

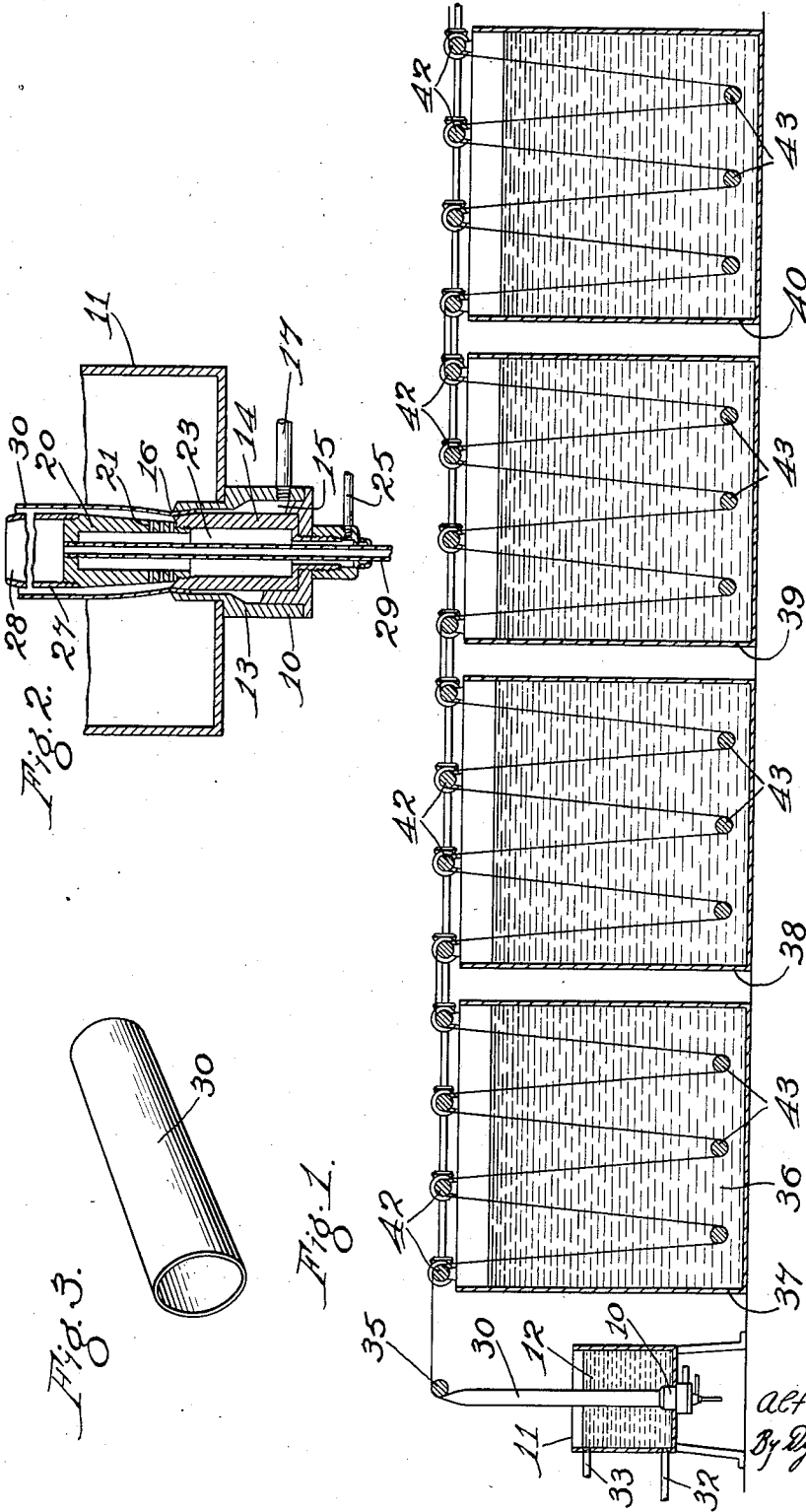
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METHOD OF PRODUCING CELLULOSE ARTICLES

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METHOD OF PRODUCING CELLULOSE ARTICLES

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The invention relates to articles formed from cellulose, and to a method of producing them, the primary object of the invention being to provide improved seamless cellulose tubing and an improved method of producing it.

Substantially all, if not all, of the seamless tubing heretofore manufactured has been obtained by extruding viscose through an annular orifice into a coagulating bath which precipitated the cellulose xanthate out of the aqueous solution, the tubing formed being then subjected to a regenerating bath which re-acted chemically with the cellulose xanthate to reduce it to cellulose or cellulose hydrate.

When the method described above is practiced, it is necessary to advance the tubing over rollers, or the equivalent, through the regenerating bath and as gases are evolved in relatively large quantities during the regenerating operation, the tubing becomes distended to such an extent that it is necessary to slit it at relatively frequent intervals so that the gases may escape. Unless the tubing is slit at proper intervals, the tubing is distended to too large a diameter and its walls are weakened and some times ruptured.

