Jan. 10, 1933. M. B. STONE ET AL 1,893,809

MANUFACTURE OF YARN

Filed June 20, 1931 2 Sheets-Sheet 1

Fig. 2.

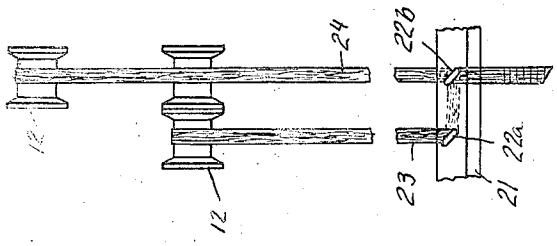


Fig. 5.

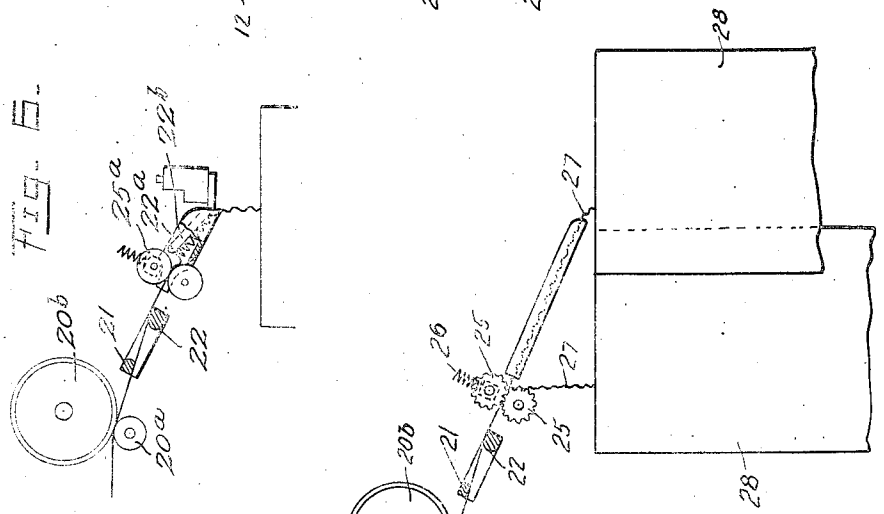
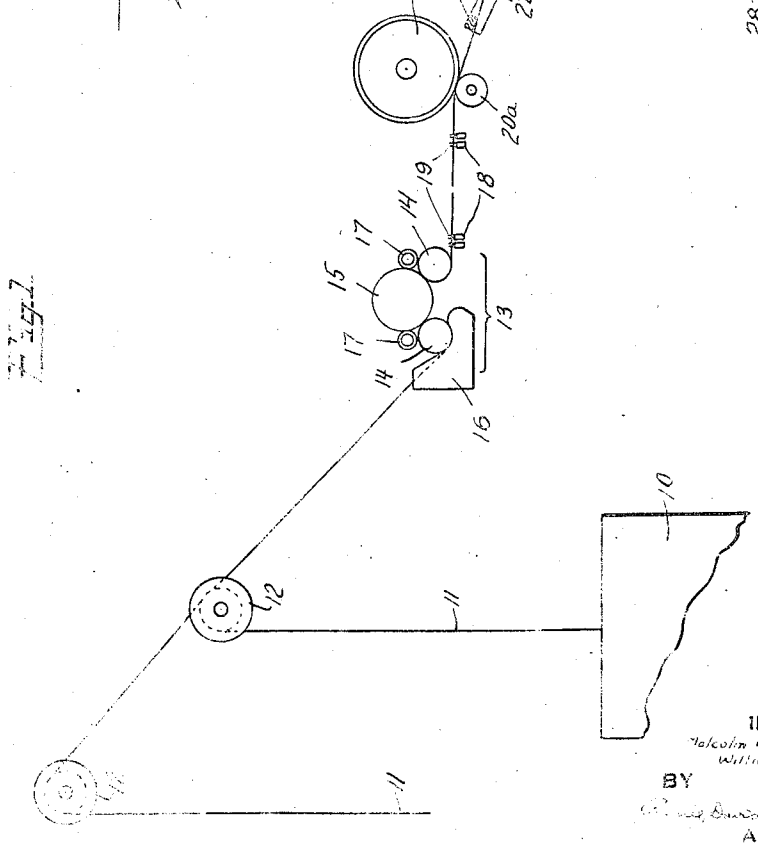


Fig. 7.



