July 9, 1968 B. H. SCHENK ET AL 3,392,073

METHOD FOR MAKING FIBROUS WEB REINFORCED CELLULOSIC CASINGS

Original Filed July 13, 1959 4 Sheets-Sheet 1

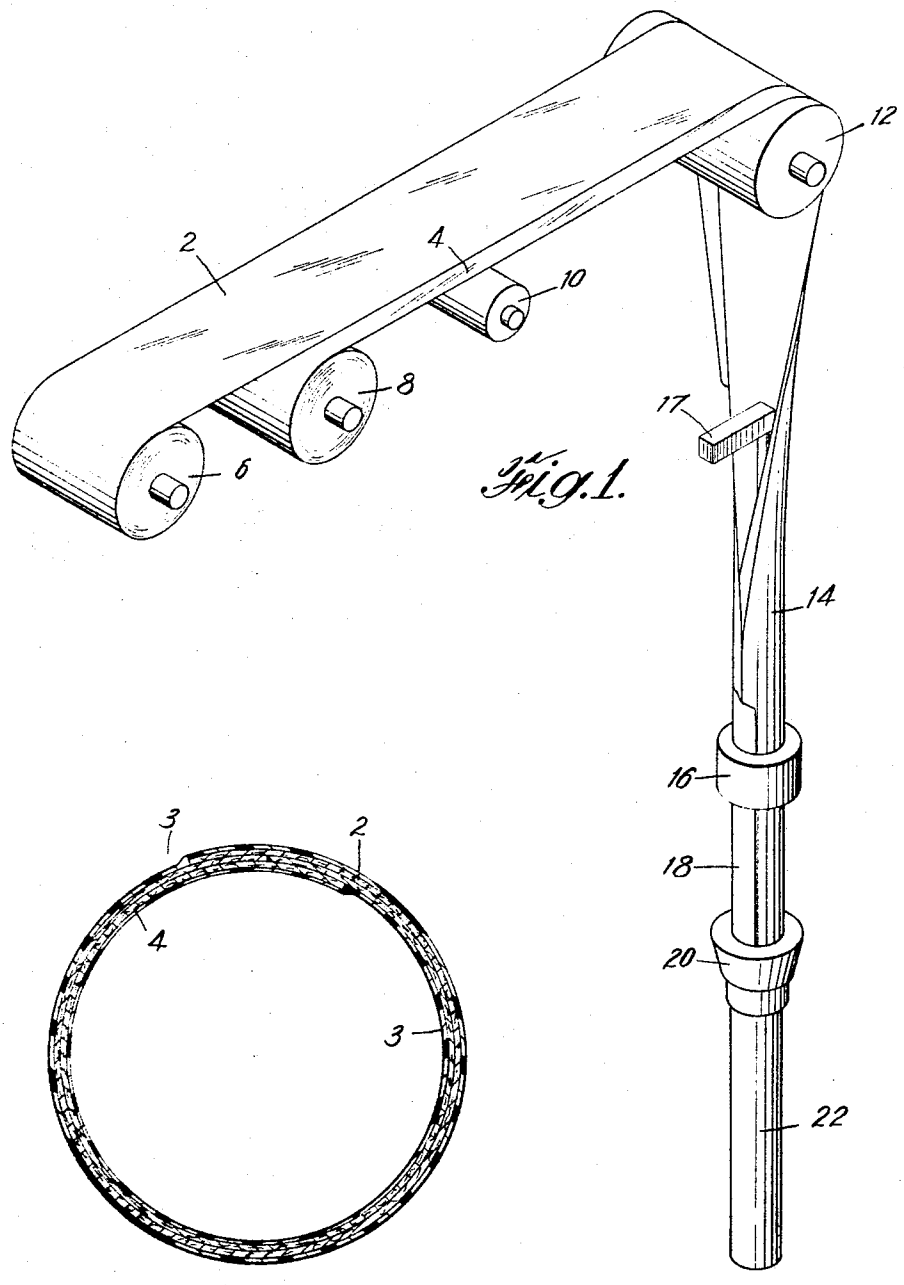


Fig. 1.

Fig. 2.

