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PROCESS AND APPARATUS FOR MAKING GUT STRING

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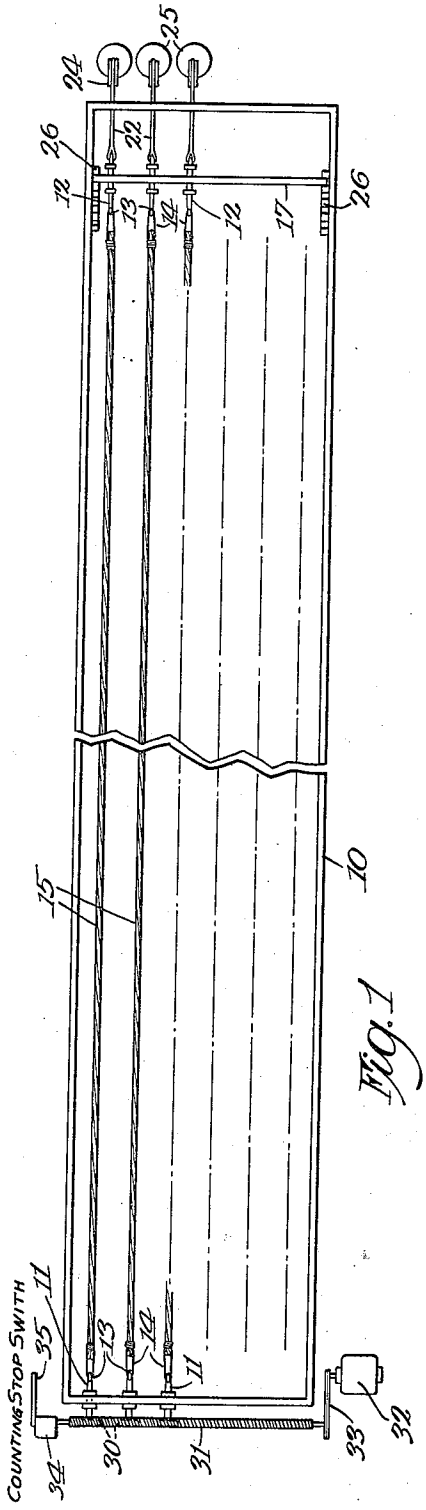


