ABSTRACT OF THE DISCLOSURE

A sliver band storage apparatus wherein continuous lengths of sliver band delivered by a first machine or other supply means are passed through a powered infeed device into the lower end of an inclined tubular container for transitory storage in coiled layers stacked therein, and previously stored sliver band is delivered through an outlet at the upper end of the container for receipt by a second machine or other receiving means.

This invention relates in general to spinning mill machinery, and more particularly to an apparatus for the intermediate, transitory storage of fibrous sliver bands.

For efficient production in spinning mill operations where the sliver band output of one machine is fed to another machine for further processing thereby, it is desirable that both machines be maintained in a state of continuous operation, or as nearly so as possible with at least one machine operating at all times. This requires that the sliver band output of the first machine be completely synchronized with the intake of the second machine unless temporary sliver band storage means are provided to compensate for variations in the output and intake rates of such machines.

In the case of most sliver band processing machinery arrangements for performing successive processing operations on a continuous sliver band, completely synchronous operation over any extended period is either impossible or impractical, even though such machines may have substantially equal average production rates. Accordingly, the invention is directed at providing an intermediate sliver band storage apparatus which when operatively connected to receive successive lengthwise portions of sliver band from a first machine will be capable of temporarily storing a sufficient quantity of such sliver band so as to supply a second machine therewith and thereby maximize the duty cycles of both machines.

Essentially, the sliver band storage apparatus of the instant invention includes a container means for transitory storage of a sliver band, said container means having a lower inlet portion disposed for receiving successive lengthwise portions of sliver band and an upper outlet portion disposed for discharging successive lengthwise portions of sliver band therefrom, and a sliver band infeed means operatively connected to the inlet of the container means to supply sliver band thereto for storage therein.

The sliver band infeed means is operatively connected to the sliver band output of a first machine to receive a continuous sliver band therefrom, and the outlet of the container means is operatively connected to the sliver band intake of a second machine whereby sliver band which has been received from the first machine and stored within the container means is passed through the outlet thereof to supply a second machine. Hence, the sliver band storage apparatus of the invention functions in a manner analogous to a hydraulic fluid accumulator reservoir.

In general, the container means is constructed to have a sliver band storage capacity which will enable both the sliver band supply means and the sliver band consuming machine to operate as continuously as possible, taking into account the sliver band flow rate of each, and their respective duty cycles under normal operation. For example, where the sliver band supply machine must be periodically stopped to permit the replenishing of stock materials, processing chemicals, etc., the container means is preferably provided with a storage capacity which will permit the sliver band consuming machine to operate during such stoppage periods, and vice versa. Thus, by using the sliver band storage apparatus of the invention, at least one of the two sliver processing machines can be maintained in operation at all times under normal conditions.

The container means and infeed means are rotated relative to each other so that the sliver band will become loosely coiled within the container for more compact storage therein. Accordingly, the container means is stationary with respect to a base surface, such as for example, the plant floor, and the infeed means can be rotated relative to the container, or alternatively, the infeed means can be stationary with respect to the base surface with the container being rotated relative to the infeed means.

The container means is preferably constructed in the form of a tubular cylinder and is inclined at an acute angle relative to the horizontal so that the major portion of the weight of the sliver band stored within is borne by the walls of the container, thereby reducing the weight component acting in the direction of its length and thus decreasing the resistance to the entry of sliver band supplied by the infeed means for storage within the container.

Such an arrangement is particularly accommodating to a sliver band storage apparatus according to a preferred embodiment of the invention wherein the infeed means and storage container are pivoted or slidably connected to each other to permit them to be displaced apart for access to the stored sliver band. By inclining the container so as to reduce the tendency of the stored sliver band to fall out through the inlet of the container when the infeed means is removed temporarily for access to the sliver band therein, the splicing of broken sliver band sections that have passed into the container is greatly simplified and becomes less critical.

In the previously known sliver band storage devices, the sliver band output of the first machine was deposited into cans which were then transported for feeding the demanded sliver band to a subsequent processing machine. While such intermediate transportation did provide for compensating the production variations of successive processing machines, it did not permit an automatic continuous feeding of sliver band stock between successive machines, and also required additional space for the transport cans. Thus, it was necessary to eliminate this disturbing and costly intermediate transport operation, and to supply the sliver band automatically from one machine to a following machine by interposing a sliver band storage band device to compensate for variations in sliver band flow rate peculiar to the individual machines.

For example, German Patent No. 1,145,062 exemplifies a sliver band storage device in which the sliver band is deposited in loops lying transversely or approximately transversely to the direction of transport upon a sliver band carrier. However, this particular storage device requires a relatively large operating space, and has a relatively low sliver band storage capacity, and thus is capable of compensating for only very brief interruptions in the operation of the sliver band supplying and consuming machines. By reason of its inherently low sliver...
band storage capability, this particular device is essentially limited to operation between carding machines.

