Jan. 12, 1937. G. McCARDLE ET AL 2,067,497

MANUFACTURE OF JUTE YARN

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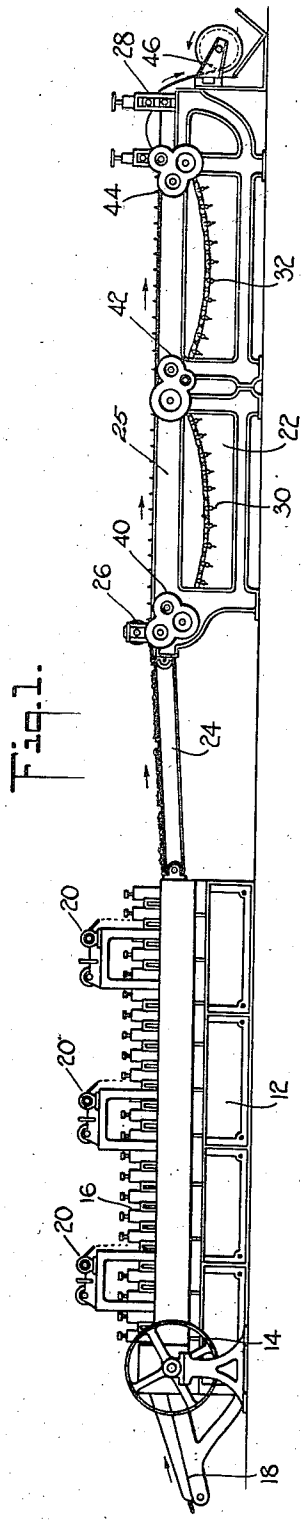


Fig. 1.

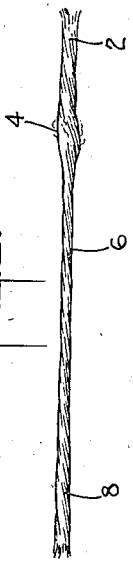


Fig. 5.

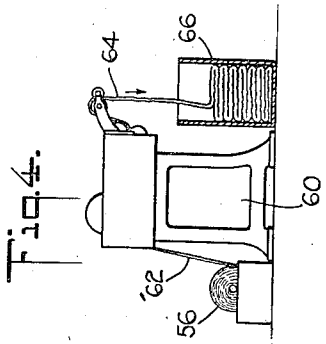


Fig. 4.

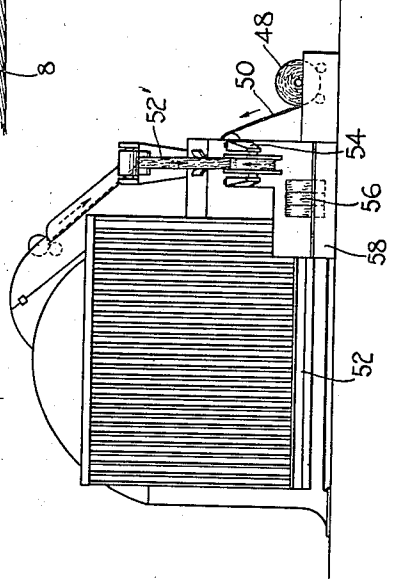


Fig. 3.

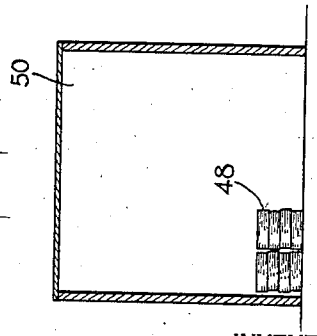


Fig. 2.

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MANUFACTURE OF JUTE YARN

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11 Claims. (Cl. 19—66)

This invention relates to the manufacture of jute yarn, and more particularly to a novel process for making a more uniform, stronger, and cleaner yarn than has heretofore been obtainable.

Jute yarn is ordinarily characterized by thickened portions, known as slubs, which are usually associated with correlative thinned portions. The slubs seem to be small accumulations of short fibres, these short fibres probably having been freer and therefore moved or gathered more readily than the long fibres during the drawing of the silver preparatory to forming the finished yarn. At the same time, this displacement or accumulation of short fibres presumably leaves an attenuated body of long fibres, thereby reducing the diameter of the yarn at the long-fibred portions adjacent the slubs. These factors in turn weaken the yarn. Furthermore, short fibres, even when not accumulated into slubs, are undesirable because they give the yarn a fuzziness which detracts from its appearance and desirability.

