Aug. 24, 1943. E. L. PERRY 2,327,738

TEXTILE CORE

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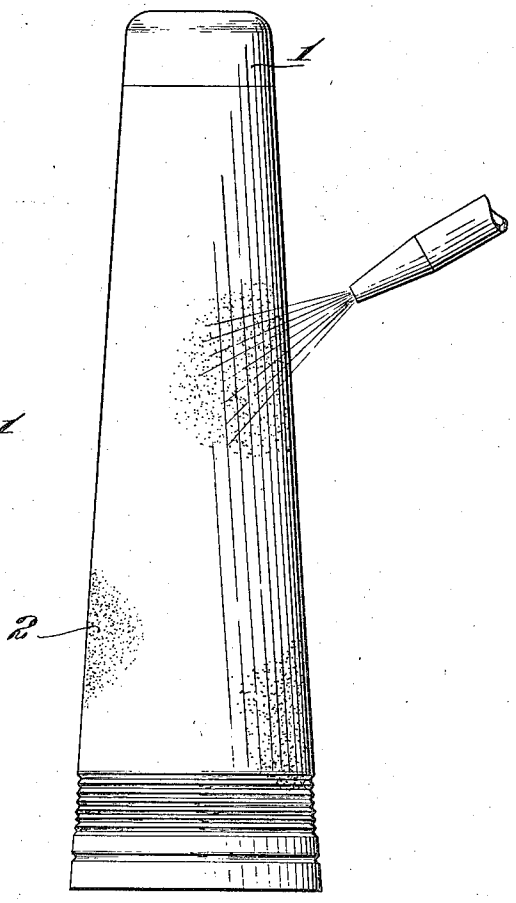

Fig. 1

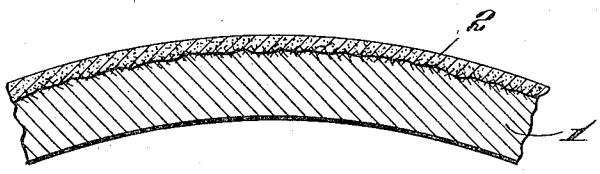

Fig. 2

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TEXTILE CORE

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6 Claims. (Cl. 242—122)

This invention relates to textile winding cores, such as cones, tubes, cops, etc., customarily employed for winding threads, yarns, fibers and filaments.

In the textile art various forms of cores are used for different types of threads and for particular purposes, although the greater number of textile fibers in thread form are wound on right conical surfaces or frustums of right conical surfaces (right cones).

The term "cores" as herein used is intended to include all such surfaces which may be used for textile winding, whether they define a tube, cone or other shape; and likewise the various types of materials which may be handled on such cores, as threads, filaments, fibers, yarn, etc., and of whatever substance, as silk, cotton, jute, linen, wool, rayon, etc., are hereinafter referred to as "threads."

The thread on a single cone may weigh as much as several pounds but it must unwind freely at high speeds, most often by pulling over the end of the package. The outer layers can usually be removed from the package without disturbance but when those adjacent to the cone surface are reached they often slip, causing breakage of the thread or otherwise delaying the subsequent operations. Especially is this the case if the surface of the cone is left perfectly smooth, when there is a minimum of friction and the threads slide under the unwinding pull and tangle.

A great deal of effort has been spent in devising cone surfaces that would provide just sufficient friction between themselves and the continuous layers of thread to prevent slippage and at the same time insure the free unwinding that is essential to the speeds of commercial operation. The cone surfaces have been turned or pressed into grooves or spirals; covered with protuberances of various shapes, such as different sized hemispheres; and the surfaces have been roughened by scuffing, grinding or other means of abrasion.

One well known surface is prepared by corrugating and another consists of overlapping rings pressed in the surface of a paper or wood cone; while still another is the result of a grinding operation.

The relatively coarse surfaces have been suitable only for coarse threads, and with cotton threads of considerable weight many prior surfaces were entirely satisfactory. However, as the threads in commercial use have become finer and finer, and as the diameter of the filaments has become smaller, it has been found necessary to modify surfaces, once thought satisfactory. For instance, while for coarse grades of cotton thread, corrugations spaced ⅛ inch apart and of substantial depth have proven entirely suitable, such corrugations have to be considerably reduced in depth and brought much closer together for the more ordinary silk threads. These, as well as pebbled and like rough surfaces, have proven generally unsatisfactory for fine yarns and impossible to use for the extremely fine filaments of modern rayon yarns.