Swiss Patent 372,231 and its corresponding British Patent 968,971 represent a significant improvement over the sliver storage apparatus of German Patent 1,145,062. As shown in the Patent 968,971 figure 1 of that invention is capable of continuously receiving and delivering sliver band from and to successive preparatory spinning machines and for such purpose is provided with a rotatable sliver coiler and a rotatable cylindrical tubular container arranged eccentrically above the coiler and into and from the lower and upper ends of which the sliver is fed and discharged. In the operation of this particular sliver accumulator apparatus, the sliver band from the first preparatory machine passes through a guide ring into a funnel-like condenser and thence through the pinch point of a pair of feed rollers through the outlet of the coiler. This coiler can be driven synchronously by the first preparatory machine. From the outlet of the coiler the sliver band enters the container which is supported and positioned by rails and rollers and is rotated by a belt drive apparatus. When this apparatus is started a disk member-insures the formation of a sliver band on platforms adjoining the container and thereafter the sliver accumulated within the container is compressed radially for compact storage therein.

However, this particular apparatus has the disadvantage that difficulties arise in introducing the sliver band from the condenser into the container since this point of sliver band introduction ordinarily lies below the outlet point of the preparatory machine which supplies such sliver band. Thus, it is necessary in transmitting sliver band from the first preparatory machine to the coiler to pass the sliver band through as many as three bend points before the lower and upper ends of the intake of the coiler.

Furthermore, with such an arrangement wherein the storage container is vertically disposed the discharge outlet of the container will be positioned at an elevation which is substantially above that of the intake point of the preceding preparatory machine.

This creates the problem that the transmission of sliver band from the container outlet to the next processing machine must necessarily take place over a path having a sufficient number of inclination points to bring the sliver band from a relatively high container outlet point to a lower intake point of substantially lesser elevation. Also, to provide a sufficient storage capacity in such vertically standing containers, it is necessary to construct them of such length that when supported above the coiler, the container outlet point is at an elevation above the plant floor which cannot be conveniently reached by the operating personnel for routine servicing.

Furthermore, with this particular type of sliver accumulator, the interior of the container is not accessible for servicing at the inlet end, since even if the funnel wheel plate of the coiler were arranged for swinging aside, upon separation of this funnel wheel plate which serves as a bottom for the storage container, the stored sliver band column would be emptied downward. Thus, disturbances in the sliver band infeed, for example rove breakage, etc., cannot be removed, in addition to the other unfavorable operating features. Besides, the entire weight of the stored sliver band column is loaded on the rotary plate used as a bottom for the container, and consequently because of the increased friction between the funnel wheel plate and sliver band column, there is an undesirable degree of interference to the infeed of sliver band into the container.

In accordance with the invention, these disadvantages are avoided by using a tubular sliver band storage container that is inclined at an angle to the vertical, and also to the horizontal, so that the effective weight component of the stored sliver band acting in the direction of the inlet is reduced over that which would exist if the container were arranged vertically.

As distinguished from the sliver accumulator of British Patent 968,971, wherein both the tubular container and the coiler are rotated, the sliver band storage apparatus of the instant invention requires rotation of only one of the storage container and infeed coiler elements. Thus, according to the invention the sliver accumulator is disposed for normal operation in a predetermined position relative to a base surface such as, for example, the plant floor, with the container being disposed for rotation relative to the infeed means to deposit sliver band coils within the container. Conversely, the container can be disposed stationary with respect to the base surface and the infeed means can be rotated relative to the container to accomplish the same result.

In general, a variety of known sliver band infeed, or coiling devices can be used in the apparatus of the invention to deposit the sliver band into the container in the form of coiled layers stacked longitudinally therewithin. For example, coiling devices which deposit the sliver band in a series of coils arranged successively in an orbital path around the longitudinal center line of the container can be used, as well as those which deposit the sliver band in a plane spiral path spirally disposed on the band platform.

It has been found preferable to construct the sliver band storage container in the form of a tube having a circular transverse cross section and bent longitudinally to define a lower inlet end and an upper outlet end which are disposed in planes perpendicular to the curved longitudinal axis of the tube. By a slight angular angle of inclination with respect to each other. The portion of the container tube adjacent to the inlet end is approximately horizontal, or at a slight upward inclination to the horizontal, with the inclination of the tube with respect to the horizontal gradually increasing along the curved portion. The upper portion of the tube, i.e., between the band and the outlet end can be straight and either vertical, or slightly inclined from the vertical.

