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BY A. P. C.

A. MICHEL
METHODS AND APPARATUS FOR SPINNING KAPOK YARNS
Filed April 9, 1940

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3 Sheets-Sheet 1

Fig. 1

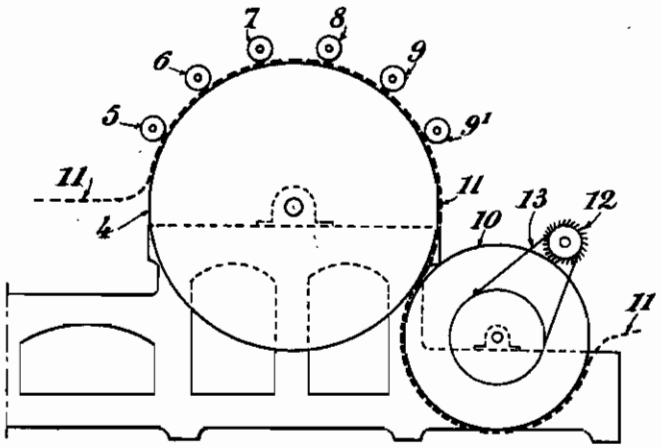

Fig. 2

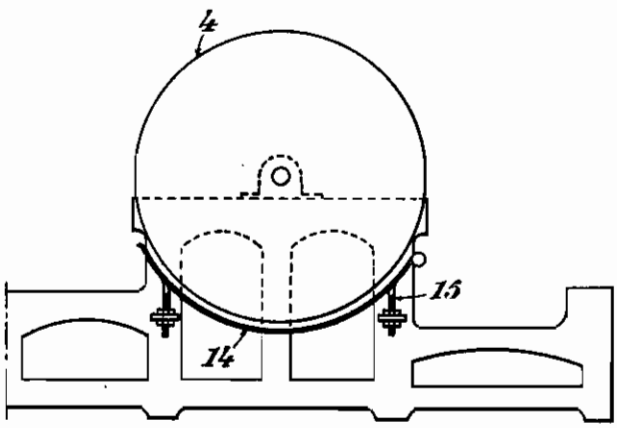

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Fig. 3

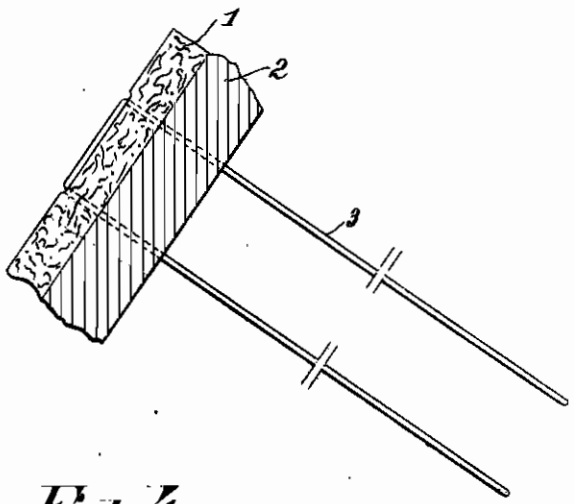
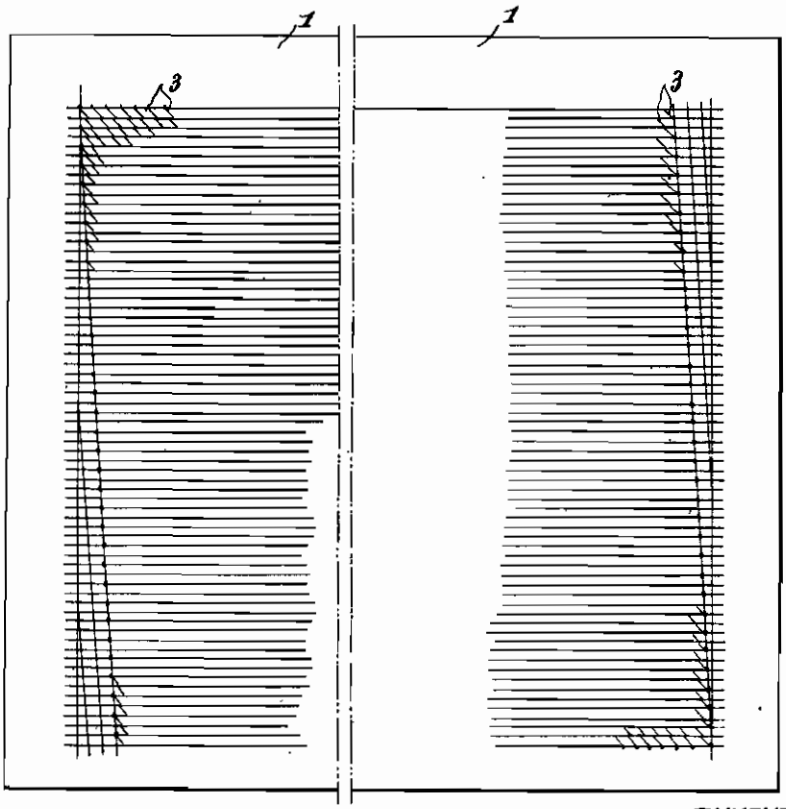