The primary and ultimate object of the present invention is to minimize the production of slubs in jute yarn, and to produce a cleaner, stronger, and more uniform jute yarn than has heretofore been known. A corollary object, or the same object expressed in its process aspect, is to minimize the production of short fibres during the manufacture of the yarn, or to make the fibre length of the sliver more nearly uniform. This object is fulfilled, broadly, by including in the manufacturing process, after the softening step and prior to the carding step, a straightening step in which the previously softened bunches of jute are drawn out into relatively long straight fibres. The softened jute is relatively slowly drawn out into a continuous long-fibred sliver with practically no fibre breakage, and it is this straightened fibre, rather than curled twisted bunches of jute, that is subsequently carded. The relatively harsh high-speed carding action, while breaking the fibre and reducing the fibre length to that desired, does not additionally produce quantities of short fibres, as is the case when unstraightened jute is carded.

Further objects of the present invention, here briefly mentioned but later considered in detail, are: to provide a suitable jute straightening process; to eliminate the breaker card, a large, complex, and costly machine; to reduce the manual labor required for handling the jute in the course of its manufacture into yarn; and to make possible simplified and convenient handling of the material throughout the process, including the conditioning of the jute prior to carding the same; as well as to improve the conditioning of the jute preparatory to carding the same.

To the accomplishment of the foregoing and such other objects as will hereinafter appear, our invention consists in the process steps and their relation one to the other, as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by a drawing in which:

Fig. 1 is a side elevation showing the jute straightening machine of the present invention, directly coupled to a jute softening machine and followed by a roll former;

Fig. 2 is a schematic showing of the conditioning of the jute in roll form under predetermined temperature and humidity conditions;

Fig. 3 is a side elevation of a typical finisher card such as may be used directly after the conditioning stage without the intermediate use of a breaker card;

Fig. 4 is a schematic showing of a conventional drawing frame several of which may be used in the usual manner to draw out the sliver; and

Fig. 5 is an enlarged view of a bit of yarn showing a slub and thinned portion, which frequently occur in jute yarn and which are minimized by the present process.

Jute is received in bales which consist of a large number of so-called heads of jute compressed together under high pressure, each head consisting of a bunch of stripped jute stalks twisted together to form a separable unit. The bales are opened, and the heads of jute are subdivided into smaller bunches which are thrown out in more conveniently manipulable form but which nevertheless are in a curled or twisted condition. These bunches of jute are fed or thrown out manually on the feed apron of a jute softening machine where the fibre is run between a long series of rolls and is at the same time treated by a lubricating emulsion which is rained onto the jute during the softening process.

In accordance with current practice, the flattened and softened bunches of jute leaving the softening machine are picked up by workmen, folded and stacked, and thereupon transferred to a conditioning room or bin where the jute is conditioned for a considerable period of time,

say, twenty-four hours, during which the emulsion is given time to spread over and through and to operate on the fibre.

The jute is next put through a series of standard and well-known machines including a breaker card, a finisher card, a number of drawing frames, and finally a roving frame. The breaker card is provided with a feed apron upon which the conditioned bunches of jute must be thrown out or spread by manual labor. The jute must be loaded upon the apron at a predetermined uniform rate, in order that the continuous sliver delivered by the machine may be of uniform weight. The breaker card runs at high speed and has relatively finely distributed pins which operate not only to split and silver the fibre, but also to break the same, the average fibre length of the delivered sliver being, say, ten inches, instead of the original stalk length of, say, five or six feet. While the breaker card thus successfully and desirably transforms the jute into a sliver having a desired average fibre length, it unfortunately and undesirably produces a considerable quantity of short fibre, which, we believe, is caused by the harsh high-speed carding action applied to jute stalks which are in a relatively twisted and irregular condition when fed into the machine.

The sliver from the breaker card is collected either in cans or rolls, and a considerable number, say, ten, such slivers are simultaneously fed into a finisher card which again cards the sliver and draws the same out to approximately its original weight per unit length. The average fibre length is but little, if at all, reduced in the finisher card. The sliver delivered by the finisher card is again collected in cans or rolls, and is fed, with appropriate doublings, to a series of drawing frames in which the draft is made greater than the doublings or multiplication of slivers, so that the delivered sliver is attenuated or reduced in weight per unit of length. Finally, the sliver is fed to an appropriate roving frame in which it is drawn out to its ultimate weight and twisted and wound upon bobbins.

