More particularly, it relates to the expansion of tubing formed from flexible shrinkable materials while the tubing is wet and to the subsequent drying of the tubing.

In the formation of tubing from flexible, shrinkable materials, for example, the type of tubing used as artificial sausage casings and for other packaging and wrapping operations, it is frequently desirable that the tubing be expanded at some point in its production so as to test the tubing and so that the tubing will have a predetermined circumference after drying and/or after rewetting. In some instances, the tubing has been expanded during drying as by maintaining the tubing expanded with air during the drying operation so that when dry it will have a predetermined dry size.

This procedure has created many problems, however, since when the tubing is maintained in an expanded condition during drying without having been preexpanded, the expanded length of tubing is required to simultaneously undergo expansion, drying and shrinking. It is difficult to control all three of these operations satisfactorily because one is inevitably influenced by the other. Also, it is impossible as a practical matter to expand a tubing sufficiently to test it and at the same time dry it to its proper size during the same operation. This is because the tubing cannot shrink to its proper dry size if maintained under an expansion pressure which adequately tests the casing, that is, expands it to a size at least equal to and preferably greater than the maximum expanded size it will assume during stuffing, cooking, curing and other processing operations.

For the purpose of overcoming the difficulties presented by the simultaneous expansion and drying process, the operation of expanding the tubing prior to the drying operation has been adopted. The expanding has been accomplished either by the use of a gas such as air or a liquid such as water, and the expansion has usually been brought about by positioning a body of fluid within a casing between two pairs of squeeze rollers and suitably adjusting the volume of the fluid so as to expand the tubing the desired amount transversely between the two pairs of squeeze rollers which serve to seal off the part of the tubing between the squeeze rollers from the remainder of the tubing and maintain the fluid in position within the tubing as the tubing is passed continuously through the successive pairs of squeeze rollers. Since the tubing requires a reasonable time to set to an expanded size, it has been found desirable to utilize a relatively long length of tubing between the squeeze rollers so that the tubing could be expanded at a relatively high speed and still have sufficient time

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to partake of set. This has necessitated some support for the tubing such as a moving belt or the like because the static weight of the tubing and the fluid between the squeeze rollers, particularly when a liquid is used as the expanding fluid, imposes additional tensile stress on the tubing over and above that naturally caused by the expansion of the tubing and creates extraneous stresses which frequently cause breakage of the tubing even when the tubing would be fully capable of withstanding the expansion incidental to stuffing, curing, cooking and the like. The use of such supports has had some unsatisfactory aspects due largely to the fact that the supports collect dust and some inevitable slippage takes place between the expanded tubing and the supports which causes the tubing to be abraded and scuffed so as to make it unsightly and in some cases even punctured. Also, the part of the tubing which is in contact with the support is not free to expand to the same extent as the tubing which is not in contact with any solid surface, so that unequal expansion of the tubing around its periphery occurs.

It is an object of the present invention to provide a process for expanding tubing which overcomes all of the aforementioned difficulties.

It is another object of the present invention to provide a process of expanding tubing uniformly throughout the area of the tubing while supporting the tubing on a liquid which does not abrade nor restrict expansion of the tubing.

It is a further object of the present invention to provide a process of producing tubing which involves the expansion of wet tubing while supported on a liquid and the subsequent drying of the tubing.

Other objects and advantages of the invention will be apparent to those skilled in the art from recourse to the following detailed description of what are now considered the preferred embodiments of the invention.

The process of the invention in general comprises supporting a length of tubing on the surface of a body of water or other liquid, filling the tubing with a gas such as air until the tubing is expanded to the amount desired, permitting the tubing to remain in the expanded condition for the time necessary for it to take a permanent set to the desired wet size while, if desired, maintaining the entire surface of the tubing wet by a fluid spray, and thereafter drying the tubing either while inflated or deflated.

The invention accordingly comprises the several steps and the relation of one or more of such steps with respect to each of the others thereof, which will be exemplified in the process hereinafter disclosed, and the scope of the invention will be indicated in the claims.

