Sept. 8, 1936. W. WHITEHEAD 2,053,305

TEXTILE PROCESS.

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Fig. 1.

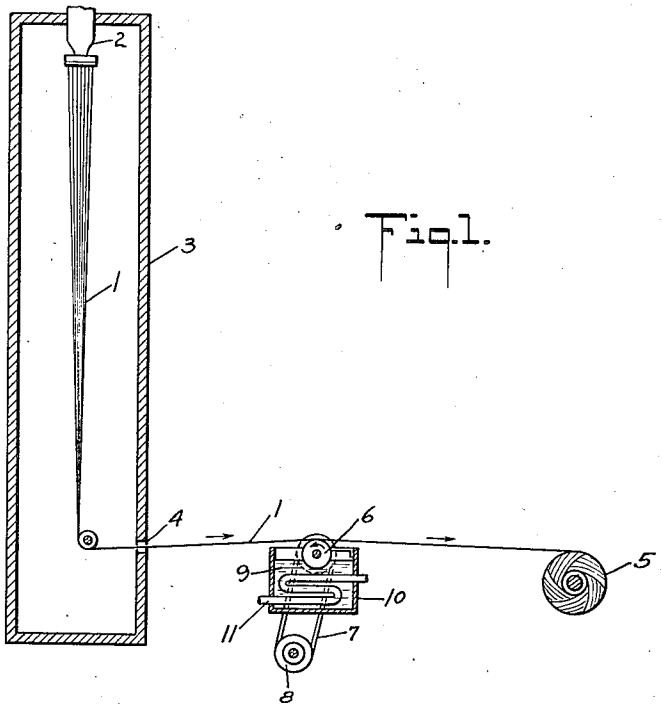
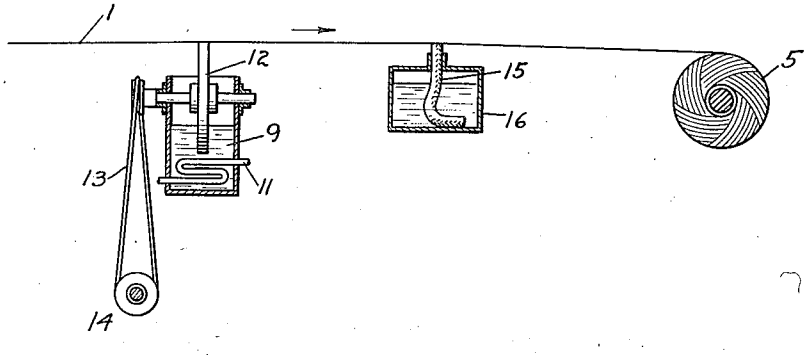


Fig. 2.



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TEXTILE PROCESS

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6 Claims. (Cl. 91—70)

This invention relates to the preparation of yarns and filaments having a coating of wax-like material thereon, and relates more particularly to artificial filaments made of organic derivatives of cellulose that are coated with wax.

An object of my invention is to coat yarns or filaments with wax-like material in an economical manner. A further object of my invention is to apply a wax-like material to yarns or filaments in such a manner that the resulting coating of wax is relatively rough so that there is a sufficient amount of frictional resistance between windings of such yarns or filaments. Another object of my invention is to provide expedients for applying such wax-like material to such yarns or filaments while they are in transit.

For certain purposes, it is desirable to apply a coating of wax to yarns. For instance in the case of yarns that are to be wound around metallic wire to be used as electrical conductors, a coating of wax on such yarns is desirable not only to increase the electric insulating properties of such yarns, but also to increase the frictional resistance between the windings of the yarns on the packages from which they are supplied. In the case of wrapping of wire, the yarn is supplied from one or more packages which are rapidly rotated about the wire, and this rapid rotation of the packages together with the severe vibrations set up in the wrapping machine tend to cause the yarns, if they have smooth surfaces, to unwind from the packages more rapidly than they are consumed in the operation of wrapping of the wire, with the result that snarling takes place. In order to prevent this phenomenon, which is known as "sluffing-off", it is necessary that the coating of wax on the yarn be relatively rough so that there is sufficient frictional resistance between the windings of the coated yarn.