Fig. 4



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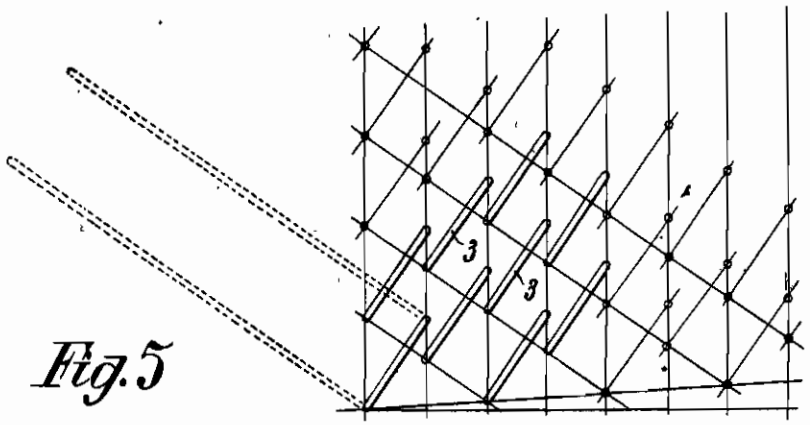
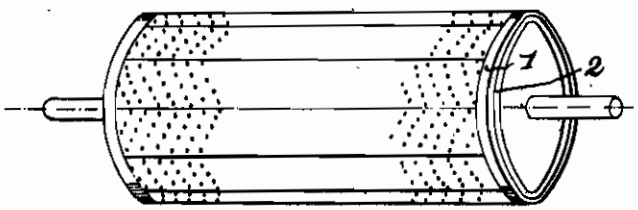


Fig. 5

Fig. 6



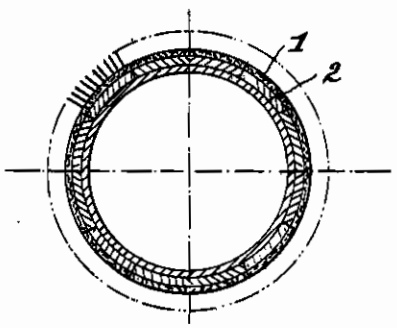


Fig. 7

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ALIEN PROPERTY CUSTODIAN

METHODS AND APPARATUS FOR SPINNING KAPOK YARNS

Alfred Michel, Paris, France; vested in the Alien Property Custodian

Application filed April 9, 1940

This invention relates to methods and apparatus for spinning kapok or similar fibres, such as akund, imitation of kapok, païna, and the like, as well as other products obtained by means of such methods and apparatus.

It may be recalled that kapok is a natural very light fibre which is non-conductive, imputrescible, impermeable and insulating.

This fibre consists of a tube closed at its ends and the walls of which are constituted of lignified cellulose, i. e. of cellulose impregnated with a waxing or softening ingredient which gives it all of the above mentioned qualities. The walls of the fibrous tube are smooth as compared with other fibres generally used in spinning which are all possessed with so-called "pricks" and it is precisely the absence of such pricky surfaces which hitherto has prevented its use economically and industrially in this art.

Moreover, kapok fibre being very fragile, same will be broken or split by submitting it to the usual process of carding thereby rendering it unsuitable for the intended purpose.

To overcome these drawbacks it has already been proposed to proceed with the weaving of kapok by mixing same with other textile matter such as cotton or wool but it has been found necessary to mix kapok in a very large proportion with cotton or wool with the result that:

On the one hand, dyeing of the mixture is rendered difficult due to the variances of the nature of the fibres so that a second dyeing operation has been required and,

On the other hand, the mixture, due to the relatively small proportions of kapok, did not maintain the essential qualities thereof, more particularly that of imputrescibility and impermeability.