For a more detailed description of the inven-

tion reference is made to the attached drawings, throughout the figures of which the same elements are represented by the same reference numerals and in which:

Fig. 1 is a side-elevational view of one form of apparatus for carrying out the process of the invention;

Fig. 2 is a vertical sectional view taken on the plane indicated by line 2—2 of Fig. 1 and looking in the direction of the arrows, and

Fig. 3 is a cross-sectional view taken substantially on the plane indicated by line 3—3 of Fig. 1 and looking in the direction of the arrows but with certain parts of the apparatus deleted for the sake of more clearly disclosing the feature to which Fig. 3 relates.

The reason for expanding tubing formed of flexible nonfibrous material, for example, regenerated cellulose, when such tubing is to be used as artificial casings for sausages and other food products, is that the casings are subjected to considerable expanding pressures when the food products and the like are filled into the casing during the stuffing operation and when the food products swell during cooking and curing. The high pressures involved frequently cause the casing to burst with a resultant waste of filling material as well as loss of time incidental to clearing away the debris caused by the failure. It has been found that such losses can be minimized by expanding tubing so used during its manufacture to a size at least equal to and preferably greater than the size to which the tubing is expanded during stuffing or curing operations for the dual purpose of testing the tubing and sizing the tubing so that lower stuffing pressures can be employed than were heretofore possible. During the preexpansion of such tubing, however, it is preferable that the tubing be uniformly wet over its entire area so as to insure that the tubing be uniformly expanded instead of overexpanded over the wet areas and underexpanded over the dry areas. It is also necessary that the expanding medium have as little static weight as possible so that the tubing is not called upon to support this unnecessary weight during the expanding operation as previously explained. In view of the fact that the tubing is of a relatively fragile nature, it is also necessary that it not be subjected to abrasion incidental to sliding it over supporting surfaces.

It has been found that relatively long lengths of tubing, for example, fifty to several hundred feet, can be supported on a relatively shallow body of water during expanding as well as moved without harming the tubing by pulling it through the body of water incidental to placing the tubing on the body of water and removing it therefrom.

Following expansion of the tubing while supported on the liquid, it may be further treated to dry and size it in accordance with the disclosures of patent application Serial No. 397,552, filed on June 11, 1941, in the names of Frank H. Reichel and Augustus E. Craver, and patent application Serial No. 399,560, filed on June 24, 1941, in the name of Frank H. Reichel.

Referring to the drawings, one form of apparatus capable of use in practicing the process of the present invention is illustrated in Fig. 1 and comprises a relatively shallow tank 10 which is supported by means of cross-pieces 12 carried by uprights 14. The uprights 14 are placed at each end of the tank and, if desired, may be placed at any desired interval along the length

of the tank 10 to provide the necessary support. The uprights 14 at the left end of the tank 10 as viewed in Fig. 1 support frame members 16 which have a roller 18 mounted for rotation thereon in suitable bearings 20.

At the left end of the tank 10 as viewed in Fig. 1, a roller 22 is suitably mounted for rotation on a pair of the uprights 14. The roller 22 is contacted by a roller 26 suitably supported for rotation in a frame 28 pivoted at 30 to the same pair of uprights 14. The end of the frame 28 opposite from the pivotal point 30 is provided with a cross bar 29 which serves as an operating handle by means of which the frame 28 and the roller 26 can be raised away from the roller 22 to provide for the insertion of tubing between the rollers. The shaft of the roller 22 carries a pulley 32 for rotation therewith and the pulley 32 is connected by means of a belt or chain 34 with a pulley 36 of a driving motor M.

A roller 40, similar to the roller 22, is mounted for rotation on a pair of uprights 14 at the right end of the tank 10 as viewed in Fig. 1. The roller 40 is contacted by a roller 42 suitably mounted for rotation in a frame 44 pivoted at 46 to the same pair of uprights. The end of the frame 44 opposite from the pivotal point 46 is provided with a cross bar 48 which serves as an operating handle by means of which the roller 42 can be raised away from the roller 40 to provide for the insertion of tubing between the rollers. The shaft of the roller 40 carries a pulley 50 for rotation therewith and the pulley 50 is connected by means of a belt or chain 52 with a pulley 54 carried by a driving motor M^1. The pulley 54 is preferably a double pulley and the portion which is not connected by means of the belt 52 with pulley 50 is connected by means of belt 56 with pulley 58 connected through a suitable friction mechanism (not shown) with a winding drum W suitably mounted for rotation in a supporting frame 60.