I have found that if the wax is applied to the yarn from a solution in a good solvent, for instance from a solution of paraffin wax in kerosene, naphtha or other low boiling solvents, the coating of wax resulting from the evaporation of the solvent is entirely too smooth to prevent this "sluffing-off". I have discovered however that if the wax-like material is applied in liquid condition under such circumstances that it is liquid at elevated temperatures but solidifies upon reduction of temperature, the resulting coating is sufficiently rough to enable the formation of hard packages from yarns so coated, from which packages the yarns do not sluff off when subjected to severe textile operations, such as for example in the wrapping of electric wires.

In accordance with my invention, I apply to yarns or filaments a coating of wax-like material under such circumstances that the wax-like material is in liquid condition because of elevated temperatures but solidifies after its application to the yarns or filaments upon reduction of temperature, whereby there is deposited upon the same a coating that is not smooth or slippery.

This invention is applicable to the treatment of yarns or filaments, under which terms are included, threads, assemblies or bundles of a number of continuous filaments which may be in parallel relationship or which may be twisted together, artificial bristles, straws, short lengths of staple fibres, or yarn spun from such staple fibres.

This invention is particularly of importance in connection with the treatment of yarns or filaments made of cellulose acetate or other organic derivatives of cellulose such as cellulose formate, cellulose propionate, cellulose butyrate or other organic esters of cellulose or methyl cellulose, ethyl cellulose or benzyl cellulose or other cellulose ethers. However it is also applicable to the treatment of yarns or filaments made of other fibres such as natural silk, reconstituted cellulose, cotton, linen, etc.

As the wax-like material, I prefer to employ an amorphous paraffin wax, which may be produced from petroleum or which may be ceresin wax made from ozokerite. However, other waxes such as crystalline paraffin wax, beeswax, carnauba wax, or other waxy materials such as cetyl alcohol or the esters or ethers of higher fatty alcohols may be employed. A mixture of two or more of such wax-like materials may likewise be employed.

If it be desired to reduce the combustibility or inflammability of the product, fire retardants, such as beta chlornaphthalene (halowax), triphenyl phosphate or tricresyl phosphate, may be incorporated either in the wax-like material or in the yarns or filaments or both.

Preferably the wax-like material is applied to the yarns or filaments while in a molten condition and preferably at a temperature just sufficient to keep it molten or at most only a few degrees, say 1 to 15° F., above the melting point, so that upon a slight cooling, the wax-like material solidifies upon the yarns or filaments. If the wax is applied at temperatures considerably above the melting point, it tends to form a relatively smooth film on the yarn.

The application of the wax-like material to

the yarn while it is in transit from the spinning machine in which it is formed or from a package on to a package into which it is wound is preferable, since it presents many distinct advantages over the application of wax to yarn while in the form of hanks. The treatment of yarn in hanks or skeins is expensive because of the many winding operations required and the frequent damage to the yarn when so handled. Moreover when hanks are dipped in a solution of wax, variations in wax content result due to uneven accumulation of the wax solution on the hanks because of the draining of the solution from the hanks as they are suspended for drying. This irregularity of deposition of wax on the yarn causes an objectionable variation in the covering power of the yarn and in its spacing when wrapped around wires or used for other purposes.

The wax-like material may be applied to the travelling yarn by any suitable devices such as wicks, discs or smooth, grooved or serrated rollers, the lower portions of which are immersed in the liquid wax-like material. The yarns or filaments may then be wound with or without twist on to any suitable packages, such as cheeses, bobbins, bottle bobbins or other desired packages. The yarn may be wound at any practical feed rate, say from 10 to 300 metres per minute. The amount of wax applied may be any suitable or desired quantity, say from 1 to 20% of the weight of the yarn, preferably 3 to 7%.

If it is desired to apply the wax at a temperature somewhat above the melting point, so that it does not solidify unaided by the time the yarn reaches the winding device, the cooling and solidification of the wax may be aided by contacting the yarn, immediately after the wax has been applied, with a cold metal surface, a wick supplying cold water or other cool liquid, or a blast of cold air or other gas.