Finally, the ingredients habitually used in softening wool or cotton fibres are inefficaceous for kapok fibres because, as has been stated hereabove, these fibres are agglutinated by an insulating substance (vegetable wax) which prevents the fibre from becoming impregnated.

The invention has for its main object to provide such methods and means which are adapted to respond in a higher degree as has been possible heretofore to the various requirements in this art and which, more particularly, will obviate the drawbacks referred to hereabove, and provide a product unknown heretofore.

The invention comprises, mainly, admixing to the kapok fibres to be spun or woven a certain quantity of heavier fibres such as fibres of artificial silk or rayon, this in the proportion of 5% to 45% by weight according to the nature of the thread to be produced, such thread being always and without exception preeminently formed of kapok.

Besides this main feature, the invention has for a further object to provide arrangements which are preferably used simultaneously as will be more fully described hereafter.

A second arrangement—related in a general way to the ingredients used in softening the textile matters, more particularly kapok—comprising forming these products by a mixture containing essentially a mineral oil such as vaseline oil (preferably about 10%), at least one fatty acid such as coco acid (preferably about 10%), at least one vegetable oil such as pine oil (preferably about 4%), at least one basic salt such as sodium carbonate (preferably about 1%), the balance being constituted by water and, eventually, by at least one animal oil such as tallow (preferably about 2%);

A third arrangement—relating to the machines for carding kapok—consisting in inclining the points of the carding lining in respect of the generating lines of the drums and preferably to dispose same along helical lines so as to insure, by reducing to a minimum the contacts on account of the brittleness of the fibres, a perfectly balanced carding action;

A fourth arrangement consisting, in these same machines, to provide a combing drum having a lining with points and cooperating with the brushing drum;

A fifth arrangement comprising, in these same machines, the provision of an adjustable subframe cooperating with the carding drum, said sub-frame being designed to follow closely the shape of said drum and capable of being moved as closely as possible to the points, this subframe preventing any loss as well as blowing-off or evaporation of the substance;

And a sixth arrangement—relating to the woven products—consisting in producing these by weaving kapok threads (more particularly those obtained by the methods described heretofore and which, besides kapok fibres, may already contain other fibres) together with threads obtained from a heavier product such as rayon, cotton, wool, and the like, certain fibres being more particularly adapted to form the chain and others the weft.

The invention aims at, and more particularly, relates to certain ways of applying said arrangements and certain ways of carrying same into praxis; and it still more particularly, this as

concerns the creation of a new industrial product, aims at and relates to methods and apparatus to be used in connection with the several arrangements, the various appropriate constituent primary elements, as well the thread proper obtained by said methods and apparatus, and the products woven with this thread or obtained or formed generally in accordance with the invention.

The several features of the invention will be brought into evidence from the following description, reference being made by way of simple example to the accompanying drawings, in which:

Fig. 1 shows, schematically and in side elevation, a machine for carding kapok;

Fig. 2 shows separately the carding drum and a subframe according another arrangement;

Fig. 3 is a section of a lining, provided for the carding drum with points;

Fig. 4 is a view showing the developed lining;

Fig. 5 is a similar partial view, on a larger scale, to that shown in Fig. 4;

Fig. 6 is a perspective view showing several carding linings juxtaposed on the drum; and

Fig. 7 is a schematic section of the carding drum.

According to the invention and, more particularly, according to the preferred means of carrying same into effect, as well as to those of realizing its various parts, spinning of the kapok is preferably carried out as follows:

As new material there is used a mixture comprising, on the one hand, kapok fibres, and, on the other hand, fibres of at least one heavier textile substance, such as rayon, cotton, or several of these substances (it being understood that, preferably, rayon be used), said mixture being prepared containing the following ingredients in the respective limits of proportions, by weight:

Kapok fibres: 95% to 55% (and even 50%),
Other fibres, more especially rayon: 5% to 45% (and even 50%),

the whole being such, considering the differences in density between the kapok and the other fibres used, that the contents of kapok in the finished product be predominating, the heavier fibres in said product being adapted to act as pricks in respect of the kapok fibres.