In the attempt to secure a finish acceptable for the fine filaments commercially available or in process of development today, it has recently been proposed to grind the face of a paper cone. This surface, so finely abraded as to be considered a relatively smooth frictional surface, consists of a mass of tiny fibers projecting irregularly, the size and length of which, and the amount to which they project above the base depending entirely on the degree of abrasion. However, regardless of the fineness of the abrasion which has created the cone surface, the fibers are sufficiently sharp pointed and projecting to catch and retard, or cause "drag" on, extremely fine filaments.

Breakage of filaments at the cone surface is a far more serious matter to the commercial user than the loss of a few feet of thread. While this loss is important where many thousands of cones are involved, the loss of time is much more serious, and where one cone is tied directly to another, so that there will be no interruption of an operation, a drag in the final layer on the emptying cone, with breakage and retying, becomes a matter of substantial cost to the user.

Thus, as filaments and threads have become finer, the character of the surface on which they are wound has become a matter of greater and greater importance to the manufacturer. It has now become so important that purchase of cones for the newer fibers is solely determined by the quality of the surface. With all the work and attention which has been devoted to producing a cone surface suitable for handling the very finest of filaments, no truly satisfactory method has been developed hitherto.

There are other requirements which must be met by any commercially acceptable cone surface. First, it must be possible to produce it at an extremely low price. Many thousands of cones are used daily in the textile industry and their cost is a substantial item in the manufacture of fabrics. To increase the cost of a cone by a fraction of a cent is a serious matter. It is necessary that whatever method or materials be employed shall be available at a low price.

Second, it must be possible to apply the surface to relatively inexpensive cone materials, such as paper or pressed pulp fiber, by some method which permits the finishing operation to be carried out with very little labor cost, and at extremely high speed. Speed in handling quantities of cones is essential to the low price per piece required.

Also, any material applied to the surface of a cone must have adherence to that cone so that no ordinary handling will rupture the bond between the surface and its base, i. e., the surface must not flake or crack off from the base at any time during a reasonable life of the cone. Further, the surface must withstand the abrasive action of threads being wound and unwound for a substantial number of uses.

The surface must also be capable of modification for different grades of fibers, as a definite relationship must exist between the surface and the fiber wound thereon. The amount of friction allowable would appear as a factor of fiber strength and elasticity and would be determined by the nature of the two surfaces and the speed of unwinding. Since the nature of the fiber varies with its chemical and physical properties and the amount of surface contact is a factor of filament type, size and the construction of the thread, it is evident that only modifications of the cone surface can maintain the necessary frictional factors at, or close to, the desired constant.

Accordingly, a satisfactory surface for textile cones has to have the special characteristics outlined above, to wit, producible at a minimum cost; adaptable to various grades of threads; and capable of ready modification to accommodate the further developments in textile yarns.

The principal objects of the present invention are to provide a core which satisfies the aforementioned requirements and more specifically to provide a core which is adapted for use with various types of filaments, whether coarse or extremely fine; which overcomes the danger of slippage without exerting appreciable drag during removal of the last windings; which is reliable and operative at the highest commercial speeds; and which may be efficiently manufactured at a relatively low cost.

Further objects will be apparent from a consideration of the following description and the accompanying drawing, wherein

Fig. 1 is an elevation of a cone embodying the present invention; and

Fig. 2 is an enlarged schematic section through the body of the cone.

In accordance with the present invention a core body which may be of fibrous or other suitable material is provided with an integument which is firmly bonded to the base material of the core to form a tough, flexible film or skin in which is dispersed an inert filler, the composition and distribution of which may, if desired, be varied according to the particular type and size of thread to be wound on the core. Since the integument requires unique properties, the selection of the constituent materials must be such as to insure the aforementioned characteristics, as well as to provide a composition which is economical to produce, easy to apply, and which dries with extreme rapidity

I have found that when a modified rubber hydrocarbon, and/or cellulose derivative, an amine aldehyde, plasticizers and selected fillers are compounded with suitable solvents in the proportions herein set forth, such ingredients constitute a synuergistic combination capable of producing an integument or film having the desired physical characteristics although such characteristics are not obtainable by any known combinations of paints, lacquers and similar coating compositions, with or without fillers, all of which have heretofore been used in unsuccessful attempts to produce a satisfactory surface.