The yarn thus produced appears uniform to the eye, particularly when wound in balls or on a bobbin. However, if wound with individually spaced strands on a black board to provide a contrasting background, it is found that the yarn is not uniform but is characterized by numerous thickened and thinned places, as well as considerable fuzz. Thus, referring to Fig. 5 of the drawing, the strand of yarn **2** is thickened at **4** to form a slub, and is thinned at **6**, the normal diameter not being regained until about at the point **8**. It is our belief that the thickened places or slubs **4** consist of accumulations of short fibres which have been drawn into bunches in the drawing frame or roving frame, while the thinned or attenuated portions **6** consists of remaining long fibres. These non-uniformities in the yarn reduce its strength. The slubs and the thinned parts are ordinarily associated in the yarn, being related as shown in Fig. 5, thereby evidencing the fact that one is presumably the cause of the other. However, it should be understood that our invention is a change in process which may in some aspects be deemed an empirical discovery, and that all theory and explanatory matter herein offered, while based on long and careful study and investigation, and while believed sound and true, constitutes no essential part of the invention.

In accordance with the present invention, slubs are minimized and the yarn improved in appearance, uniformity, and strength by producing a more nearly uniform fibre length in the sliver following the carding stage, and particularly by reducing the quantity of short fibres in the sliver. To accomplish this result, we introduce, between the softening and carding steps, a straightening step which is preferably accomplished immediately after the softening step. Thus, referring to the drawing and more particularly to Fig. 1, thereof, a conventional softening machine is indicated at **12**, this machine comprising a series of lower rollers rotated through appropriate gearing from a drive pulley **14**, and a series of upper rollers forced yieldably downward by appropriate compression springs in housings **16**. The bunches of jute stalks are manually thrown or spread upon a feed apron **18**, and are thereupon compressed and repeatedly bent by the operation of the rollers. At the same time, an appropriate lubricating emulsion is preferably rained down upon the jute during its passage through the softening machine, apparatus for this purpose being indicated at **20**.

The bunches of softened jute are fed directly from the softening machine **12** to a straightener **22**, an appropriate transfer belt or apron **24** being used to interconnect the same if the units are spaced apart. The straightener **22** may best be described by its close similarity to a breaker such as is used for hard fibre, say, Manila hemp or Mexican sisal. It comprises a frame **25** provided at one end with feed rollers **26**, and provided at its opposite end with delivery rollers **28**. Intermediate the feed and delivery ends of the machine are provided two sets of relatively long, widely spaced pins **30** and **32**, these pins being mounted on endless chains driven through appropriate gearing **40**, **42**, and **44** interconnected and driven by suitable mechanism. The straightening machine of the present invention, while structurally resembling a hard fibre breaker, differs markedly therefrom in having the draft reduced from a normal value of, say, 16 to 1, to an exceedingly low value of, say, 3 or 4 to 1. With this arrangement, no substantial amount of fibre breakage takes place in the machine. Instead, the fibre is simply drawn out into a continuous long-fibred sliver. The softened bunches of jute leaving the softening machine **12** are curled, twisted, and separable one from another. After passing through the straightener **22**, the stalks are subdivided or split somewhat, but, more importantly, are drawn out and straightened, and are delivered in the form of a continuous sliver which may be collected in a can or formed into a roll by a roll former **46**, but without substantial breakage of the fibre.

The fact that the straightener delivers the jute in the form of a continuous sliver is in itself a great convenience throughout the remainder of the process. The sliver may be formed into rolls, as shown in Fig. 1, and conditioned while in convenient roll form. Thus, referring to Fig. 2, the rolls of long-fibred sliver **48** are stacked in a conditioning room **50** which may then be simply an enclosed chamber in which the temperature and humidity conditions are preferably controlled so as to prevent evaporation of the water in the conditioning emulsion. The fibres, being closely compacted, tend of themselves to hold the emulsion, and uniform distribution of the same throughout the mass of fibre is very greatly facilitated. To

fully understand the advantages thus obtained, it may be pointed out that it frequently is the practice to take the softened bunches of jute and to place them in large bins where they are trampled down to keep the same in compacted or compressed condition during the conditioning stage or treatment. With the present process, manual handling of individual bunches of jute is entirely dispensed with once the jute has been fed to the softening machine, and the splitting or slivering of the jute prior to conditioning the same better exposes the fibre to the conditioning fluid, while if the sliver is formed into rolls, the fibre is compacted during the conditioning period without trampling or special handling of any kind.

The rolls **48** of long-fibred sliver may next be fed into a breaker card which may be of conventional type or which, more preferably, may be modified to take advantage of the continuous sliver supplied thereto. A plurality of slivers may be simultaneously fed into the breaker card to average out the weight of the delivered sliver. Manual feeding of bunches of jute to the breaker card is then dispensed with, and this is important because the jute must be fed to the breaker card at a uniform rate in order to avoid variations in the weight of delivered sliver. What is most important, however, is that with jute preliminarily straightened in accordance with the present invention, the high-speed and relatively harsh carding action of the breaker card, while reducing the fibre length to a desired value, does not at the same time produce substantial quantities of short fibres. With the present invention an average fibre length may be obtained which is more nearly uniform, the quantity of extremes or variations being greatly reduced, and the actual fibre length being brought nearer to the mean or average fibre length.