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Fig. 3

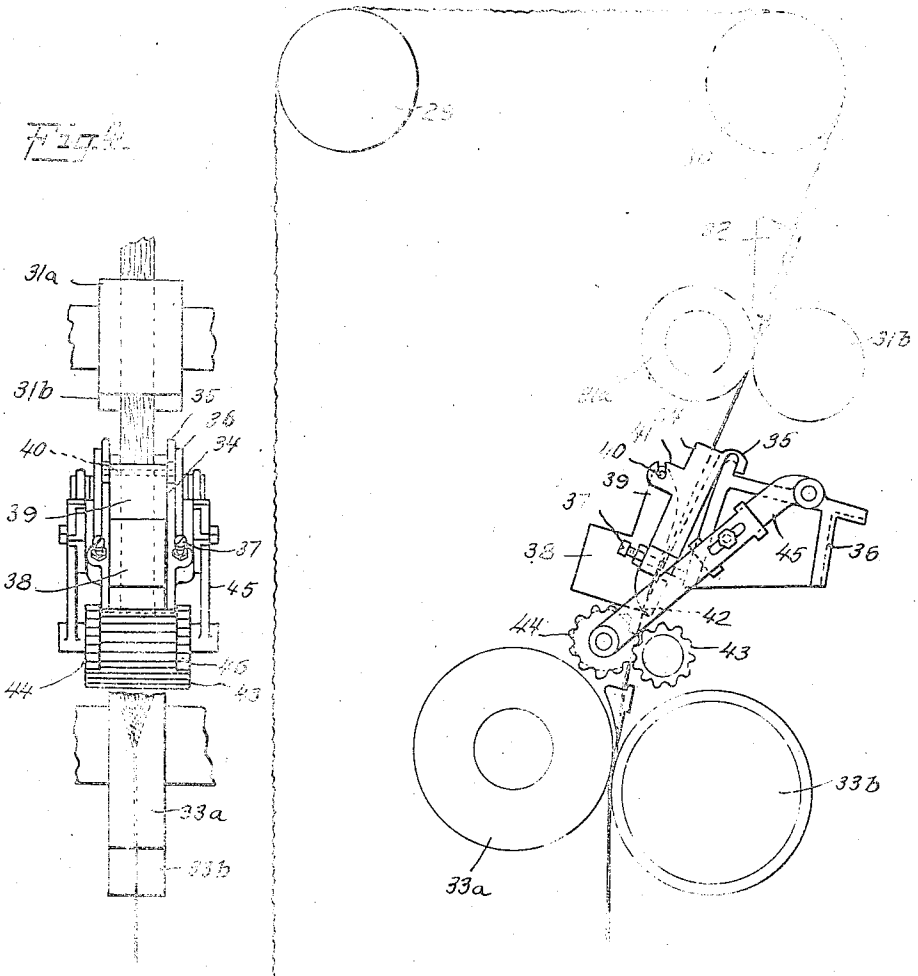
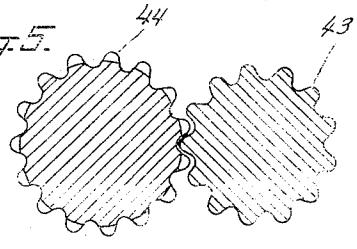


Fig. 4.

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Fig. 5.



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UNITED STATES PATENT OFFICE

MALCOLM B. STONE, OF MILTON, AND WILLIAM P. WILLIAMSON, OF LUDLOW, MASSACHUSETTS, ASSIGNORS TO LUDLOW MANUFACTURING ASSOCIATES, TRUSTEES, OF BOSTON, MASSACHUSETTS

MANUFACTURE OF YARN

Application filed June 20, 1931. Serial No. 545,725.