In practicing the improved method, the viscose is extruded continuously through an annular orifice directly into a coagulating and regenerating bath of such strength that substantially all of the gases evolved within the tube during the regenerating operation may escape through the extruding apparatus. Thus, while the tube is being formed, the evolved gases escape through that end of the tubing issuing from the annular orifice. The tubing thus obtained is of a superior quality and, in addition, is free from slits or punctures so that there is rarely waste from such causes.

Other objects and advantages of the invention will become apparent as the following detailed description progresses, reference being had to the accompanying drawing, wherein:

Figure 1 is a somewhat diagrammatic central vertical section taken through apparatus which embodies the invention.

Fig. 2 is a fragmentary central vertical section taken through extruding apparatus which forms part of the apparatus shown in Fig. 1, and

Fig. 3 is a perspective view of a short length of seamless cellulose tubing which is formed by practicing the improved method.

Referring to the drawing, wherein a preferred form of the invention is illustrated, the reference character 10 designates, generally, extruding apparatus which is mounted in the bottom walls of

a receptacle 11 adapted to hold a coagulating and regenerating bath 12.

The extruding apparatus is illustrated in detail in Fig. 2, and it will be noted that it comprises a housing member 13 which co-operates with a hollow core 14 to form an annular chamber 15. At its upper end, the annular chamber 15 terminates in an annular orifice 16 through which viscose may be extruded from the chamber 15 into the bath 12. The viscose is supplied to the chamber 15 under pressure through a pipe 17 which is connected to any supply (not shown) of viscose.

Screw-threaded in the upper end of the hollow core 14 is a hollow member 20 which forms an extension thereof and is provided with a plurality of apertures 21 at its lower end. A chamber 23 formed within the hollow core 14 and the hollow member 20 communicates with the exterior of the hollow member 20 through the apertures 21. The coagulating and regenerating solution is supplied to the chamber 23 under pressure through a pipe 25 which is preferably connected to a suitable supply (not shown) of coagulating and regenerating solution. Screw-threaded upon the upper end of the hollow member 20 is a hollow member 27, the upper end of which is open, as shown at 28 in Fig. 2. Secured to the hollow member 20 and extending through the chamber 23 is a tube 29.

The construction is such that the coagulating and regenerating solution discharged into the chamber 23 through the pipe 25 flows through the apertures 21 to engage the inner surface of the tubing which is extruded from the annular orifice 16, the outer surface of the tubing being subjected to the coagulating and regenerating solution which constitutes the bath 12. The tubing is identified by the reference character 30 in the several figures. The coagulating and regenerating solution which flows up through the apertures 21 and treats the inner side of the tubing 30 overflows into the open end 28 of the hollow mandrel 27 and is discharged through the tube 29.

The bath 12 is preferably supplied with a coagulating and regenerating solution which is drawn from the same source (not shown) as that from which the chamber 23 is supplied. Thus, the regenerating liquid is discharged into the receptacle 11 through a pipe 32 and the overflow is discharged through a pipe 33.

When the tubing 30 passes from the bath 12 it passes over a roller 35 and thence to a bath 36 in a tank 37. From the tank 37, the tubing is advanced through wash tanks 38 and 39 which

are preferably supplied with running water. After the tubing has been washed with water in the tanks 38 and 39, it is treated with a softening agent, preferably glycerine. In this instance, an aqueous solution of glycerine is provided in a receptacle 40, which solution of glycerine impregnates the tubing 30 with sufficient glycerine so that it will not become too dry and crack.

Driven rollers 42 disposed above the tanks 36, 38, 39 and 40 provide means for advancing the tubing, idler or driven rollers 43 in the several tanks being employed to guide the tubing there-through.

The coagulating and regenerating solution may be defined either as an aqueous solution of sulfuric acid and sodium sulfate, or as an aqueous solution of sodium bisulfate and sulfuric acid, but for the purpose of this disclosure, it will be treated as the former, it being readily understood that proportions given in connection with one definition may be translated into corresponding proportions for the other.

The percentages of sulfuric acid and sodium sulfate employed in the bath will be determined by the thickness of the film, the length of time the tubing is immersed in the bath, and the temperature of the bath.

In practice, a temperature of 33° C. has been found to give satisfactory results, and is easily maintained. At this temperature the aqueous solution employed as the bath 12 preferably comprises 8% to 11% sulfuric acid and approximately 15% of sodium sulfate, the exact percentages depending upon the thickness of the extruded film and upon the speed at which the tubing is advanced through the bath. Sodium sulfate is accumulated as a result of the reaction which takes place between the acid and the viscose, and the higher the concentration of sodium sulfate, the higher the concentration of acid must be, as sodium sulfate tends to mask the action of the acid and retards the regenerating re-action. Under the conditions just described, the bath will maintain itself and reach an equilibrium when the percentage of sodium sulfate amounts to from 13 to 17% of the bath.