In order further to improve the physical properties of the coating of wax-like material, there may be applied to the yarns or filaments after the application of the molten wax, a substance such as amyl acetate or butyl acetate, which is a solvent for the wax while warm, but which precipitates the wax out of solution sharply on cooling.

An important aspect of this invention is the application of wax-like material to artificial yarns or filaments immediately after leaving the spinning cabinet in which they are formed, for instance by the extrusion of a solution of cellulose acetate in acetone through fine orifices into a drying evaporative atmosphere. Frequently such artificial filaments are lubricated at the spinning cabinet with oils containing free or combined fatty acids, which upon ageing or due to electrochemical effects, detract from the electrical insulating properties of such yarn. However I have found that such lubrication may be dispensed with if the wax-like material is applied to the artificial filaments as they leave the spinning cabinet. Moreover, since the bundle of filaments formed during spinning is preferably employed in the untwisted or parallel form, the multiple ends of untwisted filaments leaving the spinning chamber, after the application of wax-like material, may be wound directly without twist on to cheeses or other convenient packages.

Cheeses or packages made in accordance with this invention contain yarns or filaments on which the wax is uniformly applied in such a physical condition as to impart to the yarns such surfaces as to prevent the package from collapsing or sluffing-off in transit or on machines employed for wrapping the yarn wound wires.

This invention is of great importance for the preparation of yarns or filaments to be employed as insulating material in electrical devices, such as for the wrapping of copper or other metallic wires or conductors to be used for many purposes, such as telephone or telegraph wires, solenoids, armatures, relays, etc. However this invention may be used for the treatment of yarns or filaments for other purposes. For instance the wax may be applied alone, or in association with soaps or other saponifying agents to facilitate the subsequent removal of the wax, to yarns which may be subsequently employed for making woven or knitted fabrics or for other textile operations such as plural and ply winding to assist the yarn in forming solid packages that do not sluff-off in severe textile processes. Likewise the wax-like material may be applied as a size to yarns to be used as warps in fabric-forming operations. Staple fibres, such as relatively short lengths of cellulose acetate filaments, may have the wax-like material applied thereto before, during or after any suitable operation involving the formation of "spun" yarn; for instance in the operation of drafting or drawing sliver containing such spun yarn, the lower portions of one or more of the drafting rolls may rotate in a bath of the hot wax and thus apply the wax to the same.

The accompanying drawing shows diagrammatically some of the many forms of apparatus for carrying out my invention, wherein

Fig. 1 shows a device for applying the wax to filaments as they are being drawn from a spinning machine in which they are formed, and

Fig. 2 shows another form of device for applying the wax and also a liquid to the filaments or yarns.

Referring to Fig. 1 the filaments 1 are extruded from a solution of cellulose acetate or other organic derivative of cellulose in a volatile solvent through orifices of the spinning jet 2 within a dry spinning chamber 3, through which heated air or other evaporative medium passes. The filaments 1 pass out of the slot 4 of the chamber 3, and are drawn to the winding device 5 to form a suitable package, which is shown on the drawing as a cheese.

In transit, the yarns or filaments 1 are caused to contact with the rotating roller 6 rotating on an axis substantially at right angles to the path of the yarns and driven through belt 7 by pulley 8. The lower portion of the roller 6 is immersed in the bath of wax 9 in tank 10, the wax being maintained in molten state by the closed steam coil 11.

Referring to Fig. 2, the yarns or filaments 1 may be drawn from a spinning chamber in which they are formed or from a suitable package such as bobbin, hank, cone or cheese, and are caused to pass over the edge of a disc 12 which is rotating around an axis substantially parallel to the path of the yarns 1. The disc 12 is caused to rotate by means of the belt 13 and pulley 14 and is so mounted that its lower portion is submerged in the bath of wax 9 which is heated by means of the closed steam coil 11.

After contacting with the disc 12, and prior to being wound on the cheese 5, the yarns 1 are caused to contact with the wick 15 which furnishes thereto a liquid contained in the trough 16. This liquid may be either a cooling liquid such as cold water to aid in the solidification of the

wax, or it may be a liquid, such as amyl acetate, which is a solvent for wax at elevated temperatures but not at room temperatures.