Fig. 1

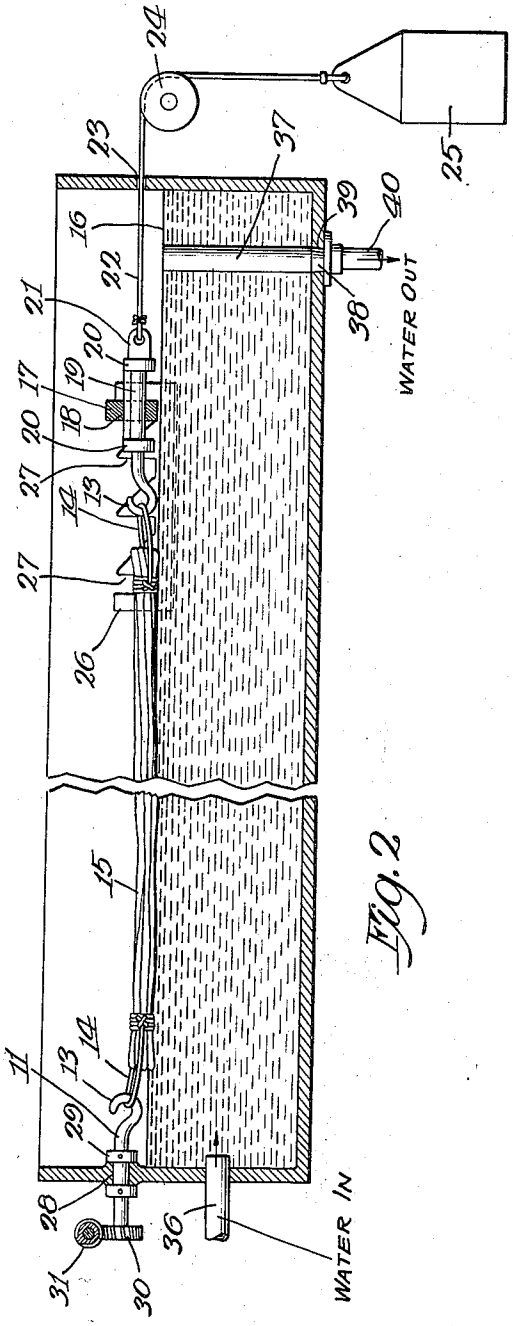


Fig. 2

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PROCESS AND APPARATUS FOR MAKING GUT STRING

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11 Claims. (Cl. 117—2)

This invention relates to making gut string, and has for its principal object to produce string of uniformly better quality at low cost.

Gut stock that has been properly prepared for spinning, or twisting, to make string is in ribbons of different cross section. When several ribbons of assorted cross section are assembled in a hank, or bundle, and twisted rapidly, the heavier ribbons are thrown out by centrifugal force more than the lighter ones and, hence, twist differently from the lighter ones. Furthermore, the ribbons being in their nature collogen, or glue, tend to stick as they chance to contact in the hank or bundle, and thus extend unevenly and one or more of them will sag from the main bundle and, swinging wide, will wrap around the remainder instead of twisting, or laying up uniformly and evenly. This makes for varying cross section in the twisted string, which is corrected with difficulty, if at all, in the subsequent operations of polishing and finishing, and often then to the damage of one or more strands, or ribbons forming the string, whereby the whole is weakened. These, briefly, are some of the difficulties inherent in the prior practice of making gut string.

I have found that by doing the twisting, or spinning, in water those difficulties are practically eliminated. Perhaps the water acts as a lubricant that prevents the casual sticking whereby, when the skein, or bundle, is picked up for spinning, or twisting, the several ribbons take their normal extended positions with approximately uniform tension from one support to the other.

And, water being about the same specific gravity as the gut ribbons, it checks the tendency of the heavier ribbons to swing out from the rest. As the ribbons are placed in the water before the twisting operation begins, they float and appear to let go the various casual adhesions. Incidentally, they are also washed at this preliminary stage, and during the twisting, or spinning, which insures the complete removal of alkalies and other foreign matter, leaving practically pure collogen to form the string. This is particularly advantageous in making surgical gut string intended to be absorbed by the patient.

Applying uniform tension before and throughout the twisting appears to contribute to the desired uniformity of twisting, or spinning, throughout the length of the string.

Apparatus that has been found suited to the purpose of this invention is shown diagrammatically in the accompanying drawing, in which

Fig. 1 is a plan view with the intermediate portion broken away, and

Fig. 2 is a longitudinal section on somewhat enlarged scale.

Generally speaking, the apparatus consists of a tank, or bath 10, equipped witth rotary spindles 11, adjacent to one end and non-rotary spindles 12 adjacent to the other. Each of the spindles has a hook 13, adapted to receive a loop 14 of cord, one of which is tied to each end of what, for want of a more accurate term, may be called a skein, or hank, of gut ribbons 15, to be spun or twisted. The spindles are located adjacent to the surface 16 of the water in the bath to the end that the skeins will hang in contact with, or float on the water. Of course, they could have their axes aligned with, or below the surface of the water, but it is a little more convenient to have the hooks slightly above the water when attaching the skeins to the spindles and in removing the string from the spindles.

In order to apply tension to the skeins prior to and during the twisting operation, the non-rotary spindles 12 are mounted for translation or sliding to and from the rotary spindle. In this instance they are mounted in a bar 17 provided with key hole slots 18 for the intermediate portions 19 of the spindles between fixed collars 20. Each of the spindles 12 has an eye 21 for a cord 22, running through a stuffing box 23 in the end of the bath and over a pulley 24, to a weight 25. The bar 17 is adjustable along inclined racks 26, having notches 27 to hold in selected adjusted positions. It is shifted to the left, in the drawing, when the skeins are to be applied or removed, and engaged with one of the notches 27 during those operations. Just after skeins have been applied to the several spindles, the rack is freed from the notches 27 and the weights 25 shifted with the spindles back towards the position shown in the drawing, applying tension to the several skeins. The rotary spindles 11 pass through stuffing boxes 28 and are in the left end of the tank, or bath 10, and are held against lengthwise movement by collars 29. Each of the rotary spindles 11 is equipped with a worm gear 30, meshing with a worm shaft 31, driven by a motor 32, through suitable gearing 33. A counting time switch 34 serves to stop the motor after a selected number of rotations of the worm gear and, hence, of the spindles 11.