This invention relates to the manufacture of yarn from long fibres, such, for example, as bast fibres including jute, hemp, and flax, and is concerned more particularly with a novel method for drawing and spinning fibres and apparatus by which this method may be advantageously practiced. The method and apparatus of the invention may be used with especial advantage in the manufacture of jute yarn, and an adaptation of the invention for that purpose will be described in detail for purposes of explanation, although it is to be understood that the utility of the invention is not restricted to that particular long fibre, and it is also contemplated that certain features of the new apparatus may be employed with short fibres.

In the production of yarn from jute as now carried on, the heads of jute after being subjected to a preliminary softening treatment are fed to a breaker card and the sliver produced is then passed through a finisher card. The resulting sliver is the passed through a suitable number of drawing frames in which the sliver is drawn and doubled and the drawn sliver is collected in cans and conveyed to a roving frame. In this frame, the sliver is subjected to a draft between two sets of rolls while it is supported on bars carrying gill pins, and the sliver is then passed through the leg of a flyer which imparts to it a loose twist to convert it into a rove which is wound on a bobbin by the flyer. Due to the fact that the rove is wound on bobbins in the roving frame, the latter necessarily includes a builder rail and a builder motion so that the rove will be wound smoothly to form a suitable package and the frame consequently consumes a considerable amount of power.

The bobbins of rove produced in the roving frame are placed in the creel of the spinning frame and the rove from each bobbin is subjected to draft between two sets of rolls, and delivered to a flyer, which imparts twist and winds the yarn on a bobbin. Between the retaining and drawing rolls, the rove passes over a breast plate, and the principal drawing action takes place between the point of contact of the fibres with the breast plate and the nip of the drawing rolls. By adjusting the position of the breast plate, some control of the fibres is obtained, and this adjustment and the twist in the rove are relied on to secure uniformity in the yarn. In this machine, the retaining and drawing rolls are heavily weighted, the retaining rolls carrying about 43 lbs. and the drawing rolls about 200 lbs., for example, and the use of this heavy pressure increases the power consumption of the machine to a substantial extent. Also, the lack of adequate control of the fibres during the drawing operation reduces the degree of uniformity of the yarn produced.

In addition to the above method of spinning yarn, there is a method of spinning directly from sliver which is known as gill spinning. In spinning by this method, the retaining of the fibres during draft is controlled by a bed of mechanically driven gills between the retaining and drawing rolls. This method entails heavy expense for the construction of the machine and for its operation and maintenance and there is a limit to the speed at which the gills may be operated.

Our invention relates to the drawing of bast and similar long fibre sliver and its conversion into yarn and is directed to the provision of a novel series of operation by which yarn of more uniform quality can be produced at less cost than is possible by prior methods. In the new method, the sliver is subjected to the desired drawing operations, but is not given a twist until the final drawing and spinning operations are completed and no gills are used. As a consequence, the sliver may be collected and supplied in cans, thus eliminating the usual roving frame and substituting a drawing frame of generally standard construction delivering the sliver into cans.

In the method of our invention, the long fibre sliver from the drawing frames, for example, and of a size which makes it suitable for feeding to a roving frame, is subjected to a drawing operation carried on by rolls and, if desired, without the use of gills, is doubled if desired, and is then treated to condense it so that the drawn sliver, which is of relatively small width, may be collected in bulk, as for example in cans, and properly supplied

for subsequent operations. Such treatments may increase the resistance of the sliver to a lengthwise pull, which is desirable when the sliver is collected in cans, and a satisfactory treatment involves transversely crimping the silver. The crimping both compacts the fibres in the sliver and gives the latter a degree of longitudinal extensibility so that it may be pulled from a can without becoming entangled and without being pulled apart.