INVENTORS
BERNARD H. SCHENK
JAMES W. MOSHER
BY John J. Holman
ATTORNEY

July 9, 1968 B. H. SCHENK ET AL 3,392,073

METHOD FOR MAKING FIBROUS WEB REINFORCED CELLULOSIC CASINGS

Original Filed July 13, 1959 4 Sheets-Sheet 2

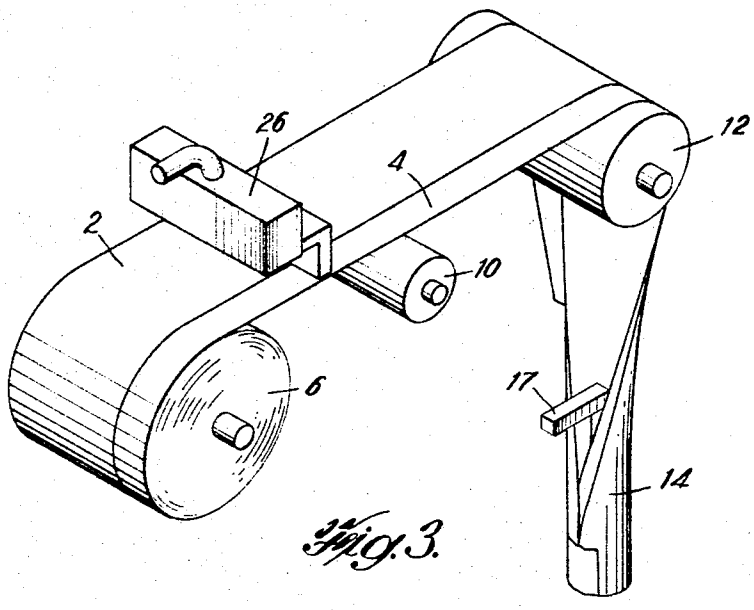


Fig. 3.

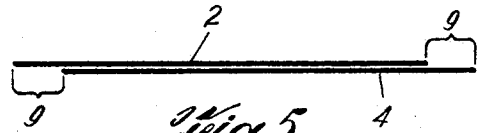


Fig. 5.

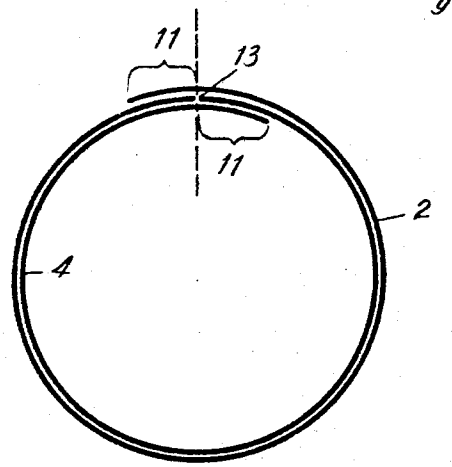


Fig. 6.