The uprights 14 at the right end of the tank 10 as viewed in Fig. 1 carry frame members 62, which rotatably support an idler pulley 64 by means of suitable bearings 66.

Tubing T is supplied by a reel R or any other suitable supply source. The reel R may be supported at the left end of the machine by a suitable supporting frame 38.

In the practice of the process of the present invention tubing T is removed from the supply roll R, passed over the idler roller 18, down between the rollers 22—26, along the liquid L in the tank 10 to the opposite end of the machine, and inserted between the second pair of pinch rollers 40—42. A supply of expanding fluid, for example air, is inserted within the tubing lying between the two pairs of pinch rollers by raising the frame 44 and inserting a fluid supply nozzle or other fluid-supplying device into the open end of the tubing and holding the tubing tightly about the nozzle or the like to prevent leakage of the fluid and thereby injecting sufficient fluid into the interior of the tubing T to expand it transversely to the desired diameter between the two pairs of pinch rollers. The frame 44 is then lowered to permit the pinch rollers 40—42 to collapse the tubing therebetween and seal an isolated substantially constant quantity of the expanding fluid within the tubing between the two pairs of pinch rollers. The motors M and M^1 are then started to feed the tubing T through the two pairs of feed rollers and horizontally along the liquid in the tank 10. The free end of the tubing T is

then passed up over the idler roller 64 and down to the wind-up reel W. The speeds of the motors M and M¹ are regulated by any well-known type of speed controllers (not shown) so that the rate of passage of the tubing T out from between the rollers 40—42 is exactly equal to the rate of passage of the tubing T into the rollers at the left-hand end of the machine. This does not necessarily mean that the speeds of the motors M and M¹ are exactly equal since the tubing may undergo some longitudinal stretching during the transverse expanding. The external diameter of the tubing is suitably measured from time to time by the use of calipers or some other suitable measuring device. If desired, an automatic calipering device may be employed to stop the machine if the tubing increases above or falls below a predetermined expanded size. When air is needed to bring the tubing to the desired diameter, the machine is stopped and a cut is made in the tubing behind the pinch rollers 40—42 through which the fluid supply nozzle may be inserted and air may be added by raising the frame 44 to separate the rollers 40—42 until the tubing expands to the desired size. The air may, of course, be added in front of the pinch rollers 22—26 instead of after the pinch rollers 40—42 if desired.

In the event it is desired to expand the tubing discontinuously, the tubing T is either severed just in advance of the rollers 22—26 or is slit sufficiently to permit the insertion of an air or other gas-supplying nozzle and the frame 28 is raised to permit the gas to pass into the tubing supported on the surface of the liquid L and to expand the tubing to the desired amount as indicated by the external size of the tubing by measuring with calipers or any other suitable measuring device. When the tubing T reaches the desired size the frame 28 is lowered to permit the rollers 22—26 to pinch and seal the tubing which is maintained in expanded condition between the rollers 22—26 and 40—42. After a sufficient time has elapsed to permit the tubing to undergo the desired amount of permanent set as determined by trial, and this time factor will vary with different tubing materials, the frame 28 is again raised and the motor M¹ only is suitably energized to pull the tubing along the water from which it is wound up onto the winding reel W. In this case the motor M may be suitably disconnected from the roller 22 by any well-known type of declutching device (not shown).

In the event the tubing was severed to permit the insertion of the air nozzle, the ends of the tubing are suitably connected so that the tubing being removed from the surface of the liquid supporting bath will draw additional tubing to be expanded onto the liquid support and subsequent lengths of tubing are expanded in the same manner. Each subsequent length of tubing is preferably joined to the immediately preceding length of tubing in any desired manner so as to permit the gas from the expanded tubing to flow into the tubing to be expanded to thereby at least partially fill the tubing to be expanded with the exhaust gas as it passes onto the liquid support.

In view of the fact that the tubing expands over wet areas more readily than over the dry areas, it is desirable that the tubing be maintained uniformly wet throughout the area being expanded, and to this end a suitable sprayhead S may be positioned above the tubing along the length of the tank 10 to keep the tubing wet over the entire area undergoing expansion. The water added by the spray S may be exhausted from the tank at any desired outlet or any number of outlets 40a. In addition to maintaining the tubing wet, the spray and supporting liquid L act as a wash for the tubing and thereby wash out any materials remaining in the tubing from the forming operation.