The sliver is then subjected to a single final drawing operation carried out on a spinning frame by means of sets of retaining and drawing rolls, and between the retaining and drawing rolls, the sliver is subjected to a dragging control or slip draft exerted over a substantial distance without using gills. Preferably, we employ at least two separate means between the drawing and retaining rolls for subjecting the sliver to the dragging or slipping control. These means allow the fibres that are gripped by the drawing rolls to slip freely but do not allow the bulk of the fibres to be disturbed. Beyond the drawing rolls the sliver is led to flyers which twist it and wind it on bobbins or quills, and the final drawing operation and the subsequent twisting are similar in all respects to the usual method of spinning, except that sliver without twist is fed into the machine instead of twisted rove and no gills are used. Due to the control afforded over continuous lengths of the sliver between the drawing and retaining rolls in the new process, the yarn produced has an equal or better degree of uniformity than has heretofore been attained and the rolls require less pressure so that the machine consumes less power.

We have found that some of the advantages and benefits of the invention may be attained when a twisted rove is subjected to the final drawing and spinning operations with the slip draft or dragging control above described and therefore do not wish it understood that the final drawing and spinning operations carried on in accordance with our method can be used only in connection with sliver. However, the substitution of our new method of drawing the sliver received from the drawing frames and then preparing it but without twisting it, in place of the prior method of drawing and twisting to produce a rove, offers so many advantages, that we prefer to maintain the sliver untwisted up to the formation of the yarn, wherever that is possible.

For a better understanding of the new method and apparatus, reference may be made to the accompanying drawings, in which

Fig. 1 is a diagrammatic elevational view illustrating the first drawing of the sliver in the new method, and a convenient means for preparing the drawn sliver;

Fig. 2 is a diagrammatic front elevational view showing a convenient means for doubling the drawn sliver;

Fig. 3 is a diagrammatic side elevational view illustrating the spinning operation according to our invention;

Fig. 4 is a view in front elevation of certain parts shown in Fig. 3;

Fig. 5 is a sectional view of certain rolls shown in Fig. 4; and

Fig. 6 is a view in side elevation and partly in section showing a modified form of the mechanism for treating the sliver.

In the drawings, such parts of the mechanism as are in common use are illustrated conventionally, and the details of roll mountings, weights, guides, and other similar parts have been omitted for the sake of clarity.

The preliminary drawing operation of our process may be carried on in a frame in some ways resembling the roving frame now commonly employed for the purpose but differing therefrom in the omission of numerous parts and the addition of others. To this frame, the sliver from the drawing frames is supplied in cans, one of which is indicated at 10, and the sliver ends 11 pass up out of the cans and around spool guides 12 to sets of retaining rolls generally designated 13. These rolls are of conventional construction and include bottom driven rolls 14 and a heavy floating top roll 15, commonly referred to as a jockey roll. The sliver end from each can is directed through a set of retaining rolls by means of a guiding or centering trough 16, and the end passes under the first driven roll 14, up and over the jockey roll 15, and down and under the second driven roll 14. Ordinarily a considerable number of driven rolls are connected together end to end in the machine while a separate jockey roll is used for each sliver end. Above each driven roll is a felt covered rod or stick 17 to catch dirt.

From the retaining rolls, the sliver may pass over and along with a set of gill bars 18 with pins 19. These bars are of standard construction and only a few are illustrated. They are used to assist in keeping the fibres straight and they occupy the space between the retaining rolls 13 and the drawing rolls 20*a*, 20*b*, supporting and straightening the fibres in that part of the sliver which is being subjected to draft. The drawing rolls are also of standard construction, the bottom roll 20*a* being driven and commonly of iron and the top roll 20*b* made of suitable material and suitably weighted. The drawing rolls operate in the usual way at a higher speed than the retaining rolls, so that the two sets of rolls draw the sliver and tend to straighten the fibres. Beyond the drawing rolls is a sliver plate 21, which may be used for doubling, in which case it has openings 22 formed in it. When the plate is used for

doubling, the end 23 from one set of drawing rolls passes over the plate, down through an opening 22*a*, along beneath the plate, and up and out the next opening 22*b*, while the end 24 from the next set of drawing rolls passes beneath the plate and up through opening 22*b*. The two ends are thus laid one on top of the other and pass to condensing means including a conductor (not shown) and means for placing the sliver in suitable condition so that it can be collected in bulk and fed as sliver to the spinning frame. For this purpose, the sliver may be treated to increase its longitudinal extensibility, as by being laterally distorted.