A chlorinated rubber having a chlorine content of approximately 67% is particularly satisfactory, although an equivalent amount of other types of modified rubber having the same or similar physical characteristics may be employed; likewise, cellulose aceto-butyrate has been found to be particularly suitable, but corresponding amounts of other types of cellulose esters or cellulose ethers having the same or similar physical characteristics may be substituted. Although the butanol-soluble modification of urea-formaldehyde resin is preferred, other types of urea resins, as well as melamine resins, which are soluble in organic solvents and possess similar physical characteristics may be employed. It is desirable, if not necessary, to use an accelerating agent to induce rapid and proper setting of the urea resin and where a butanol-soluble urea resin is employed, I have found that acidic type accelerators are most suitable, particularly the mixed butyl esters of phosphoric acid, consisting essentially of about 50% of the mono-butyl ester and 50% of the dibutyl ester.

The choice of plasticizer is governed primarily by the particular type of the above-mentioned ingredients used and in any event one or several of a wide variety of well known plasticizing agents may be employed, provided that the particular or combination of plasticizers is compatible with the aforementioned ingredients. A combination of plasticizers particularly suitable for use in conjunction with chlorinated rubber, cellulose aceto-butyrate and a butanol-soluble urea resin comprises a combination of a glycerol phthalic anhydride resin (alkyd resin) modified by the addition of a non-oxidizing short oil, and diethylene glycol diabietate which serves as an adhesive-promoting, flexibilizing agent.

The filler may consist of any suitable non-reactive pigments or mixture of pigments of the same or varying particle size. A mixture of silica powder, titanium dioxide and mineral color is illustrative of a suitable filler, although equivalent amounts of other types of fillers or pigments may be used.

In general the ingredients and proportions should conform to the following table:

	Range	Preferred
I. Modified rubber hydrocarbon:		
(a) Halogenated rubber, e. g., chlorinated rubber, brominated rubber		
(b) Rubber hydrochloride	0-40	10
(c) Cyclized rubber		
II. Cellulose derivative:		
(a) Cellulose esters, e. g., cellulose nitrate, cellulose acetate, cellulose aceto-butyrate	40-0	20
(b) Cellulose ethers, e. g., ethyl cellulose, benzyl cellulose		
III. Amine aldehyde resin:		
(a) Urea formaldehyde	0-20	10
(b) Melamine		
IV. Plasticizers:		
(a) Abietic acid derivatives		
(b) Glycerol, glycol and glycolic acid derivatives		
(c) Phthalic acid derivatives	20-60	40
(d) Phosphoric acid derivatives		
(e) Tartaric acid derivatives		
(f) Toluene sulfonic acid derivatives		
V. Fillers and/or pigment, e. g., silica, titanium dioxide, mineral color, barium sulphate, calcium sulphate, kaolin, etc	80-320	160

The total of the film-forming agents may vary substantially, of course, but it has been found that for the method of application adopted, approximately 1 part film-forming agents to approximately 2 parts filler is satisfactory. A

typical composition of this coating material is: Film agents, 12%; solvents, 63.6%; and inert filler, including the pigment, about 24.4%.

All the materials may be introduced into a pebble or ball mill and ground together for a definite period of time, the actual length depending on the characteristics of the mill and the final surface desired on the cone.

While it is possible to prepare this coating composition by charging all the materials into a ball mill and allowing them to mix until the blend is ready for use, it has been found more satisfactory to dissolve the resins separately or in groups and add the prepared solutions to the ball mill, limiting the action of this mill to the blending of fillers and carriers.