INVENTORS
BERNARD H. SCHENK
JAMES W. MOSHER
BY
ATTORNEY

July 9, 1968 B. H. SCHENK ET AL 3,392,073

METHOD FOR MAKING FIBROUS WEB REINFORCED CELLULOSIC CASINGS

Original Filed July 13, 1959 4 Sheets-Sheet 3

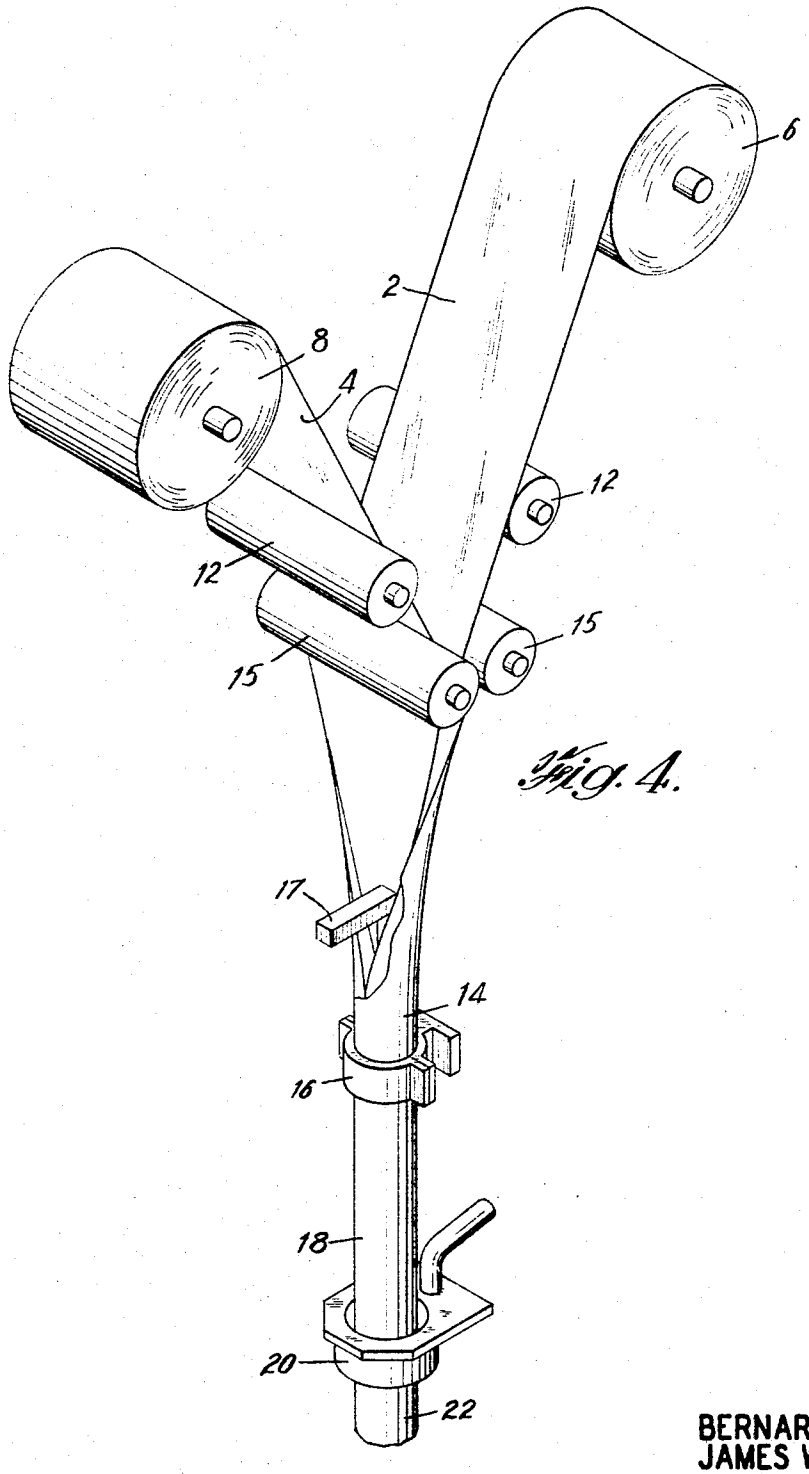


Fig. 4.

INVENTORS
BERNARD H. SCHENK
JAMES W. MOSHER
BY John F. Hohmann
ATTORNEY

July 9, 1968 B. H. SCHENK ET AL 3,392,073

METHOD FOR MAKING FIBROUS WEB REINFORCED CELLULOSIC CASINGS

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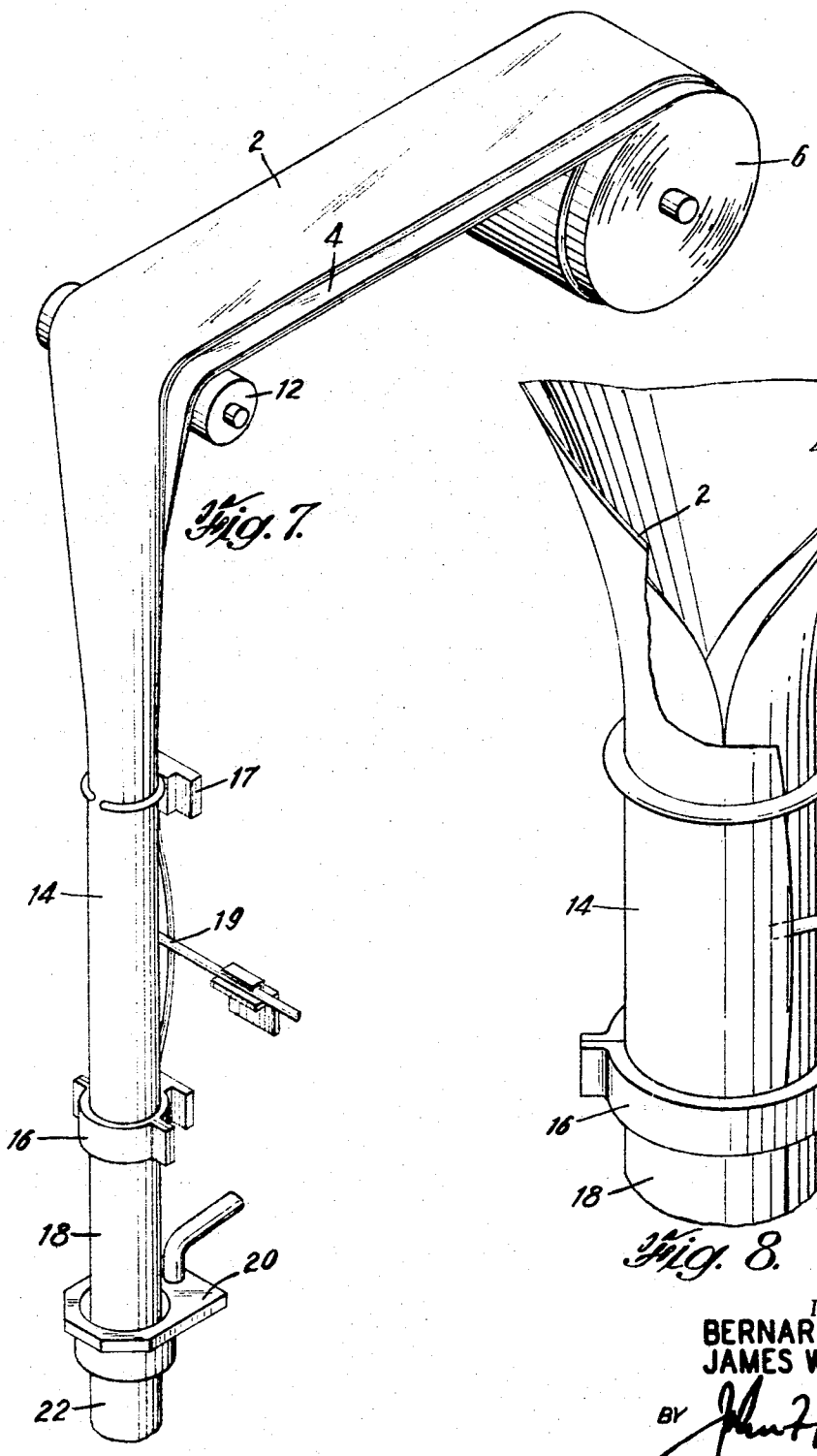


