Jan. 17, 1956 H. P. FRY, JR 2,730,898

APPARATUS FOR CONTINUOUSLY MEASURING DRYING STRAINS AND RESIDUAL SHRINKAGE

Filed Oct. 3, 1950

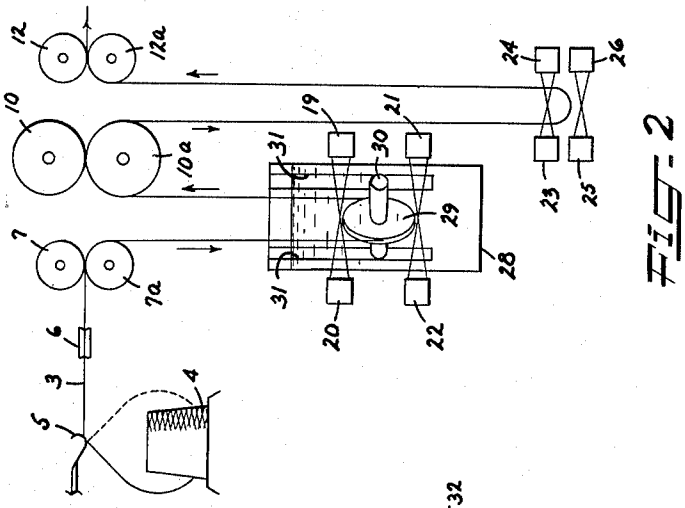


FIG. 2

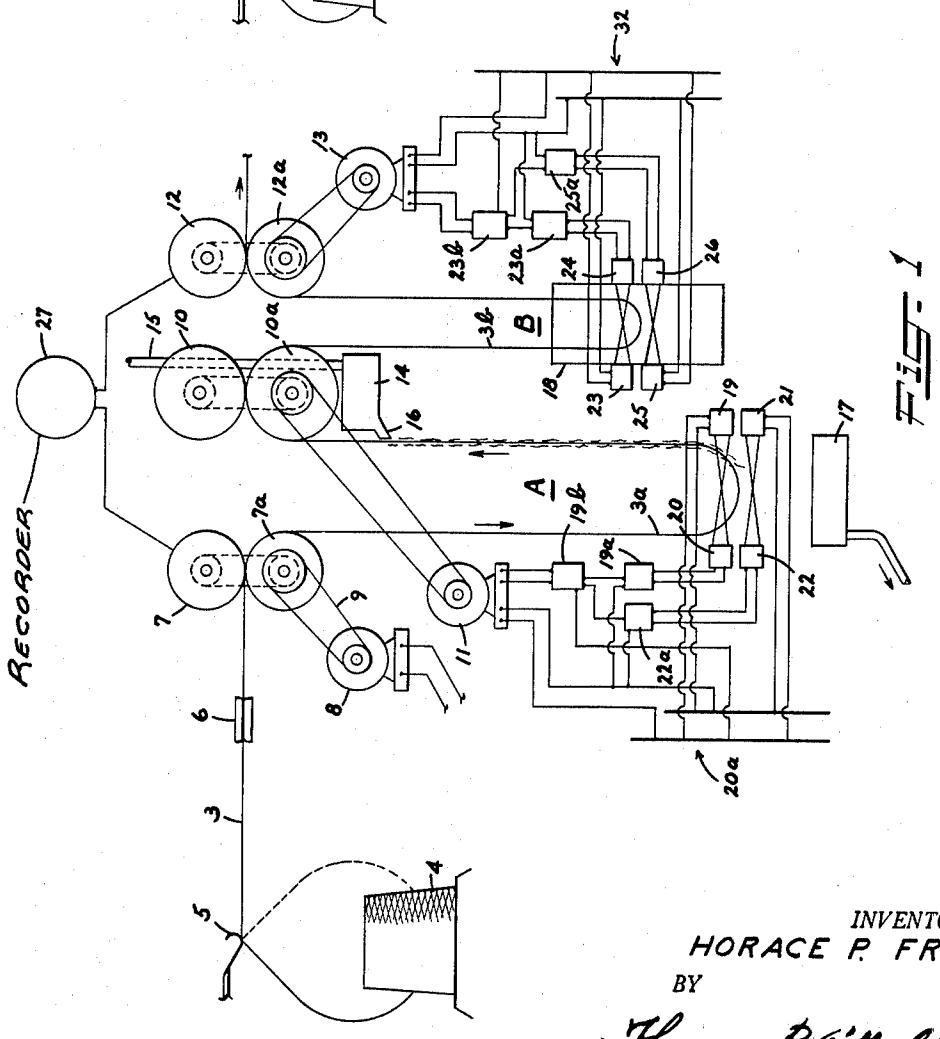


FIG. 1

INVENTOR.
HORACE P. FRY, JR.
BY
Thomas P. O'Malley
ATTORNEY.