In fact, we have found that the improvement in the nature of the carding action is so pronounced and so marked that the breaker card may be omitted entirely, permitting the conditioned sliver to be fed directly to a finisher card. Thus, referring to Fig. 3 of the drawing, a finisher card is indicated at **52** and may be of conventional type. That here shown is arranged for roll feed and roll delivery. A series say, ten, of the rolls **48** are supported in front of the machine and are simultaneously fed thereto in continuous slivers indicated at **50**. A single finished sliver, indicated at **52'**, is preferably rolled in appropriate roll forming mechanism **54**, the finished rolls **56** being collected in an appropriate trough **58**.

The process from this point on is conventional and includes multiplying and drawing the sliver in appropriate drawing frames, and finally drawing and twisting the sliver in an appropriate roving frame to form jute yarn. A typical drawing frame is indicated schematically in Fig. 4, the drawing frame **60** being supplied with a plurality, say, four, slivers **62** from corresponding rolls **56**. The draft of the frame **60** is made greater than the doubling or multiplication of feed slivers, so that a reduced or attenuated sliver **64** is delivered from the drawing frame. This may be formed into a roll, as heretofore described, or may, more simply, be collected in an appropriate can **66**. If the sliver is to be further reduced, it may be run through additional and generally similar drawing frames. Doublings may be obtained by simply feeding slivers simultaneously from several of the cans **66** to the next drawing frame. The sliver is finally passed through a conventional roving frame where it is drawn to desired weight and twisted to form the finished jute yarn.

It is believed that the process of the present invention, and the many advantages thereof, will be apparent from the foregoing detailed description. The improved uniformity of fibre length in the sliver after the carding action is of tremendous value. There is a marked reduction in quantity of slubs, and a corresponding improvement in the strength and uniformity of the yarn, as well as an improvement in appearance and reduction in fuzz. We have devised an unusually stringent test for the yarn, which permits actual quantitative weighing of the ounces of slubs for a given length, say, one thousand yards of yarn. The present process reduces the quantity of slubs to a matter of only 25% of the amount heretofore produced. The more uniform fibre length is also of advantage in the actual handling of the various slivers through the drawing and roving frames, for breakage or discontinuity of the sliver seldom occurs.

The breaker card may be eliminated entirely, thereby dispensing with the necessity for a machine which is large, highly complex, and extremely costly. Of course, the straightening machine is added, but this is an extremely simple and inexpensive machine compared to the breaker card. It may not be amiss to emphasize the fact that while in a sense the breaker card has been replaced by the straightener, and the straightener structurally resembles a hard hemp breaker, the straightener as employed by us is not a breaker, and no fibre breaking action is contemplated or desired and only a negligible amount of fibre breakage takes place. The straightener pins are long and widely spaced, and are moved relatively slowly with but little draft or step-up ratio in the movement of one set of pins relative to the other. The pins of the straightener do not hack or strike the fibre, as in the case of a breaker card, but instead relatively slowly and gradually draw the jute into a straightened continuous sliver form, the fibres being left long but being laid parallel. This continuous and straightened or combed-out fibre eases the ordinarily harsh action of the high-speed card, whether breaker card or finisher card, and, while this belief is advanced by way of explanation and not limitation of the invention, it is our belief that this in turn minimizes the production of short fibres. The present disclosure may be considered as an empirical discovery making for tremendously improved and directly measurable results. Matters other than direct description of the improved process are offered simply in an attempt to explain the gratifying and beneficial improvement obtained by practicing the present invention.

Other advantages of the improved process are: the reduction in manual labor required; the convenience of handling the fibre when conditioning the same; the automatic compacting and compressing of the fibre during the conditioning period; and the splitting or subdivision of the fibre prior to conditioning, permitting better penetration and distribution of the emulsion.

It will be understood that while roll feed and delivery is indicated at various points in the process, this is not essential, for can delivery and feed may also be employed. In fact, the

process as herein described partially employs roll feed and partially employs can feed, and the stage in the process at which transition from one to the other is made, as well as the use of one or the other throughout the entire process, is optional. Roll delivery is of value at the beginning of the process because of its convenience when conditioning the fibre, but even then is not essential. The important thing is the handling of the fibre at all times subsequent to its initial feed to the softening machine in the form of a continuous sliver, but the particular manner in which this convenient sliver is handled is of less importance. It will also be understood that two carding stages may be retained, even though one may be and preferably is eliminated.