Fig. 7.

Fig. 8.

INVENTORS
BERNARD H. SCHENK
JAMES W. MOSHER
BY
ATTORNEY

United States Patent Office 3,392,073 Patented July 9, 1968

3,392,073

METHOD FOR MAKING FIBROUS WEB REINFORCED CELLULOSIC CASING

Bernard H. Schenk, Hinsdale, and James W. Mosher, Chicago, Ill., assignors to Union Carbide Corporation, a corporation of New York

Original application July 13, 1959, Ser. No. 826,660, now Patent No. 3,104,682. Divided and this application June 4, 1963, Ser. No. 285,254

6 Claims. (Cl. 156—203)

ABSTRACT OF THE DISCLOSURE

A method is provided for obtaining a reinforced, fibrous, cellulosic tubing by superimposing at least two continuous fibrous web strips upon each other, forming them into a tubular cross-section, impregnating the thusly formed tubular, fibrous web with viscose and then regenerating the cellulose in the viscose.

This application is a divisional of application No. 826,660 filed July 13, 1959, now U.S. Patent 3,104,682.

This invention relates to a fibrous web reinforced cellulosic tubing having improved strength and durability and to a method for producing same. More particularly, it relates to such a tubing, wherein the fibrous reinforcing web is comprised of a plurality of plies or layers.

In the manufacture of cellulosic tubing having a reinforcing web embedded therein, a thin long-fibered single ply paper strip is curved about its longitudinal axis to form a tubing with overlapping longitudinal edges. Viscose is applied to the surface to coat and impregnate the web and also to the edges to seam and seal the tubing. The composite tubing is drawn through a regenerating bath which effects regeneration of the cellulose. The reinforced cellulose tubing is then drawn through purifying water baths, and is softened by passing through a bath containing a small percentage of a hygroscopic agent, such as glycerin. The tubing is dried by passing it in an inflated condition through a heated drying chamber. The cellulosic casing may be reeled and stored on rolls or it may be cut into desired lengths. Such a process is disclosed in U.S. Patent No. 2,105,273.

Cellulosic tubings produced in this manner are tough and strong. They may be used as containers or casings for sausages, meats, or other articles of food. The use of these tubings in the meat processing industry has met with a great deal of success. However, there is a continued demand for casing with greater strength to withstand the severe handling to which such casing is subjected.

One method of obtaining such a tubing is to increase the fiber content in the web used for reinforcement. This method, however, increases the cost of producing the tubing. Furthermore, there is some variability in the density of fiber distribution in single ply web structures resulting in nonuniformity and attendant localized weak points in the final reinforced tubing. Increasing the fiber content will not of itself eliminate this nonuniformity and therefore does not proportionally increase the strength. The weak points referred to herein are generally thin spots in the web. Also, many of the web structures used for reinforcing cellulosic sausage casings contain agglomerations and in many instances these agglomerations are thick spots adjacent to thin spots. The nonuniformity of the reinforcing web due to the thin spots and agglomerations results in low strentgh areas which tend to rupture under normal processing conditions.