The rolls 25 illustrated are crimping rolls and both are fluted, and the top roll bears against the bottom roll with the desired pressure, produced, for example, by springs 26. The bottom roll is driven at about the same speed as the drawing rolls and a plurality of bottom crimping rolls may be connected end to end in the machine. The top roll may have a length sufficient to permit it to act on several ends, for instance, four. These rolls provide one convenient means for treating the sliver to give it increased ability to withstand a pull without breaking, the ribs of the rolls squeezing the fibres together along spaced transverse lines and also distorting the sliver by giving it a crimped configuration. This combined action on the sliver strengthens it against tensile stresses to an extent such that the sliver can be handled without receiving a twist and the crimped sliver 27 is discharged into cans 28 mounted on standard rotating or reversing supports.

Instead of using a pair of fluted rolls for crimping the sliver, other means may be employed, such, for example, as that illustrated in Fig. 6. The mechanism shown in that figure includes a trap which includes a conductor 22*a* with a suitable tongue 22*b* pivoted at one end and weighted at its floating end, and bearing against the sliver issuing from the driven delivery rolls 25*a*. This weight serves to retard the sliver end being discharged from the delivery rolls, and the sliver backs up until the pressure behind it causes it to lift the weight to permit the sliver to pass from the trap. This mechanism produces a crimped effect and gives the sliver the desired strength for handling.

We have found that the condensed sliver may be readily collected, as for example, in cans, and be supplied from the cans without injury or entanglement, whereas, if the sliver were not condensed, the strands piled upon one another would be likely to become entangled and also pulled apart in being fed. Sliver not condensed may be collected in cans and fed therefrom but entanglement and breakage occurs so frequently that omission of the condensing operation is not possible as a practical matter. When the sliver is crimped, the effect of a pull on the sliver is first to flatten out the crimping before any pulling apart of the fibres occurs, and the likelihood of the crimped sliver being broken in the removal from the cans is extremely remote. Since the condensed sliver may be collected in cans, it will be apparent that the frame is greatly simplified in construction. It contains no builder rails, no builder motion, no spindles, and no flyers, and aside from its cheaper construction, it is much less costly to operate. Also, since no bobbins are used, no doffing is necessary and the idle time is greatly reduced. The cans 28 contain a much greater length of sliver than a bobbin and thus offers additional advantages in connection with the spinning operation.

The final drawing operation followed by twisting is carried out on a second machine which resembles a conventional spinning frame in some respects but differs therefrom in the elimination of certain parts and the addition of others. The new frame has no creel, and the supply cans 28 containing the sliver are placed in front of or behind the frame as may be desired. The end from each can is drawn from the can and advanced by means of suitable driven rolls 29, 30 to a pair of retaining rolls 31*a*, 31*b*, one roll being driven and the other weighted in the usual way. Due to the fact that it is sliver that is being acted on instead of rove, the weighting of the roll may be greatly reduced, for example, a 12 lb. weighting has been found suitable in place of a 43 lb. weighting used for the retaining rolls in a standard frame. The sliver ends are guided to the retaining rolls by suitable centering conductors 32 of standard construction.

Spaced from the retaining rolls a distance determined by the length of the fibre being treated is a pair of drawing rolls 33*a*, 33*b*, one being driven and the other suitably weighted. Here again, since the fibres being drawn are without twist, the weighting may be greatly reduced, for example, a 115 lb. weighting being used instead of a 200 lb. weighting in a standard machine. Due to this reduction in weighting, friction is cut down and the power required to drive the frame is greatly reduced.