As a typical example of this method I may prepare a coating composition as follows, all parts being given by weight:

	Parts
Mixture A—	
Rubber chloride (66–68% chlorine)	14.2
Ethyl acetate	90.0
Mixture B—	
Cellulose aceto-butyrate	14.2
Acetone	40.0
Ethyl acetate	67.4
Mixture C—	
Urea - formaldehyde butanol (60% solids in butanol)	99.2
Alkyd resin-oil modified (using non-oxidizing "short" oil) (50% solids in toluene)	42.5
Ethyl acetate	45.0
Acetone	40.0
Acidic accelerator (mixed butyl esters of phosphoric acid)	1.2
Mixture D—	
Diethylene glycol diabietate	99.2
Ethyl acetate	135.0

The various mixtures are used in amounts to give a coating of substantially the following composition:

Film agents:	Per cent
Rubber chloride	13.7
Cellulose aceto-butyrate	25.5
Urea-formaldehyde butanol	13.2
Diethylene glycol diabietate	42.7
Oil modified alkyd resin	4.7
Butyl phosphates	0.2

The solvent mixture used and found to give a satisfactory rate of drying and filming characteristics is as follows:

	Per cent
Ethyl acetate	67.8
Acetone	29.6
Butanol	1.7
Toluene	0.9

The solvents included in the preliminary mixtures are fortified with ethyl acetate and acetone to give substantially the above composition.

The inert fillers may be added in substantially the following proportions:

	Per cent
Silica powder, approximately 350-mesh	25
Titanium dioxide (low oil absorption type)	50
Mineral pigment	25

The final composition of the coating given above is approximately as follows:

	Per cent
Film agents	12.1
Solvents	63.6
Fillers	24.3

Such a mixture when run for 3 hours in a pebble mill forms a surfacing composition for cones suitable for use with the finest of modern filaments. Surfaces for finer filaments may be obtained by longer milling and similar coatings suitable for coarser threads by lesser milling, or by using coarser grades of fillers.

The composition above set forth may be varied within limits and some changes may be made in the ingredients. The cellulose aceto-butyrate, for instance, may be replaced by an equivalent quantity of the aceto-propionate of a composition such that the solvent properties are approximately the same. The diethylene glycol diabietate may be replaced with other esters of abietic acid, either wholly or in part, such as glycerol abietate.

The fillers may be varied to some extent, so long as they are not soluble in or attacked by the ingredients of the coating composition or its solvents, but the admixture of silica powder has been found most desirable, possibly due to a tendency to form agglomerates which may be reduced proportionately in size by the time of mixing in the mill. The use of other fillers than titanium oxide with the silica powder may be desirable and mixtures with barium sulphate, calcium sulphate, or colored pigments of similar character may be made without change of the characteristics of the coating.

Extremely rapid drying is necessary for the commercial success of any cone-surfacing material and the nature of the solvent mixture used with this coating composition is of particular importance. It preferably consists of low boiling solvents with none of the high boiling liquids generally used to induce "leveling" of the applied coating. Only minute proportions of such medium boiling point solvents as butanol and toluol are used and these only as necessary to keep the initial mixtures in free-flowing condition prior to mixing in the ball mill. Also, the solvent composition is of special importance because it is necessary to apply a comparatively thick coating to the cone surface; that is, a coating that is very thick as compared with a single lacquer or paint coat.

Referring to the drawings, the numeral 1 designates a core element, here shown as a formed fiber cone of conventional size and shape, which is provided with an integument 2 of the above-described composition. As shown more clearly in Fig. 2, the integument is firmly bonded to the cone by reason of at least a partial penetration of the film ingredients of the coating composition into the subsurface structure of the cone body.

The coating is applied by means of a spray gun or air-operated spray while the cone is revolving. The speed of the revolving cone is such that the coating is uniformly applied and only a few seconds required to obtain a suitably thick layer. The cone may be removed immediately, dropped into a tray or otherwise handled and a second cone placed on the supporting spindle (not shown). Several cones can be handled each minute with proper equipment, the spray being stopped and started automatically. The surface becomes sufficiently hard within a few seconds so that it may be handled freely and the cone is ready for use on the winding machines within a few hours at most.

The integument 2 thus produced is tough, strong and adherent to the cone 1, and when thoroughly dry provides a winding surface which,

although free from abrasive action, nevertheless exerts a uniform frictional drag on threads wound thereon. Although the outstanding characteristic of such surface does not permit accurate description, it is best described as having a velvet-like feel, comparable to that of an egg shell, being free from projecting particles and yet not having the glossy smoothness characteristic of polished surfaces.

The finished surface may be decorated if desired, and the cone tips may be covered with a special composition for identification or to give an extra wearing surface or less friction as wished, and the lower edge of the cone may be colored or marked for identification. Other useful and desirable modifications may be adopted as will suggest themselves.