In order further to illustrate my invention, but without being limited thereto, the following specific examples are given.

Example I

Referring to Fig. 1, an amorphous paraffin wax having a melting point of 168° F. is placed in trough 10 and is heated to 170° F. by the coil 11. The roller 6, which may be a diameter of 2'', is caused to rotate at about 15 revolutions per minute. The bundle of filaments 1, which are formed in the spinning chamber 3 by the extrusion of a solution of cellulose acetate in acetone through the jets 2, and which may have a denier of 100 to 200, are caused to contact with the roller 6 while being wound at the rate of 200 meters per minute onto the cheese 5 without twist. In this manner an amount of wax, equal to 5% of the weight of the filaments, is applied.

No other finish need be applied to the yarns or filaments, the wax being sufficiently lubricative for all textile processing involved.

Instead of drawing the filaments from a spinning chamber, the filaments or yarns may be drawn from a bobbin, hank, cheese, or other suitable package to have the wax applied thereto.

Example II

The process of Example I is followed except that instead of using pure amorphous paraffin wax, there is used a mixture of 94 parts by weight of the amorphous paraffin wax of melting point of 168° F. and 6 parts by weight of crystalline paraffin wax having a melting point of 140° F. The mixture of wax has a melting point of 165° F. The wax is applied while at a temperature of 167 to 170° F.

Example III

Referring to Fig. 2, amorphous paraffin wax having a melting point of 168° F. is placed in trough 9 and heated by coil 11 to 170° F. The yarns or filaments 1, either directly from a spinning chamber or from a textile package, is caused to pass across the edge of the rotating disc 12 dipping in the bath 9 of the wax. Immediately after the yarn leaves the disc 12, it is caused to contact with the wick 15 which applies an amount of amyl acetate equal to 5% of the weight of the yarn. The amyl acetate dissolves at least some of the warm wax, but since the wax is only slightly soluble in the hot amyl acetate and not soluble in cold amyl acetate, the wax precipitates sharply from the solution in amyl acetate on cooling. As a consequence, the desirable rough surface of the wax is further roughened and its frictional resistance is further enhanced.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of my invention.

Having described my invention, what I desire to secure by Letters Patent is:

1. Method of dressing yarns or filaments of organic derivatives of cellulose, which comprises forming a rough coating of wax thereon by applying molten wax thereto at a temperature not substantially exceeding 15° F. above the melting point of the wax, and thereafter cooling below the melting point of the wax.

2. Method of dressing yarns or filaments of cellulose acetate, which comprises forming a rough coating of wax thereon by applying molten amorphous paraffin wax thereto at a temperature not substantially exceeding 15° F. above the melting point of the wax, and thereafter cooling below the melting point of the wax.

3. Method of dressing yarns or filaments, which comprises forming a rough coating of wax thereon by applying molten wax thereto at a temperature not substantially exceeding the melting point of the wax; then applying thereto, while the wax is still warm, a liquid which is a solvent for the wax at elevated temperatures but which is a non-solvent at lower temperatures, and thereafter cooling below the melting point of the wax.

4. Method of dressing yarns or filaments of cellulose acetate, which comprises forming a rough coating of wax thereon by applying molten wax thereto at a temperature not substantially exceeding the melting point of the wax, then applying thereto, while the wax is still warm, a liquid which is a solvent for the wax at elevated temperatures but which is a non-solvent at lower temperatures, and thereafter cooling below the melting point of the wax.

5. Method of dressing yarns or filaments of cellulose acetate, which comprises forming a rough coating of wax thereon by applying molten wax thereto at a temperature not substantially exceeding the melting point of the wax, then applying amyl acetate to the wax while the wax is still warm, and thereafter cooling below the melting point of the wax.

6. Method of dressing yarns or filaments of cellulose acetate, which comprises forming a rough coating of wax thereon by applying molten wax thereto at a temperature not substantially exceeding the melting point of the wax, then applying butyl acetate to the wax while the wax is still warm, and thereafter cooling below the melting point of the wax.

WILLIAM WHITEHEAD.