An additional problem in the manufacture of such tubing for use as food casings is that of coloring the casings for sales appeal, product identification and other reasons. In using single ply reinforcing web tubing where

the web is pre-colored, it is sufficiently contiguous to the food product that there is sometimes a transfer of the coloring matter or dyes in the web to the food product itself. Consequently, such coloring matter must undergo rigid inspection and testing by the Food and Drug Administration to assure that it is non-toxic. The contained product is also discolored due to such transfer. Present processes utilized in the industry for coloring such casings are presently quite expensive and involved due to the special coloring agents and processes that must be used to assure non-toxicity and to avoid transfer. A casing capable of using less expensive coloring materials and methods would consequently reduce the cost of producing colored fibrous web reinforced casings.

It is accordingly an object of the present invention to provide an improved fibrous web reinforced cellulosic tubing and a method of making same.

It is a further object to provide such an improved tubing having increased strength and durability without increasing the overall fiber content.

It is a further object to provide such an improved tubing by utilizing a plurality of reinforcing webs.

It is a further object to provide such an improved tubing in which the longitudinal seam therein is of reduced thickness.

It is a still further object to provide a colored fibrous web reinforced tubing wherein all portions of a pre-colored reinforcing web are separated from contact with objects contained within the tubing by at least one thickness of a web free of coloring agent.

Further objects and advantages will be apparent from the specificaton and drawings in which:

FIGURE 1 is a schematic isometric of one type of apparatus which may be used in forming a fibrous web reinforced regenerated cellulose tubing according to the invention using two plies of said fibrous web.

FIGURE 2 is an exaggerated transverse cross-section of a multiple ply fibrous web reinforced cellulosic tubing illustrating one type of seam formed by the overlapping edges of the multiple ply web.

FIGURE 3 is a schematic illustration of another apparatus for producing such reinforced cellulosic tubing wherein viscose is allowed to penetrate the reinforcing prior to the formation of the tubing.

FIGURE 4 is a schematic illustration of still another apparatus for producing such tubing wherein the reinforcing plies are axially aligned prior to formation of the tubing.

FIGURE 5 shows two plies of reinforcing web positioned in an offset manner prior to formulation into a tube to allow for reduction in marginal thickness.

FIGURE 6 is a schematic of the tubing made from the offset plies of FIGURE 5, showing the reduction in seam thickness.

FIGURE 7 is a detailed schematic isometric view illustrating apparatus for forming tubing having multiple plies of a reinforcing web wherein the plies are prelaminated.

FIGURE 8 shows conventional apparatus used in forming and seaming of the cellulosic tubing.

According to the invention there is provided a fibrous web reinforced cellulosic tubing having improved strength and durability which comprises a plurality of layers of said fibrous reinforcing web seamed along their longitudinal edges to form a tube and thoroughly impregnated with a cellulosic material.

It has been found that when two layers of paper or other material are used to form the reinforcing web, each having one-half the total basis weight normally employed for the manufacture of reinforced cellulosic tubing that the tubing has tensile, wet tears and Mullen values greater than when the casings are reinforced with a single ply having about the same total basis weight. Thus there is

provided a reinforced cellulosic tubing with added strength and without the added cost of increasing the fiber content.

The basis weight of the web or paper as used herein is equivalent to the ream weight which is the weight in pounds of 480 sheets, size 24" x 36". The basis weight in pounds is determined as follows: Weight in grams of 91.47 sq. inches of paper $\times 10$, corrected to 50% relative humidity. The conversion factor is taken into account by the size of the template and factor of 10. (See ASTM Designation D646–50, Basis Weight of Paper and Paper Products, ASTM Stds. on Paper and Paper Products and Shipping Containers, September, 1955). Thus the total basis weight of the reinforcing web is directly proportional to the total fiber content.

Tensile, wet tear, and Mullen values are specific ASTM tests and will be more completely designated with reference to the examples following the description of the invention.

FIGURE 1 shows an apparatus for preparing a multiply fibrous web reinforced cellulosic tubing according to one embodiment of the invention. In this apparatus two strips of paper **2** and **4**, from rolls on individual unreelers **6** and **8**, are carefully superimposed on one another so that their edges are parallel and laterally displaced and drawn over tension bar **10**, over guide roll **12**, subjected to curvature about their longitudinal axis around forming mandrel **17** to form a tube **14** with overlapping and abutting longitudinal margins. A strip of viscose is applied to the underlying and abutting margins as shown at **19** in FIGURE 8 and the tubular formation **14** passes through a forming ring **16** which effects seaming the margins. Seamed tube **18** then passes through a viscose coating ring **20** which applies the viscose to the outer surface of tube **18**. The coated and impregnated tube **22** passes into a coagulating and regenerating-bath, not shown since it is well known in the art, and then through additional purifying and glycerin baths.