The coating composition described herein is suitable for application to textile cones and especially to textile cones made of paper or paper pulp formed to shape, and to similar products, for the purpose of producing a surface adapted to hold threads properly and allow them to unwind at high speeds without objectionable "drag" or damage. The surface is essentially an integument containing insoluble particles or agglomerations of particles wholly surrounded by the film-forming ingredients and distributed more or less uniformly over the surface of the cone, producing a frictional surface having a degree of adherence for the filaments and threads to be used in contact with it, the degree of such adhesion being determined by the size of the particles in the finished coating composition.

The word "particle" as used in this description applies to individual particles of whatever size and to agglomerates of these particles as they may be found in the cone surface. The word "integument" as used herein is descriptive of the skin-like membrane which surrounds the particles of insoluble materials and holds them in relative position to themselves and to the cone structure.

I claim:

1. A textile core having an integument firmly adhering thereto and constituting a winding surface, said integument consisting essentially of approximately 10 parts chlorinated rubber, 20 parts cellulose aceto-butyrate, 10 parts of an alcohol-soluble urea-formaldehyde resin, 40 parts of a plasticizer including an alkyl abietate and an alkyd resin, and 160 parts of a finely divided inert filler.

2. A textile core having an integument firmly adhering thereto and constituting a winding surface, said integument consisting of approximately 1 part of film-forming ingredients and 2 parts of a finely divided inert filler, the film-forming ingredients consisting essentially of approximately 1 part of chlorinated rubber, approximately 2 parts of cellulose aceto-butyrate, approximately 1 part of an alcohol-soluble urea-formaldehyde resin, approximately 3 to 4 parts of a plasticizer comprising a major proportion of an alkyl abietate and a minor proportion of an alkyd resin.

3. A textile core having an integument firmly adhering thereto and constituting a winding surface, said integument consisting of approximately 1 part of chlorinated rubber, approximately 2 parts of cellulose aceto-butyrate, approximately 1 part of an alcohol-soluble urea-formaldehyde resin, approximately 3 to 4 parts of a plasticizer comprising a major proportion of an alkyl abietate and a minor proportion of an alkyd resin, and approximately 15 parts of a finely divided inert filler.

4. A textile core having an integument firmly adhering thereto and constituting a winding surface, said integument consisting essentially of a material composed of 1 part film-forming ingredients and approximately 2 parts filler, said film-forming ingredients having the following composition:

	Per cent
Chlorinated rubber	13
Cellulose aceto-butyrate	26
Urea-formaldehyde butanol	13
Diethylene glycol diabietate	43
Oil modified alkyd resin	5

5. A textile core having a winding surface consisting essentially of from 60 to 120 parts of film-forming ingredients and from 80 to 320 parts of a finely divided inert filler, said film-forming ingredients having the following composition: up to 40 parts of a modified rubber hydrocarbon selected from the group consisting of halogenated rubber, rubber hydrochloride and cyclized rubber, up to 40 parts of a cellulose derivative selected from the group consisting of the cellulose esters and ethers, up to 20 parts of an amine aldehyde resin selected from the group consisting of urea-formaldehyde and melamine, and from 20 to 60 parts of a plasticizer selected from the group consisting of the abietic acid derivatives, glycerol glycol and glycolic acid derivatives, phthalic acid derivatives, phosphoric acid derivatives, tartaric acid derivatives and toluene sulfonic acid derivatives.

6. A textile core having a winding surface consisting essentially of approximately 80 parts of film-forming ingredients and approximately 160 parts of a finely divided inert filler, said film-forming ingredients consisting of approximately 10 parts of a modified rubber hydrocarbon selected from the group consisting of halogenated rubber, rubber hydrochloride and cyclized rubber, approximately 20 parts of a cellulose derivative selected from the group consisting of the cellulose esters and ethers, approximately 10 parts of an amine aldehyde resin selected from the group consisting of urea-formaldehyde and melamine, and approximately 40 parts of a plasticizer selected from the group consisting of the abietic acid derivatives, glycerol glycol and glycolic acid derivatives, phthalic acid derivatives, phosphoric acid derivatives, tartaric acid derivatives and toluene sulfonic acid derivatives.

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