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METHOD AND APPARATUS FOR EQUALIZING THE TENSION IN A PLURALITY OF STRANDS

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Fig-1

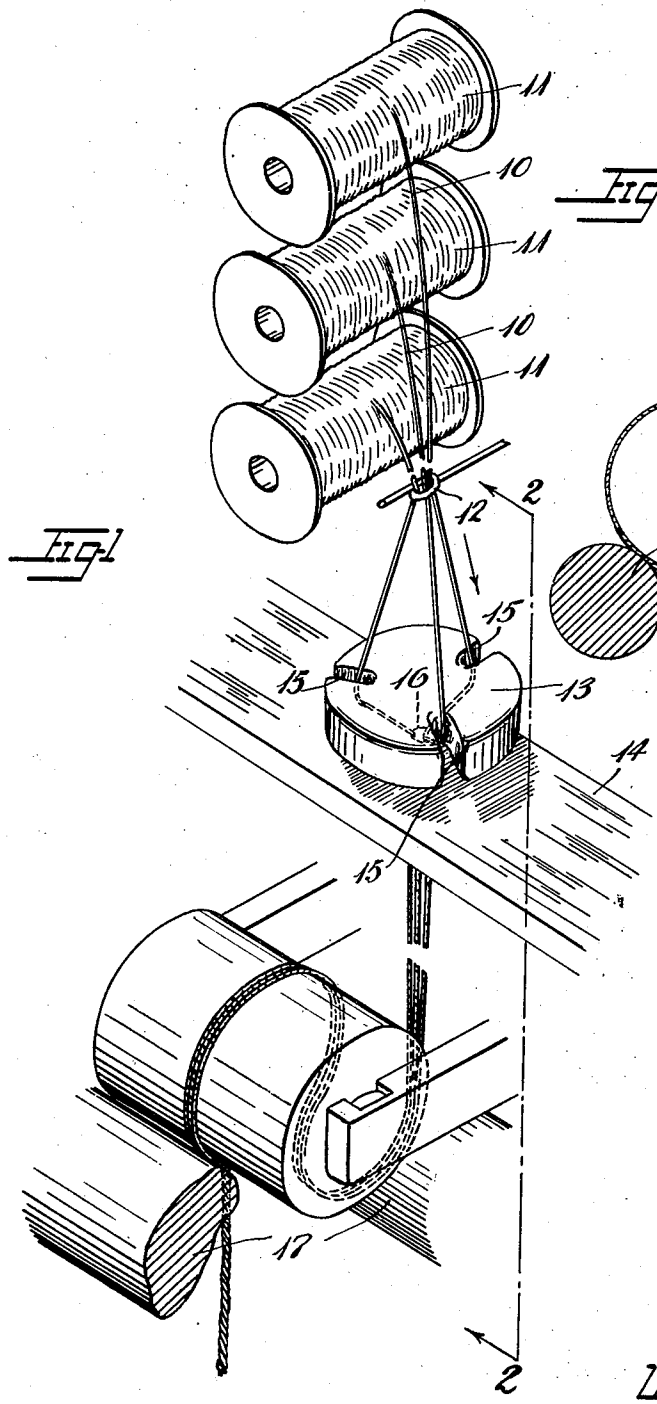
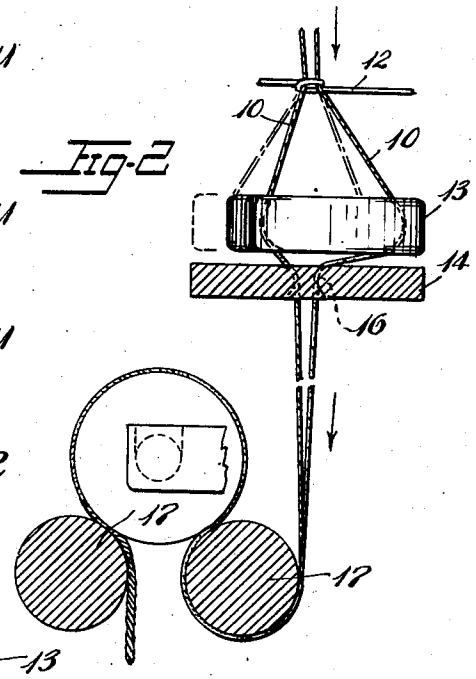


Fig-2



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METHOD AND APPARATUS FOR EQUALIZING THE TENSION IN A PLURALITY OF STRANDS

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5 Claims. (Cl. 57—106)

This invention relates to a method and apparatus for equalizing the tension on a plurality of strands and particularly to a device for maintaining an equal tension on each of a plurality of threads, yarns, or plied yarns of a textile material prior to their twisting into plied yarns or cords.