FIGURE 2 is an enlarged cross sectional view taken across the completed tubular casing of FIG. 1 showing the reinforced cellulosic casing having two plies of reinforcing web. The two layers of the web **2** and **4** are impregnated with cellulose **3** which has penetrated both layers of paper to bond them together. The details of the three-layer overlapping and abutting seam are also evident in this view.

In another embodiment of this invention shown in FIG. 3, two rolls of lightweight paper are carefully superimposed on one another so that their edges are parallel and laterally displaced and are then rewound together on a single roll to permit the unwinding of these two plies of paper from one standard unreeler. The method of manufacture from here on is the same as hereinbefore described. The figure shows both rolls of paper on one unreeler **6** leaving unreeler **6** as plies **2** and **4**, passing over tension bar **10** and around guide roll **12**. Furthermore, to prevent any separation of the two plies of paper in their passage from unreeler **6** to the forming ring (**16** of FIGURE 1), viscose from supply head **26** can be applied to the top ply **2** of the paper just after its departure from the unreeler **6**. Application of the viscose at this point permits the viscose to penetrate into the lower ply **4** of the paper, thus minimizing relative motion between the plies **2** and **4**.

Still another feature of the invention as shown in FIGURE 7 is to laminate two plies of lightweight paper, **2** and **4**, which have been superimposed on one another so that their edges are parallel and laterally displaced, with dilute viscose, regenerate the viscose to bond the plies and then dry the two-ply strip and wind it on a reel as a single sheet of laminated web. The method of manufacture of the casing from here on is the same as hereinbefore described for FIG. 1.

In this latter embodiment the preferred practice is to laminate two plies of lightweight paper with viscose regenerate the viscose with heat and thereafter wind on a reel.

Another method of practicing the invention as illustrated in FIG. 4 is to utilize two rolls of lightweight paper on separate unreelers placed well apart and laterally displaced in relation to each other and brought together, from widely divergent points, at the closest possible point to the nozzle of the forming ring. In this manner the webs are most readily superimposed in lateral displacement.

In FIGURE 4, one roll of lightweight paper is placed on unreeler **6** and one roll is placed on unreeler **8** which is laterally displaced from unreeler **6**. The two strips of paper, **2** and **4** are drawn from unreeler **8** and **6** respectively over guide rolls **12** and brought together at nip rolls **15**, are formed into a tube and pass through forming ring **16** where they are carefully superimposed on one another so that at least two opposing edges of said layers abut each other and at least two opposing edges thereof overlap each other and thus formed into a single tube with overlapping and and abutting longitudinal edges. A strip of viscose is applied to the underlying and abutting edges, and tube **14** passes through forming ring **16** which effects seaming of the edge. Seamed tube **18** then passes through a viscose-coating ring **20** which applies a coating to the outer surface of tube **18**. Coated tube **22** passes into a coagulating and regenerating bath, not shown, and then through additional purifying and glycerination baths.

Another feature of this invention is to produce a seam of equal strength and durability but with a substantial reduction in thickness as compared to a conventional overlap seam, e.g., 25%. FIG. 5 illustrates the plies of paper positioned in such a manner that a portion **9** of each ply extends a distance equal to the overlap necessary to make the seam for the tube. In FIG. 6 it is shown that the extent of the overlap **11** is equivalent in length to the offset distance **9** of FIGURE 5. The advantage of so positioning the plies of paper to minimize the overlap at the seam is clearly illustrated in FIGURE 6 which shows three plies of paper at the seam **13**. This method of positioning the plies of paper can be used with the methods and apparatus of FIGS. 1, 3, 4 or 7.

The following examples illustrate the greater durability obtained by this invention wherein two plies of paper are used instead of a single ply and wherein the total basis weight for the two plies were substantially equal to that of the single ply.

Table I indicates the strength values obtained from conventional single ply reinforced tubing. For these tests a fibrous web of the indicated basis weight was made into tubing by the method described in U.S. Patent 2,105,273 using a viscose composition of 7% cellulose, 6% caustic and an index value of 40.

The index value is the number of cc.'s of a 10% acetic acid solution required to completely gel 100 grams of viscose at room temperature. The test results on this tubing are shown in Table I.

In Example 1–5 of Table II, two plies of a paper web each having a basis weight of 6.77 were used. Each ply was fed from a separate reel. The webs were removed from the reels, aligned as shown in FIGURE 1, and formed into tubing by the method illustrated in FIGURE 1, and impregnated by the method shown and described in U.S. Patent 2,105,273 using a viscose composition of 7% cellulose, 6% caustic and an index value of 40. The test results are shown in Table II.