The rayon used may be of any suitable type such as obtained, for example, by the viscous process, the acetate, copper, or collodion method, or the like, and it may be formed, as desired, from plain or hollow fibres, the latter type, however, being preferably used.

Before proceeding with spinning, the mixture is given the desired homogeneity by proceeding as described hereafter.

A layer of kapok fibres is spread out upon which a layer of appropriate softening ingredient is applied which, itself, is covered with a less important layer of a heavier carrier, such as rayon, this within the limits of the proportions indicated hereabove, this operation is repeated so as to obtain from six to eight layers. The whole is then mixed by means of the usual machines and the mixture is then transferred to a carding machine.

The softening operation is carried out in such way as to render the fibres capable of becoming rapidly impregnated and lubricated respectively so as to permit their reciprocal longitudinal sliding movement this without their abandoning the highly intimate contact which latter is ensured by the capillary action of the softening ingredient, and, furthermore, to soften the fibres and, at the same time, increase their adhering capacity.

Due to this braked sliding motion of the fibres, the subsequent carding operation, which has more particularly for its object to place the fibres in parallel relationship by the action of the points of the carding drum, may be carried out correctly, that is to say without danger of the fibres being torn by said points.

Finally, the softening ingredient must be such as to modify the constitution of the fibre but temporarily, i. e. during the carding and spinning operations.

To this effect, it may be indicated to utilize the following formula which is given by way of example only, it being understood that only the limits of proportions of the several ingredients are given and that the several substances mentioned may be replaced by others having similar properties.

Per 100 lbs. of softening material ready to be used:

	Pounds	Ounces
Purified oil of vaseline	10	11
Pine oil	3	12
Greasy coco acid	10	11
Tallow	1	14½
Castor oil	1	4
Carbonate of sodium	1	4
Water	70	7½
	100	

It should be noted that the proportion of water used may vary in accordance with the prevailing hygrometric conditions.

The proportion, by weight, of the softening material to be used in respect of the weight of the fibrous material to be treated depends on the density of said material and may, i.e. vary between 10 and 40%.

It may be remarked that, besides its use as a softening agent, the softening composition according to the above formula may furthermore be used as agglutinant.

The carding operation may be carried out on any known type of carding machine which, however, is conveniently provided with carding linings so as to permit of obtaining a uniform repartition of the fibres over the entire width of the lap.

Furthermore, due to the fragility of the kapok fibres, the contacts between these and the points of the lining are preferably reduced to a minimum, one contact, at least, being nevertheless ensured between each of the fibres and one of said points.

On the other hand the thickness of the fibre itself should also be considered since the carding operation shall not have for its exclusive object to secure a perfect parallelism of the fibres, but also to eliminate foreign ingredients which may be present in the kapok.

To this effect one preferably proceeds in one of the following ways.

As regards firstly the active elements of the carding cylinder (cylinder shown schematically by reference numeral 4, Figs. 1, 2, 7) it comprises linings provided with points, certain of said linings being constituted by a band of woven felt or molton 1, 2, these linings being traversed by clamps 3 made of hardened steel the extremities of which, forming said points, are preferably in-

clined in respect of said band and, consequently, of the periphery of the drum (Figs. 3 to 5).

The arrangement is preferably such that said points, on rotation of the cylinder 4, determine a helicoidal disengagement, as may be seen in Figs. 4 and 5, which may be obtained by helical winding upon the cylinder of the band 1, 2 which forms the lining with points.

Due to this helicoidal winding of the lining the number of points put in contact with the kapok is reduced to a minimum while no portion of the surface is being left uncarded.

Various helicoidal windings running in opposite directions may also be provided (Fig. 6).

The linings 1 and 2 are fixed upon the cylinder by any suitable means.

Once realized, this arrangement is completed, firstly, by several operating drums 5 to 9 (Fig. 1) which are preferably provided with a continuously or discontinuously operating change speed device so as to permit choosing of the properly adapted speed for the treatment of each type fibre; said operating drums being furthermore precisely regulated in respect of the drum surface.

A combing cylinder 10 (Fig. 1) is then associated with drum 4, said cylinder receiving the web or lap 11 on leaving the drum; in accordance with another arrangement of the invention, means are provided upon the periphery of said combing cylinder which are adapted to take up foreign matters contained in the kapok which, otherwise, would eventually tear the web and thereby determine frequent breakage of the thread.

Said means are preferably constituted by a rotatable brushing cylinder 12 provided with fancy filleting, i.e. a filleting with highly flexible and relatively long steel points having a length of approximately 20 m/m.