If the temperature of the coagulating and regenerating bath is lowered, the concentration of acid in the bath can be considerably above 11% and if the temperature of the bath is increased less acid may be employed. If the temperature of the bath were increased to 45° C., the bath might comprise approximately 6.5% sulfuric acid and would give satisfactory results, and by further increasing the temperature, it is possible, although not desirable, to decrease the acid until it constitutes about 5% of the bath.

The bath 36 is employed principally as a safety measure so that all of the cellulose xanthate will be subjected to the regenerating action. The solution employed in the bath 36 may be identical with the solution employed in the bath 12 and may be drawn from the same source (not shown) of supply. However, a bath 36 having a smaller percentage of acid than the bath 12 has been employed with satisfactory results.

After the tubing has been advanced through the baths 12 and 36, it is advanced through the water which is held in the tanks 38 and 39 and is then subjected to the softening agent, preferably glycerine, disposed in the tank 40.

Relatively large quantities of gases are evolved during the regenerating re-action and the gases evolved within the tubing distend it as illustrated in Fig. 1, wherein the tubing is shown distended

from the annular orifice 16 to the roller 35. The gases evolved are mainly carbon-disulfide, carbon-dioxide and hydrogen sulfide, with hydrogen-sulfide predominating. Heretofore, it has been necessary to slit or puncture the tubing at relatively frequent intervals to permit escape of the gas. However, when the improved method is practiced so that the viscose is extruded directly into a solution adapted to regenerate, the gases escape through that end of the tubing being formed at the annular orifice. In the apparatus shown in the drawing, the gas escapes through the tube 29 and is discharged into the air. An extremely high percentage of the total amount of gas evolved during the regenerating operation is evolved and discharged from the tubing before it passes over the roller 35 and, therefore, it is rarely necessary to permit the escape of gas from the sections of tubing trained over the rollers 42 and 43. In fact, when the improved method is practiced, the casings of the smaller sizes need never be punctured to eliminate gas. This is advantageous, as it is then unnecessary to discard lengths of punctured tubing during a subsequent drying operation which includes the step of inflating the casings as described in U. S. Letters Patent No. 1,612,508 granted to W. F. Henderson et al., December 28, 1926.

When the improved method is practiced, it is a relatively simple matter to produce cellulose tubing, which is of a uniform and superior quality and has a wall which is of a constant thickness. The tubing has a high tensile strength, which property is exceedingly advantageous when the tubing is employed as casings for sausage, etc. The tensile strength of the tubing permits rapid operation of the apparatus for producing it and, therefore, effects a saving in labor costs, etc.

While I have shown and described certain embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims in which it is my intention to claim all novelty inherent in my invention as broadly as possible, in view of the prior art.

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

1. A method of forming seamless cellulose tubing which comprises extruding viscose in tubular form into an extrusion bath comprising a solution of a plurality of compounds, one of said compounds being primarily a coagulating agent and the other of said compounds being primarily a regenerating agent, using the latter in sufficient concentration to mainly regenerate the material as a result of its passage through the extrusion bath, passing the tubing over a carrier element disposed above the extrusion bath and serving to effect flattening of the tubing, and discharging the trapped gases through the extrusion end of the tubing.

2. A method as specified in claim 1, in which the compounds employed comprise sulfuric acid and sodium sulphate, said sulphuric acid comprising at least approximately 5% of the aqueous solution.

3. A process as set forth in claim 1, in which the compounds employed are sulphuric acid and sodium sulphate, the sulphuric acid comprising

from 8% to 11% of the solution and the sodium sulphate comprising approximately 15% of the solution.

5 4. A method as specified in claim 1, in which the compounds employed are sulphuric acid and sodium sulphate, the sulphuric acid comprising from 8% to 11% of the solution and the sodium sulphate comprising approximately 15% of the solution, said solution having a temperature of
10 substantially 33° C.

15 5. A method of producing seamless cellulose tubing which comprises extruding viscose through an annular orifice upwardly through a coagulating and regenerating bath and passing the tubing about a flattening element disposed above said bath, said bath comprising a solution of a plurality of compounds, one of which is primarily a coagulating agent and the other of which is primarily a regenerating agent, the re-

generating agent being employed in sufficient concentration to mainly complete the regeneration of the tubing as a result of its passage through said bath, and discharging the trapped gases formed within the tubing through the extrusion end of the tubing. 5

6. A method of forming seamless cellulose tubing which comprises extruding viscose in tubular form into and drawing the same through a relatively high acidity extrusion bath comprising not less than about 5% sulphuric acid and thereby causing rapid regenerating action and gas evolution during passage of said tubing through said extrusion bath, subjecting the tube to flattening action to trap the gas generated within the tube during its passage through said extrusion bath, and discharging the trapped gases through the extrusion end of the tubing. 10 15

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