Oct. 5, 1937. A. BERIA 2,095,122

METHOD OF WINDING ARTIFIGIAL YARNS

Filed Sept. 11, 1933

Fig. 1

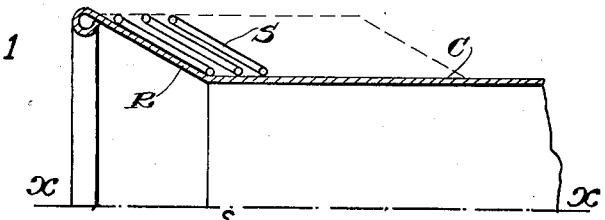



Fig. 2

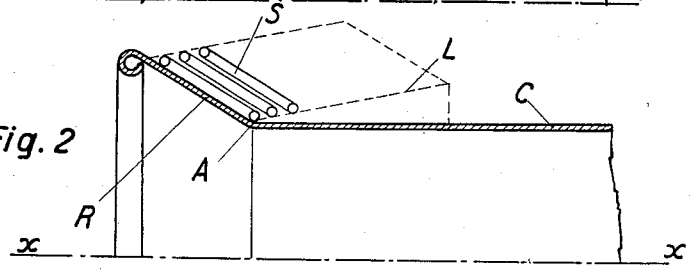



Fig. 3

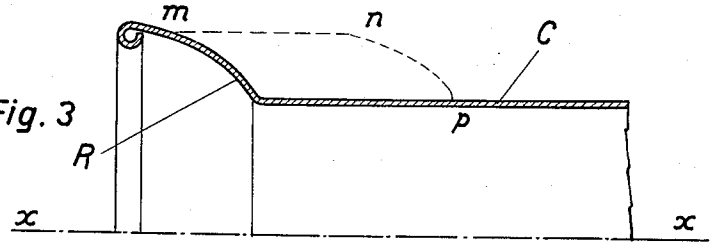
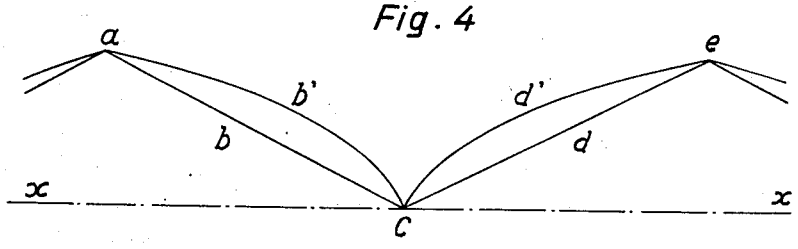



Fig. 4

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## METHOD OF WINDING ARTIFICIAL YARNS

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2 Claims. (Cl. 18—54)

This invention relates to bobbin spinning machines for spinning artificial yarns, and its object is to provide a method of winding the yarn onto bobbins in such a way as to ensure the yarn, directly as wound onto the spinning bobbin, being free from internal tensions after drying, and therefore directly utilizable without further steps of reeling, washing the hanks and subsequent drying, such as are at present employed in order to give the yarn the above mentioned property.

It is known that the fibres, or strands, of an artificial yarn are formed during the spinning operation itself, generally being carried out in a coagulating bath, from which the threads, in bobbin spinning machines, emerge to be wound directly on to the bobbin. However, on issuing from the bath, the thread is not yet completely formed inasmuch as the coagulating action requires a certain time to penetrate into the depth of the thread: this action, which tends to cause a shrinking of the thread, does not reach completion until the thread is already wound upon the bobbin. It is also a known fact that the thread which is wound on to the bobbin is wet with a liquid which it is necessary to wash off, and that after this operation the bobbin is placed in a dryer where the yarn is dried. During this drying the yarn tends to shrink considerably.