The position of the brushing cylinder is regulated in such way that its points are flush with the combing cylinder; the distance between the extremities of said points and those of the combing cylinder being, for example, not more than 2/100 mm.

According to a further arrangement, the lower part of the carding drum 4 is preferably provided with an adjustable false-bottom or subframe 12 which is supported in such manner that it may be brought in close relation-ship to said drum so as to have clear spaces just wide enough to permit the passage therethrough of the linings 1, 2 and of the points 3.

This false-bottom may, for example, be mounted upon supports provided with set screws 13. It thus permits to circumvent any loss, ventilation and evaporation, or, in other words, to retain the fibres which have a tendency of escaping due to gravity or due to displacements of air occurring along the surface of the drum. Any other suitable means may be used to secure the same effect.

Regardless of which of the above arrangements may be used, it appears clearly that, according to the invention, a material is obtained which may be advantageously used for spinning purposes and which is perfectly adapted for weaving purposes while still retaining the remarkable qualities of kapok.

The product resulting from the mixture obtained is more particularly characterized by the features defined hereafter.

Since artificial silk, called "rayon" has a density of about 1,5 whereas the density of kapok is only 0,15, that is 10 times less, the percentages in weight of the materials of the mixture as compared to those obtained with known mixtures, give particularly reduced percentages in volume.

The following table gives the percentages of the materials of the mixture, such as artificial silk called "rayon", compared with the percentages in weight of the mixture material.

Percentages in weight		Percentages in volume		
Kapok	Artificial silk called "rayon"	Density of the mixture	Kapok	Artificial silk called "rayon"
60	40	0.690	93.50	6.50
70	30	0.555	95.70	4.30
80	20	0.420	97.60	2.40
90	10	0.285	98.90	1.10
95	5	0.217	99.48	0.52

Thus, the use, in this mixture, of the heavy fibre of the artificial silk called "rayon" mixed with the very light kapok fibre, permits of reducing to insignificant figures the percentage in volume of the fibre of the mixture. The thread resulting from this mixture thus has the external appearance of kapok and the properties of softness, non rotting, poor electrical conductivity which are peculiar features of this fibre.

The threads made with the mixtures given in the preceding table permit of obtaining per kg. the following lengths (of a thread comparable in section to that of a thread of cotton of 5.000 metres to the kg.).

Density of the mixture	Lengths obtained to the kg.
0.69	12.000
0.55	15.000
0.42	19.750
0.285	29.000
0.217	37.000

These figures are only given by way of example as they are a ratio of the torsion of the thread.

In conclusion:

The addition of fibre of "rayon" in the proportions indicated herein to the kapok permits of obtaining the following technical advantages:

(*a*) Due to the presence of rayon feeding, a principal requirement in spinning of the kapok fibres can be realized.

(*b*) The proportion in volume that is to say apparent of the material of the mixture, is much reduced.

(*c*) The properties of the product obtained are those of kapok: non rotting, slight conductivity, impermeability, insulating qualities.

(*d*) The product can be dyed uniformly.

It should be noted that the invention is also applicable to a mixture of kapok and cotton since the latter material has only a slight difference in density to rayon. It would then be possible to obtain mixed threads of 40 to 5% cotton, a result never obtained, giving no difficulty in dyeing and having the advantages outlined above.

As a new industrial product various types of fabric may be obtained by utilizing kapok thread obtained in accordance with the invention.

Kapok thread may be spun in combination with rayon thread whereby a fabric is obtained which is warmer, lighter and cheaper as compared to that obtained by using rayon exclusively

and this new fabric may be dyed in the same manner as a rayon product. Analogous advantages may be obtained in combining, by spinning, kapok and linen or cotton thread.

Another fabric is made by spinning in combination a fine cotton thread with a coarser kapok thread (it being understood that the kapok thread always contains a certain addition of other fibres,) more particularly, rayon fibres. The cotton yarn may be used as chain thread, while the kapok yarn is used as weft thread. In this fabric which is very warm and solid and which has a silky touch, the fine cotton threads disappear practically completely, that is they can neither be seen nor felt.

Still another fabric can be made by using kapok and woolen yarns; this latter fabric is warmer, lighter and cheaper than that made exclusively of woolen yarn.

A velvety appearance may be realized by subjecting the fabric to a raising or twisting operation.

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