Between the retaining and drawing rolls, we provide means for controlling the fibres in an extended length of the sliver between the nips of the two sets of rolls and undergoing draft and two separate means are used in combination in the construction illustrated. These devices subject the sliver to what is known as a "slip draft", that is, they exercise a dragging control on that part of the sliver which is undergoing draft, allowing the fibres to slip when caught by the nip of the drawing rolls and holding back fibres which have not yet reached the nip. By the use of this control, we have found it possible

to produce yarn of equal or greater uniformity than heretofore and avoid the use of gills which are expensive to install and maintain, and are also objectionable because they cannot be operated beyond a fairly definite and relatively low speed limit. The new control mechanism offers these advantages regardless of whether it is sliver or rove that is being spun but we prefer to spin sliver for the numerous reasons above pointed out.

The first of the control devices may take different forms and that illustrated is of the friction type and it comprises a conductor plate 34 which may have side walls to give it a trough shape and is hung by a lip 35 on a suitable support 36 and adjustable with reference to the support by means of screws 37. The sliver or rove, as the case may be, leaving the retaining rolls passes over this conductor plate and moves beneath a weight 38 having a tail 39 carrying pins 40 which lie in slots in arms 41 extending up from the side edges of the conductor. The weight is free to swing toward and away from the conductor plate and the lower edge 42 of the weight bears against the fibres passing down over the conductor. The weight is relatively light, of the order of a pound, and it is not heavy enough and does not bear sufficiently directly on the fibres to injure them. However, it does serve to retard the fibres not yet gripped by the drawing rolls, and thus distributes the drawing action.

Beyond the first slip draft device is the second which comprises a pair of elements having traveling surfaces, the fibrous strand passing between the elements and in contact with the traveling surfaces which move in a direction of strand movement. These elements are mounted and constructed to permit slippage of the fibres between them and they are positively driven so that their surfaces travel at the same rate. In the construction illustrated these elements take the form of a pair of rolls. The rolls have surfaces for producing the desired effect and those illustrated are fluted. Roll 43 is in fixed bearings and driven and it has deep flutes from end to end while roll 44 is mounted in arms 45 adjustable in length and pivoted at any convenient point, for instance, on the support 36. Roll 44 is of special construction and it has deep flutes for a short length at each end, while between these end portions 46, its ribs are cut down so that its overall diameter at its ends is substantially greater than at its middle. With this arrangement, the rolls may spread slightly by the sliver but always rotate at the same speed, since the deep ribs at the ends of roll 44 continue to mesh with the ribs in roll 43, even though the rolls are elsewhere out of contact.

The second slip draft device comprising a pair of elements having traveling surfaces, for example, rolls, is an important feature of our invention and while we contemplate that other means may be employed for allowing slip draft at this point just in front of the drawing rolls, the combination of a fixed driven roll and a floating roll driven continuously by the first roll, and particularly fluted rolls, have given the most satisfactory results in our work up to the present. These rolls hold the fibres and appear to supply them to the drawing rolls with great uniformity as is evidenced by the uniformity of the yarn produced. They do no injury to the fibres, and together with the conductor 34 and weight 38 afford a high degree of control of the fibres.

The fibres leaving the drawing rolls 33*a*, 33*b* are led to flyers of standard construction and wound on bobbins in the form of yarn in the usual way.

It will be apparent that in the best practice of our new method, the sliver is received from the drawing frames is subjected to successive drawing operations and twisted into yarn, without receiving any substantial twist until the final single drawing operation is completed. Following the first drawing operation in our new method, the sliver is treated to condense it, as by crimping, to compact it to prevent entanglement and also to increase its tensile strength and it thus may be handled as sliver and need not be converted into rove. By using the sliver, it is possible to collect and supply it in large supply units, such as cans for the subsequent operations, and as a can of this sliver will contain about a two days' supply for a spindle in a spinning frame, while a rove bobbin holds only about 4 hours supply, the saving in labor on the part of the spinner will be apparent. Also, by using cans to collect the product of the first drawing operation in our new method, no doffing of bobbins is required.