United States Patent Office

2,730,898

Patented Jan. 17, 1956

2,730,898

APPARATUS FOR CONTINUOUSLY MEASURING DRYING STRAINS AND RESIDUAL SHRINKAGE

Horace P. Fry, Jr., Swarthmore, Pa., assignor to American Viscose Corporation, Wilmington, Del., a corporation of Delaware

Application October 3, 1950, Serial No. 188,091

3 Claims. (Cl. 73—159)

This invention relates to apparatus for the wet treatment of yarns, fabrics, and the like. More particularly, it relates to apparatus for continuously measuring drying strains and residual shrinkage of yarns, fabrics, webs, sheets, bands, and the like.

While the present invention is applicable to any type of continuous shrinkable material, for convenience, the same will be described as it is applicable to the continuous measurement of drying strains and residual shrinkage of yarns or threads. It should be understood, however, that this is merely intended to be illustrative and not limitative.

It is desirable that multiple filament thread, such as viscose artificial thread, etc., have uniform physical and chemical characteristics, particularly a uniform residual capacity to shrink of low order. Uniformity of these characteristics is of great importance in thread employed in weaving for the reason that in the course of the process of their manufacture, woven fabrics are washed, dyed and thereafter dried on tentering frames. If the thread from which the fabric is woven possesses a non-uniform residual capacity to shrink, or, if uniform, a comparatively high residual capacity to shrink, non-uniform dyeing of the fabric will result.

The term "residual capacity to shrink" or "residual shrinkage" has reference to the amount, in proportion to its original length, by which a dry thread will shrink upon being rewet and redried under conditions permitting it to shrink without restraint.

It is well known the yarn dried with a strain in it will become shorter if it is rewetted and redried in a relaxed state. However, the residual shrinkage of yarn collected and dried in the manner characteristic of the usual discontinuous processes, such as by the conventional cake-spinning system, is not uniform. This is due to the fact that the yarn on the outside dries faster than that on the inside of the cake. Thus the yarn on the inside is usually not dried sufficiently to relieve the strain on the outside yarn.

Various means are known for testing the drying strains or residual shrinkage of yarns. These means are generally designed for testing a small portion of the yarn, there being no known means for conveniently testing the drying strains of the entire length of yarn in a continuous manner.

It is an object of the present invention to provide an apparatus for testing continuously the drying strains or residual shrinkage of a yarn while being unwound from a dried package.

It is another object of the invention to provide an apparatus for testing continuously the drying strains or residual shrinkage of fabrics, webs, sheets, bands, and the like.

Other objects and advantages of the present invention will be obvious from the description thereof hereinafter.

In connection with the following description of the invention, reference should be had to the accompanying drawing in which,

Figure 1 is a diagrammatic side elevation of one embodiment of the invention, and

Figure 2 is a diagrammatic side elevation of another embodiment of the invention.

The objects of the present invention are in general accomplished by feeding a yarn, fabric, or the like, continuously, at a constant rate, into a wetting or moisture applying zone wherein the yarn, or fabric, or the like is in a relaxed state. Thereafter the material is fed to a drying zone upon removal of excess moisture therefrom. The material is dried in a relaxed state and then removed from the drying zone. The difference in speed with which the material enters the wetting zone and leaves the drying zone is a measure of the drying strains or residual shrinkage of the material.

Referring to the embodiment shown in Figure 1, the same operates as follows: a yarn 3 is unwound from a cake 4 and passed through a guide 5, then through a suitable tension device 6. The yarn passes between feed rollers 7 and 7*a* which are driven at a constant speed by motor 8 by means of chain 9. A belt may be employed in place of the chain if desired. The yarn then extends downwardly in a relaxed state forming a loop 3*a* in the wetting zone A. The yarn then passes through the variable speed feed rollers 10 and 10*a* and thereafter forms another loop 3*b* in the drying zone B. Rollers 10 and 10*a* are driven by motor 11.