It will therefore be apparent that while we have shown and described the method of our invention in preferred form, many changes and modifications may be made in the steps thereof, without departing from the spirit of the invention, defined in the following claims.

In the appended claims we use the term "combing" for convenience, but this term is not intended to have its usual technical meaning in the textile art, but instead means the slow splitting, parallelizing, and slivering action herein described. It is used in the sense of "gilling" rather than in the sense of carding, hackling or breaking.

We claim:

1. In the manufacture of jute yarn, the method which includes softening the jute, slowly combing, staightening and slivering the softened jute without substantial breakage, carding the long-fibred sliver, and finally doubling, drawing, and twisting the sliver in conventional manner.

2. In the manufacture of jute yarn, the method which includes softening the jute, slowly combing, straightening and slivering the softened jute without substantial breakage, breaking and finishing the same in a finisher card without intermediately using a breaker card, and finally doubling, drawing, and twisting the sliver in conventional manner.

3. In the manufacture of jute yarn, the method which includes softening the jute, slowly combing, straightening and slivering the softened jute, conditioning the sliver by storing it away for long exposure to a conditioning fluid, carding the conditioned sliver, and finally doubling, drawing, and twisting the sliver in conventional manner.

4. In the manufacture of jute yarn, the method which includes softening the jute, slowly combing and straightening and slivering the softened jute without substantial breakage, conditioning the long-fibred sliver by storing it away for long exposure to a conditioning fluid, carding the same in a finisher card, and finally doubling, drawing, and twisting the sliver in conventional manner.

5. In the manufacture of jute yarn, the method of minimizing slubs, which includes softening the jute, slowly combing and straightening and slivering the softened jute without substantial breakage, conditioning the long-fibred sliver by storing it away for long exposure to a conditioning fluid, thereafter breaking and finishing the same in a finisher card without intermediately using a breaker card, and finally doubling, drawing, and twisting the sliver in conventional manner.

6. In the manufacture of jute yarn, the method which includes slowly combing and transforming the jute into a continuous long-fibred sliver immediately following the softening step, thereafter conditioning the sliver by storing it away for long exposure to a conditioning fluid, and then carding the sliver by feeding the fibre in sliver form to a carding machine.

7. In the manufacture of jute yarn, the method which includes slowly combing and straightening and slivering but not breaking the bunches of stalks immediately after softening the same, thereafter conditioning the jute while in sliver form by storing it away for long exposure to a conditioning fluid, and then carding the sliver by feeding the fibre in sliver form to a carding machine.

8. In the manufacture of jute yarn, the method which includes transforming the stalks into a continuous long-fibred sliver without substantial breakage, and rolling the same into rolls, all immediately following the softening step, thereafter conditioning the same while in roll form by storing it away for long exposure to a conditioning fluid, and then carding the sliver by feeding the fibre in sliver form to a carding machine.

9. In the manufacture of jute yarn, the method of promoting uniformity of fibre length, which includes softening the jute in conventional manner, then slowly combing, splitting and drawing out the softened stalks into a straightened continuous sliver, said combing action being used in substitution for the conventional harsh, high-speed breaker card action, and after said combing action feeding the fibre in sliver form to a carding machine, the introduction of the combing stage ahead of the carding stage operating to minimize short fibres and slubs.

10. In the manufacture of jute yarn, the method of promoting uniformity of fibre length which includes softening the jute in conventional manner including the application of a conditioning fluid thereto, then slowly combing, splitting and drawing out the softened stalks into a straightened continuous sliver, said combing action being used in substitution for the conventional harsh high-speed breaker card action, conditioning the fibre while handling the same in unbroken sliver form by storing it away to permit long exposure to the conditioning fluid, and thereafter feeding the fibre in sliver form to a carding machine, the introduction of the combing stage operating to minimize short fibres and slubs.

11. In the manufacture of jute yarn, the method of promoting uniformity of fibre length which includes softening the jute in conventional manner including the application of a conditioning fluid thereto, then slowly combing, splitting and drawing out the softened stalks into a straightened continuous sliver, said combing action being used in substitution for the conventional harsh high-speed breaker card action, winding the sliver into rolls, conditioning the sliver while keeping the same in rolled form by storing the rolls away to permit long exposure to the conditioning fluid, and thereafter feeding the fibre in sliver form to a carding machine, the introduction of the combing stage operating to minimize short fibres and slubs.

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