Water is supplied through the inlet pipe 36 and the level is controlled by the outlet pipe 37 having a tapered end 38 to fit a corresponding

socket 39 in the bottom of the tank adjacent to the discharge 40.

In operation two attendants will have a group of prepared skeins with the loops 14 assembled on a stick; one attendant will hook the loops in series on the spindles 12, beginning at the lower right, Fig. 1, the other attendant will hook the opposite loops to the spindles 11 beginning at the upper left. As the skeins, or hanks, come into position they float on the water somewhat loosely, and their several ribbons are bathed and spread out, freeing any casual adhesions. Upon freeing the bar 17 from the notches 27 the weights 25 draw each of the skeins up under uniform tension, and maintain that tension until the bar is shifted to the left again. While thus under tension the switch lever 35 is operated, setting the motor in motion, and the rotary spindles 11 are given a selected number of turns, depending upon the length of the skein and the size of the ribbons and other conditions. Roughly speaking, seventy-five turns per inch is good practice. The skeins are made up in lengths from two to twenty feet or more, according to the use to which they are to be put.

The process and apparatus are particularly suited to making gut music strings, tennis racket gut strings, surgical gut strings, gut cordings for mechanical purposes, etc., from animal intestines, chiefly sheep.

The intestines are cleaned and dressed down to a sub-mucous membrane, split into ribbons, further cleansed, and cured, according to customary or any other suitable practice, the ribbons are then gathered in numbers to make the string of desired diameter and the loops are put on. Of course, great care must be taken to sort the ribbons uniformly and to get the lengths approximately equal between the loops.

The speed of the spindles or the rate of twisting is somewhat a matter of choice, depending on the conditions, but just by way of example, one thousand revolutions per minute (1000 R. P. M.) has been found satisfactory in practice with a machine conforming to the diagrammatic drawing.

While, as here shown and described, the twisting is done from one end only, it might well be done from both ends simultaneously, and those attempting to make use of the invention will make other formal changes in the apparatus and the procedure without departing from the substance of the invention.

I claim as my invention:—

1. The process of making gut string which includes twisting a skein of gut ribbons of substantially uniform length in a bath of water.

2. The process of making gut string which includes twisting a skein of gut ribbons of substantially uniform length in a bath of water while applying uniform tension.

3. The process of making gut string which includes hanging a skein of gut ribbons in water and twisting them.

4. The process of making gut string which includes hanging a skein of gut ribbons in water, applying uniform tension, and twisting them.

5. In apparatus of the class described, a bath, spaced spindles adapted to hold a skein in the bath, and means to rotate one of the spindles.

6. In apparatus of the class described, a bath, spaced spindles adapted to hold a skein in the bath, means to rotate one of the spindles, and means to stop that spindle after a selected number of rotations.

7. In apparatus of the class described, a bath, spaced spindles adapted to hold a skein in the bath, means to tension the skein, and means to rotate one of the spindles.

8. In apparatus of the class described, a bath, a rotary spindle, means for rotating it, a second spindle and means to shift the second spindle to tension the skein between the spindles in the bath.

9. In apparatus of the class described, a bath having opposed walls, a plurality of spindles rotatably mounted to project beyond one of the walls, means for rotating the spindles, a plurality of spindles, each aligned with one of the first and mounted to move back and forth adjacent to the opposed wall, means to shift the last mentioned spindles away from the first mentioned to tension string in the bath.

10. The process of which includes floating a skein of gut ribbon in a bath, applying tension and twisting while continuing the tension.

11. The process of making gut string which includes hanging a ribbon of gut in water and twisting the same.

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