The process of the present invention may be employed in connection with tubing formed from all of the materials set forth in the above-mentioned patent applications.

The tubing may be plasticized or softened before, during or after expansion but before drying. It is preferred to expand the casing while in a wet state but before plasticizing, since by deferring the plasticizing step until after the expanding step, the loss of plasticizer is avoided in the event that the tubing breaks while expanding. Also, the thinner wall of the expanded tubing facilitates the plasticizing step in that less time is required for the plasticizer to penetrate entirely through the walls of the tubing. Any plasticizer or softener agent appropriate to the nature of the tubing material may be used. For example, with cellulose hydrate tubing, the plasticizer may be an aqueous solution of glycerine, a glycol, sorbitol, or the like. The tubing may be plasticized by passing it in a flat condition through a tank containing the plasticizing solution. For example, as by festooning it over a plurality of rolls so that at least the lower portions of the loops of the tubing pass into the plasticizing solution; or the tubing may have a plasticizing solution included on the interior of the tubing as well as on the exterior; or the plasticizing solution may be restricted to the interior of the tubing only so as to avoid the formation of deposits of excess plasticizer on the exterior of the tubing and place the majority of the plasticizer on the interior of the tubing where it facilitates stuffing and later removal of the casing from the stuffed product. The absence of free glycerine deposits on the external surface permits printing inks to spread uniformly and adhere tenaciously to the surface.

Tubing treated in accordance with the present invention may either be wet following the process of forming the tubing or may be rewet after once having been dried.

Casings which have been dried before being expanded by the present process may be conditioned for such expansion by first treating them with a suitable wetting agent having regard for the nature of the casing material. For example, dried cellulose hydrate tubing may be placed in a wet state by soaking in an aqueous solution of a wetting agent such, for example, as tergitol, aerosol, monopole oil or other wetting agent. Casings which have become wrinkled or otherwise distorted may be reshaped so as to remove the distortion and/or sized or resized at the same time by the process of the present invention.

It is to be understood that all expansion of the casing according to the present invention is independent of and distinct from any stretching to which the casing may have been subjected prior to denitration or prior to regeneration, as the case may be, for example, as disclosed in U. S. Patent No. 2,176,925. Any stretching of the tubing which is carried out before denitration or regeneration does not accomplish the novel results produced by expanding the casing after denitration or regeneration in accordance with the present invention.

The tubing which is to be expanded in accordance with the present invention may be produced

in any well-known manner, but preferably the tubing to be expanded by the present invention is produced according to said U. S. Patent No. 2,176,925.

Following expansion of the tubing while supported on the liquid bath it may be dried in a flattened condition, for example, in accordance with the disclosure of patent application, Serial No. 397,552, or in an expanded condition, for example, in accordance with patent application, Serial No. 399,560.

When the tubing has been expanded to the proper amount while supported on the liquid and dried in a flattened condition in accordance with the disclosures of patent application, Serial No. 397,552, it is severed into suitable lengths to form artificial sausage casings and when such casings are received by the packer, they are usually tied at one end and then soaked in water or some liquid which swells the casing material. The open end of the wet casing is slipped or shirred over the stuffing horn of any desired type of stuffing machine. While the casing is so held tightly about the horn by one hand of the operator, the latter operates a pedal or the like to release the product to be filled into the casing from the stuffing machine. The product, such as sausage meat, is ejected from the machine under pressure and is forced into the casing to fill the same and to expand the casing the small amount only which is necessary to insure that the casing closely conforms to the product introduced into the casing without wrinkles or bulges. When the end of the casing is reached, the operator stops the flow of the sausage meat from the stuffer and twists the casing to close the open end. While holding the twisted end of the casing, the operator then ties the twisted end or clips it in accordance with the usual procedure to close the casing. The stuffed food product is then passed for further smoking and curing operations in accordance with well-known prior art practices.

The small amount which it is necessary for the sausage meat to expand the casing in accordance with the present invention relieves the operator of the effort heretofore required to hold the casing against a high pressure. For example, while stuffing prior art casings, it has frequently been necessary to expand the casing in excess of 40 per cent. During stuffing of the casing of this particular modification of the present invention, an expansion of 10 to 18 per cent is all that is required to maintain the casing in tight contact with the casing filling at all times.