The yarn passes through the variable speed take-away rollers 12 and 12*a* and passes to a suitable winding mechanism (not shown). Rollers 12 and 12*a* are driven by motor 13.

Positioned beneath roll 10*a* is a water tank or bath 14 which is fed by line 15. If desired or necessary, the water may contain a suitable wetting agent. Extending downwardly from the bottom of tank 14 is a spout 16 which feeds the water to the yarn adjacent thereto. The excess water runs down the yarn and drops into the tank 17 positioned beneath the loop 3*a*. The excess water remaining on the yarn is removed from the same when the yarn passes between squeeze feed rollers 10 and 10*a*.

Adjacent the bottom of loop 3*a* in the yarn wetting zone is a light source 19 and a photocell 20. Light source 19 is connected to the power source 20*a*. Cell 20 is connected to relay 19*a* which is in turn connected to the speed regulator mechanism 19*b* for controlling motor 11 such as by controlling the current through a field thereof. In like manner light source 21, positioned directly below light source 19, is connected directly to power source 20*a* and cell 22, positioned below cell 20, is connected to relay 22*a* which is in turn connected to the speed regulating mechanism 19*b*. It is to be understood that the system shown in Figure 1 is diagrammatic and any of the known and presently used speed regulating mechanisms and relays, and other means of connecting the same, are satisfactory and may be employed in the present invention. For example, the systems used in United States Patents 2,147,421 and 2,422,651 may be substituted.

The speed of the feed or take-away rollers 10 and 10*a* is so regulated as to position the bottom of loop 3*a* between the photoelectric cells. Should the loop 3*a* get shorter and pass upwardly from between the light source 19 and photocell 20, thus interrupting the light to cell 20, the motor 11, and in turn rollers 10 and 10*a*, will be slowed down thus allowing the loop 3*a* to get larger and drop back between the photoelectric cells. In like manner, should the loop 3*a* get longer and drop down between the light source 21 and photocell 22, breaking the beam of light therebetween, motor 11 will be speeded up and the loop will be shortened until again between the photoelectric cells.

In a similar manner in the drying zone, there are positioned adjacent the drying chamber 18, light sources 23

and 25 and photocells 24 and 26. The photoelectric cells are spaced one above the other and the loop 3*b* so positioned as to fall between the same. Light sources 23 and 25 are connected directly to power source 32. Cell 24 is connected to relay 23*a* which is in turn connected to the speed regulating mechanism 23*b*, while cell 26 is connected to relay 25*a* which is in turn also connected to the speed regulator 23*b*. The speed regulator is connected to motor 13 and power source 32 furnishes the power for the system. In like manner this system is also shown diagrammatically and other speed regulators and relays, as well as other means of connecting the same, which are well known in the art, may be employed.

When the loop 3*b* becomes too short and passes upwardly between the light source 23 and photocell 24, thus interrupting the light to cell 24, the motor 13 will be slowed down thus decreasing the rate with which the yarn is removed from the drying zone B and in turn allowing the loop to get larger again. Should the loop 3*b* get longer and drop between the light source 25 and photocell 26, interrupting the beam of light, motor 13 will be speeded up until the loop is short enough to again permit the beam of light to pass to cell 26.

The photoelectric cells in the wetting and drying zones serve as loop positioning means thus keeping the size of the same fairly constant. The variation in size of the loops 3*a* and 3*b* will cancel out over the period of testing a cake of yarn and will be of no particular detriment insofar as final values are concerned.

Rollers 7, 7*a* and 12, 12*a* are connected to a recorder 27 which records continuously the revolutions per minute of each set of rollers. Since the yarn when rewet and redried becomes shorter, the rollers 12 and 12*a* will have to rotate at a slower speed than 7 and 7*a*. Hence, since 7 and 7*a* rotate at a constant rate, the difference between the speed of the two sets of rollers measures the amount the yarn has shrunk. For example, in the case of viscose rayon when the rollers 7 and 7*a* are rotating at 100 R. P. M. the rollers 12 and 12*a* will vary in speed between 85 and 100 R. P. M. signifying a residual shrinkage between 0 and 15%.