The rotary control device comprising a pair of rolls positively driven in unison and with one roll, preferably the top, floating, that is, bearing on the sliver only by its own weight or with a light weighting so that it permits slippage of such fibres as are nipped by the drawing rolls but prevents other fibres from being drawn along by adhesion, affords an excellent control of the fibres and may be used advantageously throughout the drawing of the sliver, that is, in final drawing operation associated with spinning as well as in preceding drawing operations. In each case, the device provides a dragging control on fibres undergoing draft and prevents bunching up.

Gills have heretofore been used to some extent in connection with the final drawing operation involved in spinning yarn from long fibres, and have been regularly used in drawing long fibre sliver. The new dragging control device takes the place of gills and the substitution results in a great sav-

ing in expense for construction and maintenance of the frames and in a great reduction in cost since it permits the frames to be run at much higher speeds than are possible with gills. In addition, we have found that its use is accompanied by a substantial improvement of the quality of the yarn, particularly when the yarn is spun from sliver.

What we claim is:

1. A method of making yarn from bast and similar long fibres which comprises subjecting sliver to a drawing operation, treating the drawn sliver of said drawing operation without twisting it to increase its ability to undergo a lengthwise pull without being broken, subjecting the treated sliver to a single final drawing operation reducing it to yarn size, an extended length of the sliver being supported and subjected to dragging control without the use of gills, during said single drawing operation, and twisting the product of said single drawing operation and winding it into a yarn package.

2. A method of making yarn from bast and similar long fibre sliver received from drawing frames which comprises subjecting the sliver to a drawing operation, treating the drawn sliver to give it longitudinal extensibility, collecting the treated sliver in bulk, supplying the treated sliver in bulk to a single drawing operation in which the sliver is reduced to yarn size and which does not involve the use of gills, and twisting the product of said single drawing operation and winding it into a yarn package.

3. A method of making yarn from bast and similar long fibre sliver received from drawing frames which comprises subjecting the sliver to a drawing operation, treating the drawn sliver to give it longitudinal extensibility, collecting the treated sliver in cans, supplying the treated sliver from the cans to a single drawing operation in which the sliver is drawn to the size required for yarn without the use of gills, during said single drawing operation, controlling the fibres in that part of the sliver undergoing draft, and twisting the product of the final drawing operation and winding it into a yarn package.

4. A method of making yarn from bast and similar long fibre sliver which comprises drawing the sliver to a size suitable for rove, laterally distorting the drawn sliver to give it longitudinal extensibility, collecting the drawn sliver without substantially twisting it, subjecting the drawn sliver to but a single drawing operation without the use of gills to reduce it, to a size suitable for the desired yarn, and twisting the product of said single drawing operation.

5. A method of making yarn from bast and similar long fibre sliver which comprises drawing the sliver to a size ordinarily requiring that the product be twisted in order to withstand subsequent operations, crimping the drawn sliver and collecting it in bulk, drawing the crimped sliver to a size suitable for yarn in a single operation, and twisting the product of said single drawing operation.

6. A method of making yarn from bast and similar long fibre sliver which comprises drawing sliver to a size suitable for a rove, and thereafter drawing the drawn sliver in but a single operation to the yarn size desired and, during the said single drawing operation, subjecting the sliver being acted on to slipping control throughout a substantial portion of its length undergoing draft without the use of gills, the product of said first drawing being maintained without substantial twist.

7. In a method of making yarn from bast and similar long fibre sliver, the steps of subjecting the sliver to a drawing operation, distorting the drawn sliver laterally to enable it to withstand lengthwise handling stresses, collecting the distorted sliver in bulk, supplying the distorted sliver in bulk directly to a single spinning operation, and, in said spinning operation, reducing the sliver to yarn size and twisting it.

8. In a method of making yarn from bast and similar long fibre sliver, the steps of subjecting the sliver to a drawing operation, and thereby reducing it to a size ordinarily requiring that it be twisted in order to withstand subsequent operations, crimping the drawn sliver, collecting the crimped sliver, supplying the crimped sliver directly to a spinning operation, and, in said spinning operation, drawing the crimped sliver to yarn size in a single operation and twisting it.