In the method of winding at present in use, in cylindrical layers on rigid, metallic bobbins, it is evident that the first layers of yarn which are wound cannot, owing to the rigidity of the bobbin, effect the above mentioned shrinkages; the outer layers, however, due to the fact that the underlying layers form, in a way, an elastic cushion, can, in a greater or lesser degree, shrink. The same applies to methods of winding wherein the yarn is wound up on the bobbins in conical layers, inasmuch as each length of yarn is given a varying possibility of shrinkage according to whether it is being wound near the body of the bobbin or near the external surface of the winding. Tensions varying from layer to layer or from point to point of the yarn, at certain intervals are thus set up, which tensions are not lessened even if the yarn is subsequently slackened out, because owing to a well known property of artificial yarns, as long as the yarn is dry such tensions remain permanently established in them as internal tensions in the material. These internal tensions however are then annulled, and the yarn takes on that shrinkage which it was unable to effect before, if the yarn is wetted in a state in which it is free to shrink, as for instance, in hanks.

It is evident that a yarn showing different internal tensions from one point to another cannot be successfully employed in subsequent processes, as for instance, weaving.

In fact if, for example, a fabric be woven with yarn taken direct from the bobbin and therefore presenting different internal tensions from one point to another in the threads, and the fabric is then wetted, the different threads will shrink, usually in differing degrees in various places, according to the different internal tensions, thus causing wrinkling of the fabric.

In order to eliminate this defect the yarn at present obtained by the current methods of winding on to bobbins, is unwound and gathered into hanks, which are then wetted and again dried. This system entails however a reeling operation and a second drying, with a consequent complication of the processes of manufacture and relative increase in costs, whilst the formation of the yarn into hanks is of no practical use, as industry requires it wound on cops, bobbins, spools, etc.

In the drawing, Figure 1 is a diagram illustrating the current mode of winding thread in conical layers.

Figure 2 is a diagram illustrating the principle of winding in conical layers on which the invention is based.

Figure 3 is a diagram illustrating the result of the improved method of winding.

Figure 4 is a diagram illustrating the improved method in more detail.

Reference is made to the drawing. Figs. 1 to 3 show parts of cylindrical bobbins each having at one end a conical portion, destined to take a winding of yarn in conical layers or substantially such. In each of Figs. 1 to 4, $x$—$x$ is the axis of the bobbin, C the body of the same, R the conical portion; S is the layers of yarn, represented schematically and to a scale much larger than natural size, for the sake of clearness in the drawing.

Fig. 1 represents the current mode of winding the turns of yarn on a bobbin by a to-and-fro motion of the thread guide which distributes them in conical layers, similar to what takes place in many throwing machines. From an examination of this figure, it will at once be noted that in order to get a regular winding it is necessary to feed forward the run-out of the thread guide in the direction of the axis of the bobbin, a distance exactly equal to the thickness of a thread for each layer wound on.

Fig. 2 shows the shape the winding takes if this feed is less than the thickness of the thread, that is, the succeeding layers pile one on the other in such a way as to leave the cylindrical part of the bobbin. By winding the yarn with certain precautions, particularly when the yarn is wet, so that the turns tend to adhere to each other and cannot slip down onto the body of the bobbin, it would be possible to obtain in this way bell-shaped bobbins in which the windings touch the bobbin only at its base, i. e. at A, going away

from the bobbin according to a generatrix AL. It is evident that in a bobbin wound in this manner nothing prevents the free contraction of the yarn during the coagulation subsequent to the winding or the successive drying, because, except on the truncated conical part, there is no contact between the yarn and the bobbin. A yarn thus wound will have no internal tensions.

A winding of this kind has not, however, the stability necessary to enable the bobbin to withstand the successive operations, so that it is not suitable for practical purposes. But if the feed is so little less than the thickness of the thread that the space between the yarn and the bobbin is such that it will disappear through the shrinking of the thread during subsequent coagulating or drying, it is possible to cause the yarn to settle on the bobbin substantially without tension, and at the same time in such a way as to confer upon the winding the desired stability.

The possibility of obtaining this compensation between the detachment of the yarn from the bobbin, by means of the aforementioned choice of feed, and the shrinkage of the thread, has been experimentally tested by the applicant; it has also been proved that the yarn thus obtained, when washed and dried on the bobbin, is free at all points from internal tensions.