In the construction of plied-yarns or cabled yarns, such as in the manufacture of tire cord, for example, by twisting together a plurality of single yarns or plied yarns by means of a conventional twisting mechanism, it is common practice to feed the yarns to be twisted directly from bobbins mounted above the twister to the feed rolls of the twister. In such practice, however, it frequently happens that the supply bobbins drag unequally on their spindles with the result that the yarns supplied to the feed rolls of the twister vary considerably in tension and unequal lengths of the several yarns are twisted together into a single plied yarn or cord. The plied yarns or cords thus obtained obviously do not possess their maximum strength since the individual strands share unequally in resistance to tensile rupture and, under test, a sequential failure of one strand after another occurs at much lower loads than those required when all plies share the load equally. These are commonly called "ply breaks."

It is accordingly an object of this invention to provide an efficient and economical method and apparatus for equalizing the tension on the several yarns supplied from the bobbins prior to their being fed to the twister rolls so that uniform plied yarns and cords of maximum tensile strength and resistance to rupture may be obtained. A more general object of the invention is to provide method and apparatus for equalizing the tension in each of a plurality of strands regardless of the nature of such strands or the subsequent use to be made of the strands. Further objects will appear hereinafter.

These objects are accomplished in this invention by providing in the path of a plurality of strands having varying individual tension conditions a single tension equalizing device which frictionally engages a bight of each of the strands and is movable radially to the strands in response to increased tension in any of the strands thereby "taking up the slack" as well as introducing a greater frictional drag on the looser strands than on the tighter strands and thus equalizing the tension in all the strands.

In a preferred form of the invention a plurality of strands usually three in number, of a textile material, cotton or rayon for example, are led from bobbins supported above the feed rolls of a conventional twisting mechanism downward to the rolls through two spaced-apart restricted zones by means of guide rings or the like and a friction device interspaced between the two zones. This friction device comprises a "floating friction member" by which is meant a member having a substantial degree of freedom in its lateral movement, which engages a bight of each of the strands preferably at equidistant points about its periphery and by frictional drag imparts tension thereto. Since the floating friction member is movable laterally to the direction of travel of the strands, if any of the strands unwound from the bobbins possesses a tension greater than other strands the floating member is forced against the other looser strands taking up the slack and also increasing the tension on these strands by making them drag over a larger arc of contact. At the same time the tension on the tight strands is reduced by providing a shorter path and reduced friction. As a result the various strands are fed to the twister under substantially equal tension.

In order further to explain the invention, reference is had to the accompanying drawing wherein

Fig. 1 is a perspective view of an apparatus illustrating a preferred embodiment of the invention and

Fig. 2 is an elevation partly in cross-section taken on the line 2—2 in Fig. 1.

Referring to the drawing, a plurality of strands 10 of textile material are unwound from bobbins 11 and directed in substantially parallel relation through guide ring 12. From guide ring 12 the strands 10 pass downward and engage rounded grooves in a floating friction member 13, resting on support 14 and consisting, as shown, of a disc but which may partake of any variety of sizes, shapes or weights, at equidistant points about the periphery of the floating member. The strands 10 are spread apart by the friction member 13 and are maintained at the equidistant points by any suitable means such as the rounded axial slots 15. The strands 10 then pass radially between the surfaces of the floating member 13 and its support 14 to a vertical aperture 16 in support 14 through which they pass to feed rolls 17 of a conventional twisting mechanism.

In the operation of the device if the strands 10 as they are unwound from the bobbins 11 are under unequal tensions the strand under the greatest tension will force the floating friction

member 13 laterally against the looser strands, as shown in Fig. 2, thereby transferring some of the tension from the looser strands to the tighter strands by reason of the motion of the floating member, and increasing the friction encountered by the looser strands as their radial path between the surfaces of the floating friction member 13 and the support 14 is increased. At the same time the tension on the tight strands is relieved until a condition of equilibrium is attained and the tension on each of the strands in the span between the support 14 and the feed rolls 17 is substantially equal.