Table I shows the results obtained when fibrous tubing is used comprising a single ply of paper such as is normally used in casings for processed meats such as sausage, bologna, etc.

The Examples of Table II show the results obtained when a fibrous tubing according to this invention is used. The table clearly illustrates that tubing comprising a multitude of layers of paper has greater durability than conventional single ply reinforced tubing. At the same time,

the fiber content of the cellulosic impregnated fibrous tubing has not significantly increased.

TABLE I

Sample	Number Plies of Fibrous Web	Basis Wt. Each Ply, lb./ream	Wet Tears [1] (force in grams)		Wet Tensiles [2] (lbs./sq. in.)		Mullen Values (lbs./ sq. in.	
			Mach. Dir. TAPPI	Trans. Dir. TAPPI	Mach. Dir.	Trans. Dir.	Dry	Wet
1	1	12.5	168	195	5,359	4,513	69.9	35.8
2	1	12.6	178	235	5,946	4,815	71.7	38.5
3	1	12.5	165	206	5,335	4,493	60.6	35.6
4	1	12.0	152	189	5,463	4,716	60.9	35.6
5	1	13.0	178	227	5,979	4,918	78.8	38.3

[1] ASTM Designation D689-44; ASTM Stds. 1952. TAPPI-T414m-49.
[2] ASTM Test D882-54T-C; ASTM Stds. on Plastics, October 1955, p. 222.
[3] ASTM Designation D774-46; ASTM Stds. 1955.

TABLE II

Sample	Number Plies of Fibrous Web	Basis Wt. Each Ply, lb./ream	Wet Tears [1] (force in grams)		Wet Tensiles [2] (lbs./sq. in.)		Mullen Values (lbs./ sq. in.	
			Mach. Dir. TAPPI	Trans. Dir. TAPPI	Mach. Dir.	Trans. Dir.	Dry	Wet
1	2	6.77	200	248	7,077	5,000	97.7	55.3
2	2	6.77	216	256	7,394	5,675	84.2	48.8
3	2	6.77	208	232	7,923	5,701	85.0	51.8
4	2	6.77	224	264	7,024	5,900	87.3	56.2
5	2	6.77	240	256	7,209	5,225	87.6	55.8

[1] ASTM Designation D689-44; ASTM Stds. 1952. TAPPI-T414m-49.
[2] ASTM Test D882-54T-C; ASTM Stds. on Plastics, October 15, p. 222.
[3] ASTM Designation D774-46; ASTM Stds. 1955.

To further illustrate the dramatic increase in strength obtained by using multiple plies of the fibrous web, each test result in Table I was divided by the total basis weight of the webs used to show the result per unit basis weight. This is shown in Table III.

TABLE III.—RATIO OF TEST RESULT/BASIS WEIGHT (TOTAL)

For Table I

	Wet Tears		Wet Tensiles		Mullen Values	
	Mach.	Trans.	Mach.	Trans.	Dry	Wet
Sample:						
1	13.4	15.6	428.7	361.0	5.59	2.86
2	14.1	18.6	471.9	382.1	5.69	3.06
3	13.2	16.5	426.8	359.4	4.85	2.85
4	12.7	15.7	455.2	393.0	5.08	2.97
5	13.7	17.5	459.9	378.3	6.06	2.95

For Table II

Example:						
6	14.8	18.4	524.2	370.4	7.24	4.10
7	16.0	19.0	547.7	420.4	6.24	3.61
8	15.4	17.2	586.9	422.3	6.30	3.84
9	16.6	19.6	520.3	437.0	6.47	4.16
10	17.8	19.0	534.0	387.0	6.49	4.13

A further advantage of the present invention is realized in the production of colored tubular food casings. As stated previously, when a pre-colored reinforcing web is utilized in the manufacture of single ply reinforced tubing, difficulty is encountered due to transfer of the coloring agent to the product therein. By means of the present invention, particularly the embodiment disclosed in FIG. 6, such transfer can be eliminated.

In producing a colored tubing according to the present invention the outer web or layer of reinforcing material is dyed or pigmented per se. The multi-ply web is then formed into a tubing and impregnated with cellulosic material in the manner hereinbefore described with the colored web occupying the outer layer of the multi-ply tubing. It may thus be seen that there are one or more layers of non-colored reinforcing web between the colored web and the inside of the tubing. The separation or barrier formed by the non-colored web has been found to prevent coloring agent transfer.

To completely eliminate contact of the pigmented or dyed web of the casing with the food encased therein, the manner of offsetting the layers disclosed previously in conjunction with FIGURE 6 would be used. It will be noted that if layer **2** of FIGURE 6 is dyed or pigmented, no contact is made between this layer and the ingredients encased therein.