9. In a frame for drawing fibrous products, the combination of a pair of retaining rolls for a single fibrous strand, said rolls being weighted to exert a firm grip on the strand, a pair of drawing rolls for said strand, said drawing rolls also being weighted to grip the strand and to prevent slippage thereof, and a slip control device between the retaining and drawing rolls for controlling the fibres in that part of the strand undergoing draft, said device comprising a driven roll having deep depressions in its surface and mounted in fixed bearings, a floating roll cooperating with said driven roll and having shallow depressions in its surface, said floating roll being lightly weighted and free to move toward and away from said fixed roll in accordance with inequalities in said strand, said floating and driven rolls permitting slippage of fibres between them but exercising control thereon, and means for positively driving the floating roll in unison with the fixed roll.

10. In a frame for drawing fibrous products, the combination of a pair of retaining

rolls for a single fibrous strand, a pair of drawing rolls for said strand, and a slip control device for said strand between said pairs of rolls, said device comprising a pair of rolls between which said strand passes, the upper roll of said pair being mounted to move freely toward and away from the lower roll in accordance with inequalities in said strand, and both rolls being fluted and having their ribs meshing during operation, the upper roll having its ribs partially cut away between its ends and said lower roll being in fixed bearings and positively driven, said device permitting fibres gripped by said drawing rolls to slip through it, while holding back other fibres.

11. In a frame for drawing fibrous products, the combination of a pair of retaining rolls for a single fibrous strand, a pair of drawing rolls for said strand, and a slip control device for said strand between said pairs of rolls, said device comprising a lower roll positively driven and mounted in fixed bearings, said roll being fluted from end to end, and an upper roll resting on the strand passing over the lower roll, said upper roll being mounted in bearings permitting it to move freely toward and away from the lower roll in accordance with inequalities in said strand, said upper roll being fluted and having its ribs partially cut away between its ends, the ribs at said ends meshing with those of the lower roll during operation whereby said lower roll positively drives the upper one, said device permitting fibres gripped by said drawing roll to slip through it while holding back other fibres.

12. In a frame for drawing fibrous products, the combination of a pair of retaining rolls for a single fibrous strand, a pair of drawing rolls for said strand, and a slip control device for said strand between said pairs of rolls, said device comprising a lower roll positively driven and mounted in fixed bearings, said roll being fluted from end to end, an upper roll resting on the strand passing over the lower roll, said upper roll being fluted and having its ribs partially cut away between its ends, the ribs at said ends meshing with those of the lower roll during operation whereby said lower roll positively drives the upper one, and a swinging mounting for said upper roll permitting it to move toward and away from the lower roll in accordance with inequalities in the strand, said device permitting fibres gripped by said drawing rolls to slip through it while holding back other fibres.

13. In a frame for drawing fibrous products, the combination of a pair of retaining rolls for a single fibrous strand, a pair of drawing rolls for said strand, and a slip control device for said strand between said pairs of rolls, said device comprising a pair of rolls between which said strand passes, one roll of said pair being mounted in fixed bearings and driven and being fluted from end to end, the other roll of said pair being fluted from end to end with its ribs partially cut away between its ends, the end ribs on said second roll meshing with those of the first roll during operation whereby said rolls rotate in unison, and a mounting for said second roll permitting it to rest against said strand and to move toward and away from the first roll in accordance with inequalities in said strand, said device permitting fibres gripped by said drawing rolls to slip through it while holding back other fibres.

In testimony whereof we affix our signatures.

MALCOLM B. STONE.
WILLIAM P. WILLIAMSON.

DISCLAIMER

1,893,809.—*Malcolm B. Stone*, Milton, and *William P. Williamson*, Ludlow, Mass. MANUFACTURE OF YARN. Patent dated January 10, 1933. Disclaimer filed December 27, 1944, by the assignee, *Ludlow Manufacturing & Sales Co.*

Hereby enters this disclaimer to claims 1 and 6 in said specification.

[*Official Gazette January 23, 1945.*]