When the casing is expanded to the proper extent while supported on the liquid and is later dried in an expanded condition to produce a tubing of the type described in patent application, Serial No. 399,560, the predetermined diameter to which the casing is expanded is ascertained by trial and is selected so that the casing, after drying and rewetting, will have a circumference smaller than the circumference to which it will be stuffed. The difference between the rewetted circumference and the circumference immediately after stuffing is made as small as possible, having regard for the wall thickness of the casing and the physical characteristics of the material from which it is formed, so as to require a minimum stuffing pressure and, at the same time, cause the elastic forces exerted by the casing during stuffing to be sufficient to hold the product within the casing in a compact, shapely mass which is free from bulges such as would occur if the casing did not exert any pressure on the stuffing material during and subsequent to stuffing. An expansion to a diameter from 5 to 40 per cent greater than the diameter after stuffing has been found to be satisfactory.

When the casings are to be wet prior to stuffing, they are usually tied at one end and then soaked in water or some liquid which wets the casing material. The casings will then shrink when the stresses are relieved which were set in the casing by drying while in an expanded condition. The amount which the casing so shrinks is determined by the magnitude of the predetermined diameter to which the casing was expanded in the drier, and the rewet diameter will be just sufficiently smaller than the diameter to which the casing is to be stuffed to enable the casing to exert the necessary pressure upon the material stuffed into the casing to hold the material firmly in position and prevent bulging and wrinkling of the casing.

When the casing is stuffed while dry, one end of each of the dry casings as received by the stuffer is closed as by tying or clipping and the material to be filled into the casing is merely poured in from a suitable container or from a suitable spigot, nozzle or the like, while at atmospheric pressure. When the dry casing is thus filled in the same manner as one would pour any product into an open bag or the like, the upper end is closed as by gathering the casing and tying it or clipping it, and the stuffed casing is set aside for a short period. During this period the moisture within the filling material wets the casing and causes it to shrink in the same manner that the casing shrank when rewet prior to stuffing. The shrinkage of the casing while stuffed causes the casing to compress the filling material and force it into a compact, shapely mass which is of substantially uniform size throughout its area. The stuffed product is then passed for further treatment in accordance with well-known practices.

Tubing may be expanded while supported on the liquid and thereafter dried while merely held open without stretching the tubing transversely by an internally applied fluid pressure, for example, by an apparatus such as that disclosed in patent application, Serial No. 399,560. In this manner the cylindrical shape of the tubing is maintained during drying.

All of the specific examples set forth in the two aforementioned patent applications for the production of tubing are to be understood as applying to the process of the present invention.

The process of the present invention makes it possible to support tubing over a considerable area instead of merely a line contact as is the case when tubing is supported on a conveyor belt or a stationary surface, and at the same time the tubing is supported so as to make it impossible to abrade or in any way scratch the tubing. Also, the tubing is permitted to expand or contract during transverse expansion and in so doing move over the surface of the water without putting longitudinal stress within the tubing because of the ease with which the tubing can move over the surface of the water as contrasted to the friction which would be present if the tubing were resting on a solid surface such as a conveyor belt.

Since certain changes may be made in carrying out the above process without departing from the scope of the invention, it is intended that all matter contained in the above description

shall be interpreted as illustrative and not in a limiting sense.

The invention having been described, what is claimed is:

1. In a process of continuously expanding a film-forming hydrophilic organic plastic tubing to a predetermined size prior to drying, the steps comprising placing said tubing in the wet gel state, continuously advancing and expanding successive sections of the wet tubing to the predetermined size with an isolated substantially constant volume of a fluid and supporting the expanded section of the tubing horizontally on the surface of a body of liquid while so advancing the tubing.

2. In a process of continuously expanding a film-forming hydrophilic organic plastic tubing to a predetermined size prior to drying, the steps comprising placing said tubing in the wet gel state, continuously advancing the wet tubing while expanding it to the predetermined size by trapping an isolated substantially constant volume of gas inside successive sections of the tubing and floating the expanded section horizontally on the surface of a body of liquid while so advancing the tubing.