The photoelectric cells may be spaced any distance apart depending upon the particular material being measured or tested. Illustratively the photoelectric cells may be one inch apart or the light beam may be as close as ¼ inch.

In Figure 2 there is shown another embodiment of the invention. The only change in this embodiment over that shown in Figure 1 is in the means for wetting the yarn, fabric, film, or the like. The yarn 3 extends down into tank 28 which is filled with water. The loop 3*a* is formed about the periphery of the weighting wheel 29 which is rigidly mounted on the shaft 30. The shaft is mounted in vertical slots 31 in the side of tank 28 so that the weighting wheel is free to move up and down. The wheel should also be of such weight as to not stretch the yarn appreciably. The remainder of the embodiment shown in Figure 2 is the same as that shown in Figure 1.

In the present invention the take-off speed, or speed of rollers 12 and 12*a*, will vary with the strain, i. e., a highly strained yarn will be taken off at a lower rate than a yarn with less strain. The invention is advantageous when testing a cake of yarn. In the case of a cake of yarn that has been dried on the outside before the inside has dried enough to relieve the strain on the outside yarn, the present invention would show the gradual decrease of strain from outside to inside of the yarn cake as the yarn is continuously unwound. Further, the present invention is beneficial for comparing several methods of yarn drying for the purpose of determining which method is best.

The apparatus of the present invention may also be used for the wet treatment of yarns, such as coating, impregnating, or the like, by replacing the water in 14 or 28 with the necessary yarn treating or coating composition. The embodiment shown in Figure 1 would be particularly advantageous when it is desired to coat a film, fabric, sheet, or the like on one side only, or when yarn, film, fabric, sheet, or the like is to be treated in a relaxed state, particularly if changes in length are encountered due to variations in strains. Numerous other advantages will be obvious to those skilled in the art.

It is to be understood that changes and variations may be made without departing from the spirit and scope of the present invention as defined in the appended claims.

I claim:

1. In apparatus for measuring shrinkage in a textile material, the combination which comprises means for feeding a continuous length of textile material to a wetting zone, means for driving said feeding means at constant speed, means for removing the material from the wetting zone and positioned with respect to the feeding means to provide a depending loop of textile material therebetween, first detecting means positioned adjacent the bottom of said loop responsive to a lower predetermined limit for the bottom of the loop, second detecting means adjacent the bottom of the loop and above the first detecting means responsive to an upper predetermined limit for the bottom of the loop, means responsive to impulses from each of said detecting means to vary the speed of the material removing means to maintain the bottom of the loop between said predetermined limits, means for applying a wetting agent to the material in the wetting zone, third material handling means subsequent to the material-removing means so positioned and arranged with respect to said material-removing means to form a second depending loop in the material passing therebetween, third detecting means positioned adjacent the bottom of said second loop responsive to a lower predetermined limit for the bottom of the second loop, fourth detecting means adjacent the bottom of the second loop and above the third detecting means responsive to an upper predetermined limit for the bottom of the second loop, means responsive to impulses from each of said third and fourth detecting means to vary the speed of the third material handling means to maintain the bottom of the second loop between said predetermined limits defined by the third and fourth detecting means, and means operatively connected with the material feeding means and the third material handling means for determining the relative speed of the material passing through each of said means.

2. Apparatus in accordance with claim 1 in which the feeding means, the removing means, and the third material handling means are pressure rolls and the determining means is a recorder showing relative peripheral speeds of the feeding means and the third material handling means.

3. Apparatus in accordance with claim 1 in which the material-removing means comprises a pair of squeeze feed rolls.

References Cited in the file of this patent

UNITED STATES PATENTS

1,653,451	Ybarrondo	Dec. 20, 1927
2,121,149	James	June 21, 1938
2,251,127	Gessner	July 29, 1941
2,275,278	Andrews	Mar. 3, 1942
2,276,605	Andrews	Mar. 17, 1942
2,422,651	Ayers	June 24, 1947

FOREIGN PATENTS

354,540	Great Britain	Aug. 13, 1931
535,023	Germany	Oct. 6, 1931