The coloring of the reinforcing web may be accomplished by dyeing or pigmenting to produce the desired color, e.g., TiO_2 for a white casing, carbon black for a black casing. This may be done either at the time of manufacture or subsequently. Pigmenting or dyeing of the paper is well known to those in the art of paper manufacturing.

A paper formed of hemp fibers bonded together with regenerated cellulose is preferred as the fibrous reinforcing web. However, other nonwoven reinforcing webs, such as Yoshino paper, rice paper, hemp, nylon, polyethylene terephthalate, acrylonitrile, rayon and cotton may be used. Woven fabrics such as cheesecloth, muslin, marquisette, organdy, voile and the like can also be used.

This invention, furthermore, is not limited to any given number of plies of fibrous reinforcing web. It can be readily appreciated that the number of plies can be varied depending on the basis weight of each ply and the total overall basis weight of reinforcing web desired.

While the invention has been described with reference to regenerated cellulose or viscose as the impregnating material for the multi-ply web, other cellulosic materials namely, cellulose acetate, cellulose derivatives, such as cuprammonium cellulose, and the ethers such as ethyl cellulose could be used without departing from the spirit and scope of the invention.

It is also to be understood that while apparatus for externally impregnating the formed fibrous tubing with cellulosic material has been set forth and described as the preferred method, internal impregnation by any well known method and apparatus could be utilized. Such internal impregnation has some advantage in forming a final casing having a high degree of smoothness which facilitates parting of the casing from the product contained therewithin. However, for most applications external impregnation is sufficient.

The other characteristics of the casing such as moisture vapor, smoke permeability, flexibility and printability are substantially unchanged.

There has thus been shown and described a superior fibrous web reinforced cellulosic tubing having improved strength and durability and a method for making same. These improvements are achieved without increasing the total reinforcing fiber content and without substantially affecting the cost.

While the invention has been described with reference to certain preferred embodiments, it is to be understood that certain modifications and substitutions may be made without departing from the spirit and scope of the invention.

We claim:

1. A method for producing fibrous web reinforced cellulosic tubing having increased strength which comprises

superimposing at least two parallel and adjacent continuous fibrous web strips upon each other so that their edges are laterally displaced, forming said superimposed strips into a tubular cross-section, seaming the edges of said strips together to form a tubular member, having abutting and overlapping edges impregnating said tubular member with viscose, and regenerating the cellulose in said viscose in situ.

2. A method for producing a high strength fibrous web reinforced cellulosic tubing which comprises passing at least two parallel and adjacent fibrous web strips past a treating station in superimposed laterally displaced contacting relationship, impregnating the strips with a viscose solution at said treating station, passing the strips through forming and seaming means to form a tube having overlapping and abutting edges by longitudinally seaming the strips at said edges, impregnating the thus formed tube with more viscose and passing the impregnated tube through a regenerating bath, and subsequently washing and drying the tube.

3. A method as set forth in claim 2 wherein the cellulose in the viscous impregnated fibrous web strips is regenerated prior to the tubular formation.

4. A method for producing high strength fibrous web reinforced cellulosic tubing which comprises superimposing at least two adjacent fibrous reinforcing webs upon one another so that their edges are parallel and laterally displaced with respect to each other, impregnating the strips with a cellulosic material to form a single laminated fibrous web reinforcing strip, forming the laminated fibrous web reinforcing strip into a tubular cross section, seaming the overlapping and abutting edges with cellulosic material to form a tubular member, and impregnating the tubular member having abutting and overlapping edges with additional cellulosic material.

5. A method for producing a high strength fibrous reinforced cellulosic tubing which comprises superimposing two fibrous web reinforcing strips upon one another so that their edges are parallel and laterally disploced, forming said strips into a tubular cross section, seaming said strips to form a tubular member wherein the outer edge of the resultant inner strip abuts the inner edge of the resultant outer strip and the inner edge of the inner strip and the outer edge of the outer strip overlap each other and impregnating the tubular member with a cellulosic material.

6. A method for producing a colored high strength fibrous reinforced cellulosic tubing which comprises superimposing a colored and an uncolored fibrous web reinforcing strip upon one another so that their edges are parallel and laterally displaced, forming said strips into a tubular cross-section with the colored strip exterior to the uncolored strip, seaming said strips to form a tubular member wherein the outer edge of the inner strip abuts the inner edge of the outer strip and the inner edge of the inner strip and the outer edge of the outer strip overlap each other, and impregnating the tubular member with a cellulosic material.

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EARL M. BERGERT, *Primary Examiner.*

H. F. EPSTEIN, *Assistant Examiner.*