3. In a process of continuously expanding a film-forming hydrophilic organic plastic tubing to a predetermined size prior to drying, the steps comprising placing said tubing in the wet gel state, continuously advancing the wet tubing while expanding it to the predetermined size by trapping an isolated substantially constant volume of gas inside successive sections of the tubing, floating the expanded section horizontally on the surface of a body of liquid while so advancing the tubing, and continuously moistening the surfaces of the expanded section which are not in contact with said body of liquid.

4. In a process of continuously expanding a film-forming hydrophilic organic plastic tubing to a predetermined size prior to drying, the steps comprising placing said tubing in the wet gel state, continuously advancing the wet tubing while expanding it to the predetermined size by trapping an isolated substantially constant volume of gas inside successive sections of the tubing, floating the expanded section horizontally on the surface of a body of liquid while so advancing the tubing, and continuously flattening the expanded tubing.

5. In a process of continuously expanding a film-forming hydrophilic organic plastic tubing to a predetermined size prior to drying, the steps comprising placing said tubing in the wet gel state, continuously advancing the wet tubing while expanding it to the predetermined size by trapping an isolated substantially constant volume of gas inside successive sections of the tubing, floating the expanded section horizontally on the surface of a body of liquid while so advancing the tubing, and thereafter drying the tubing.

6. In a process of continuously expanding a film-forming hydrophilic organic plastic tubing to a predetermined size prior to drying, the steps comprising placing said tubing in the wet gel state, continuously advancing the wet tubing while expanding it to the predetermined size by trapping an isolated substantially constant volume of gas inside successive sections of the tubing, floating the expanded section horizontally on the surface of a body of liquid while so advancing the tubing, continuously flattening the expanded tubing, and thereafter drying the tubing while in said flattened condition.

7. In a process of continuously expanding a film-forming hydrophilic organic plastic tubing to a predetermined size prior to drying, the steps comprising placing said tubing in the wet gel state, continuously advancing the wet tubing between spaced pairs of pressure rollers, expanding the section of tubing to the predetermined size between said rollers with an isolated substantially constant volume of a fluid, and supporting the expanded section between said rollers horizontally on the surface of a body of liquid while so advancing the tubing.

8. In a process of continuously expanding a film-forming hydrophilic organic plastic tubing to a predetermined size prior to drying, the steps comprising placing said tubing in the wet gel state, continuously advancing the wet tubing between spaced pairs of pressure rollers, expanding the section of tubing to the predetermined size between said rollers with an isolated substantially constant volume of a gas, and floating the expanded section horizontally on the surface of a body of liquid while so advancing the tubing.

9. In a process of producing artificial sausage casings formed of a hydrophilic organic plastic material, the steps comprising placing said tubing in the wet gel state, continuously advancing a length of wet tubing while expanding it to a predetermined size by trapping an isolated substantially constant volume of a gas inside successive sections of the tubing, floating the expanded section horizontally on the surface of a body of liquid while so advancing the tubing, maintaining the expanded section in a moist condition, continuously flattening the tubing, and drying the flattened tubing.

10. In a process of continuously expanding to a predetermined size regenerated cellulose tubing formed by the denitration of nitrocellulose tubing in the course of which the tubing is subjected to a liquid treatment, the steps comprising continuously advancing a length of the tubing while it is in the wet gel state resulting from said liquid treatment, expanding successive sections of the wet tubing to the predetermined size with an isolated substantially constant volume of a gas, and floating the expanded section of the tubing horizontally on the surface of a body of liquid while so advancing the tubing.

11. In a process of continuously expanding to a predetermined size regenerated cellulose tubing formed from viscose by coagulation and regeneration, in the course of which the tubing is subjected to a liquid treatment, the steps comprising continuously advancing a length of the tubing while it is in the wet gel state resulting from said liquid treatment, expanding successive sections of the wet tubing to the predetermined size with an isolated substantially constant volume of a gas, and floating the expanded section of the tubing horizontally on the surface of a body of liquid while so advancing the tubing.

12. In a process of continuously expanding to a predetermined size a regenerated cellulose tubing, which during formation, is subjected to a liquid treatment, the steps comprising continuously advancing a length of the tubing while it is in the wet gel state resulting from said liquid treatment, expanding successive sections of the wet tubing to the predetermined size with an isolated substantially constant volume of a gas, and floating the expanded section of the tubing horizontally on the surface of a body of liquid while so advancing the tubing.

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