The invention further provides, however, means whereby the possibility for the yarn of freely shrinking during subsequent coagulation and drying is further improved. To this end the invention contemplates the adoption of a particular form of the truncated conical base of the bobbin and a particular governing of the to-and-fro movement of the thread guide. This is made clear by the following considerations, which refer to Figs. 1, 3 and 4.

In the winding represented in Fig. 1, the successive layers of yarn are arranged according to trunks of cones having a rectilinear generatrix. If a thread is followed in its winding, it will be seen that it is arranged according to arcs of a conical spiral which, starting from the external diameter, draws gradually nearer to the cylindrical body C of the bobbin: the yarn touches the bobbin for a very short distance (theoretically at a point) and afterwards leaves it again, and so on as before. The diagram in Fig. 4 represents this fact inasmuch as the axis $x$—$x$ represents the circular profile, developed, of the cylindrical body C and the broken line *abcde* represents the yarn, projected on to a plane normal to the axis of the bobbin; the distance of the various points of the broken line from the axis $x$—$x$ represents the distance of the various points of the spiral from the cylindrical surface of the bobbin. As will be seen, the yarn draws near to and away from the bobbin according to a linear law. The thickness of the underlying layers, which, in a case in which even a minimum tension tends to develop in the yarn wound on the bobbin, should act as an elastic cushion, have for a relatively long distance on the spiral too slight a thickness to enable them to fulfill this purpose. According to the invention the conditions of winding, from this point of view, are improved by making each turn draw near to the cylindrical body of the bobbin (touching it at one of its points) for a shorter portion of its length; in other words, that the part of each turn whose points are less than a certain distance from the surface of the bobbin, is reduced in length as much as possible. This is attained by laying the yarn through a suitable choice of the law of motion of the to-and-fro action of the thread guide, in spirals lying on a surface of a substantially truncated conical form, but having a curved generating line, so that the projection of the spiral on to a plane normal to the axis of the bobbin be (Fig. 4) as *ab'cd'e* instead of as *abcde*.

In this way, the underlying layers of yarn attain a sufficient excess thickness to enable them to act as an elastic cushion, so that even should the thread being wound take on a certain tension, this can freely cancel itself out during the drying operation.

In Fig. 4 is shown a form of the curve *ab'c*, similar to the arc of an ellipse, which lends itself to the purpose described.

Of course, the conical part of the bobbin must be conveniently shaped to the form of the surface on which the turns are laid by the thread guide, that is, it must itself have the above mentioned curved profile, similar to the arc of an ellipse. For convenient expression the base R has the contour of a truncated paraboloid. This shape is shown in Fig. 3, in which the dotted lines further denote respectively the outer cylindrical surface of the winding, and the substantially conical surface on which the last turns are wound.

According to the invention then, it is possible to obtain industrially, bobbins on which subsequent operations can be performed directly, such as desulphating, bleaching, dying, etc. and which can then be mounted in throwing machines or rings which carry out the twisting of the yarn and the winding of it on to cops, bobbins, spools, and the like, which can then be offered directly for sale. By the method according to the invention a much simpler sequence of manufacturing processes is obtained, less costly and more rational than that which entails the use of hanks and a second drying.

I claim:

1. An improved method of winding artificial yarns on to bobbins during the spinning operation in bobbin spinning machines, which comprises winding the yarn to-and-fro in substantially conical layers, and giving the thread guide a feed movement the stroke of which is slightly less than the thickness of the thread, resulting in a slight piling of the successive layers one on the other and a tendency of the turns of the winding to slightly clear the cylindrical body of the bobbin.

2. An improved method of winding artificial yarns onto a bobbin with a base having the contour of a truncated paraboloid, during the spinning operation in a bobbin spinning machine, which comprises winding the yarn by giving the thread guide a to-and-fro feed movement the stroke of which is slightly less than the thickness of the thread resulting in a slight piling of the successive layers one on the other and a tendency of the turns of the winding to slightly clear the cylindrical body of the bobbin, and varying the speed of said to-and-fro movement so as to apply the thread in layers which are convex because of the contour of the base, the concavities of which layers face the axis of the bobbin.

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