It is well known that the frictional drag on a rope or belt slipping over a pulley is given by the equation $f=f_0e^{-k\theta}$ where f and f_0 are the tensions on the two sides of the pulley, k is the coefficient of friction and θ is the angle of contact. In this invention the movable floating friction member automatically increases θ for loose strands thus increasing the drag and the tension, and it decreases θ for tight strands, thus decreasing their tension.

While the invention may be applied to a plurality of strands regardless of whether the strands are to be twisted, wound or otherwise used after their tension is equalized, it is particularly suitable for equalizing the tension in three plied yarns of a textile material in connection with a twisting device for twisting the three plied yarns into a cord such as a tire cord. For example, it has been found that the ply breaks occurring in cotton tire cords twisted from plied yarns has been reduced, by equalizing the tension of the plies prior to twisting in the manner described, from over 75% to less than 10% in a standard test.

It is to be understood that the embodiment of the invention shown and specifically described is merely illustrative of the invention and it is not intended that the invention be limited thereto for numerous modifications and variations which will be obvious to one skilled in the art may be made therein without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. Apparatus for equalizing the tension in a plurality of strands being advanced together in a generally vertical direction under varying individual tension conditions, said apparatus comprising means for guiding the strands together through two restricted zones at spaced apart points along a generally vertical path of travel, and a floating friction member spreading the strands apart between the said two zones and engaging a bight of each strand for frictionally tensioning the same, the said member being controlled in its location by engagement of the bights of the strands and movable laterally of the direction of the strands by reason of the difference of tension in the individual strands, whereby to increase the frictional drag on the strand having the least tension and to equalize the tension in all the individual strands.

2. Apparatus for maintaining an equalized tension in each of a plurality of strands being advanced together in a generally vertical direction under varying individual tension conditions said apparatus comprising means for guiding the strands in a substantially parallel relation through two restricted zones at spaced-apart points along a generally vertical path of travel, and means for spreading the strands apart between the said two zones, said means comprising a floating friction member having substantial weight and engaging the individual strands at equidistant points about its periphery, the said floating member being movable laterally of the direction of travel of the strands by reason of the difference of tension in the strands, thereby increasing the tension on the strands having the least tension and equalizing the tension in all the individual strands.

3. Apparatus for maintaining an equalized tension in each of three strands having varying individual tension conditions, said apparatus comprising guide means for directing each of the strands toward a single frictioning member, a single frictioning member resting on a horizontal support of relatively larger horizontal surface, and engaging a bight of each of the strands at equidistant points about its periphery, and guide means for radially directing each of the strands between and in contact with the surfaces of the frictioning member and the support, the said frictioning member being movable radially to the strands and laterally to the support in response to increased tension in any of the strands thereby increasing the resistances to travel in the other strands by reason of an increase in the radial length of the other strands in contact with the surfaces of the frictioning member and the support and equalizing the tension in all the strands.

4. Apparatus for maintaining an equalized tension in each of three strands being advanced together in a generally vertical direction under varying individual tension conditions, said apparatus comprising upper and lower guides for guiding the strands in a substantially parallel relation through two restricted zones at spaced-apart points along a generally vertical path of travel, said lower guide comprising a horizontal support having a vertical aperture therethrough, and means located between said guides for spreading the strands apart and imparting increased tension thereto, said means comprising a floating disc having substantial weight resting on said horizontal support and centered above the said aperture therethrough, said disc engaging a bight of each of the strands at equidistant points about its periphery and effecting a radial course in each of the strands as they pass from said points to said aperture, the said disc being displaceable laterally along said support in response to inward pulls resulting from relatively increased tension in any of the strands and being adapted to force the other strands outward increasing their tension as such lateral displacement occurs whereby to equalize the tension in each of the three strands.

5. A method for equalizing the tension in a plurality of strands being advanced together in a generally vertical direction under varying individual tension conditions which comprises directing the strands together through two restricted zones at spaced-apart points along a generally vertical path of travel, spreading the strands apart between the said two zones by means of a floating friction member engaging each of the strands at equidistant points about its periphery, the said floating friction member being movable laterally of the direction of travel in the strands by reason of the difference of tension in the strands, and imparting tension to the individual strands by frictional engagement with said floating member inversely proportional to the original tautness of the individual strands.

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