By using such a curved container tube, which somewhat resembles an elbow bend fitting used in plumbing, a significant portion of the sliver band stack weight is borne by the curved wall portion of the tube, so as to reduce the weight component acting in the direction of the inlet. Thus, in the sliver band storage tube of the invention, there is less force tending to urge the stored sliver band out through the inlet and against the rotary plate of the infeed device of substantially greater force tending to urge the container tube. This feature is particularly advantageous not only because it reduces the interference with sliver band infeed, but also because it permits an arrangement whereby the container and infeed device can be separated for access to the interior of the container through the inlet.

Furthermore, it is preferable to use such a curved tubular container because it also provides the same advantages of a straight vertical container insofar as transmission of sliver band from its outlet is concerned.

The storage container used in the invention is preferably made of a transparent material such as Plexiglas, so as to permit continuous visual inspection of the sliver band, and the rapid detection of breakages which have passed into the container.

To permit repair of such breakages, as well as other servicing operations, the storage container and infeed device are arranged for displacement relative to each other to provide access to the interior of the container through the inlet thereof. Such displacement capability can be expediently provided in the form of means pivotally connected to the container to the infeed device, or in the form of means slidably connecting them to each other.

Since the operation of the entire storage apparatus and the sliver band supplying and consuming machines must necessarily be interrupted when the container and infeed device are separated for sliver band servicing through the inlet, the invention provides one or more servicing apertures disposed through the container wall so as to permit
an operator to reach in and repair sliver breakages or to rearrange the sliver coil without shutdown.

The particular shape and dimensions of the sliver storage container can be varied to suit the space requirements of a given application. Likewise, the container tube can be bent to provide a sliver band column having a slope which is most advantageous for a given application, although the curved container tube of the invention is operable over a wide range of sliver band column slopes.

For example, where a plurality of sliver band storage devices according to the invention are operated to supply a plurality of sliver bands in parallel to a subsequent processing machine, it will be advantageous to arrange the individual container tubes for sliver band discharge onto a band-guide table arranged at a convenient servicing height above the machines which supply the individual sliver bands to the respective storage devices.

The sliver band storage apparatus of the invention is expeditiously adapted to automatically controlled operation, for example by means of sensing devices which monitor the instantaneous quantity of sliver band stored in the container, to permit control of sliver infeed and outfeed in response to the quantity of sliver band already stored. By controlling the operative action of the machines which supply and receive sliver band from the storage apparatus in response to the quantity of sliver band stored, emptying and overfilling of the container can be prevented, and the quantity of sliver band stored can be regulated in relation to the available storage capacity of the container so as to assure accommodation of the demands of both processing machines.

It is therefore, an object of the invention to provide a transitory sliver band storage apparatus which can be interposed in the sliver band flow path between successive sliver processing machines to compensate for variations in the output and intake of each.

Another object of the invention is to provide an apparatus as aforesaid which has a sufficient sliver band storage capacity to permit maximum duty cycle operation of both sliver processing machines.

A further object of the invention is to provide an apparatus as aforesaid wherein the sliver band is stored in such a manner as to present a minimum of interference to the continuous infeed of sliver band for storage therein.

A further object of the invention is to provide an apparatus as aforesaid wherein the stored sliver band is conveyed to the operating personnel.

Another object of the invention is to provide an apparatus as aforesaid which can be used with a variety of sliver processing machines.

Still another and further object of the invention is to provide an apparatus as aforesaid including means for monitoring the instantaneous quantity of stored sliver band whereby the operation of its associated sliver processing machines can be regulated.

Other and further objects and advantages of the invention will become apparent from the following detailed description and accompanying drawings in which:

FIG. 1 is a schematic side elevation view of a sliver band storage apparatus according to one embodiment of the invention, illustrating a typical installation thereof in conjunction with a sliver band supplying machine.

FIG. 2 is a schematic side elevation view, partly in section, of a sliver band storage apparatus according to another embodiment of the invention.

FIG. 3 is a schematic side elevation view, partly in section, of a sliver band storage apparatus according to a preferred embodiment of the invention, in a typical installation thereof, similar to that of FIG. 1.

FIG. 4 is a schematic elevation view of the sliver band storage apparatus shown in FIG. 3, as seen in the direction of the arrows 4—4.

FIG. 5 is a detail view, partly in section, of a portion of a tubular sliver band storage container typical of those shown in FIGS. 1—4, and incorporating means for maintaining the sliver band coil layers perpendicular to the center line of the container.

FIG. 6 is a detail view, in plan, of the upper portion of the sliver band storage apparatus of FIGS. 3 and 4, in a typical installation wherein the sliver band stored therein is fed, along with other sliver bands, to a subsequent processing station.

FIG. 7 is a plan view, partly in section, of a typical sliver band infeed device which can be used in the apparatus of FIGS. 3 and 4.

FIG. 8 is a plan view, partly in section, of another sliver band infeed device which can be used in the apparatus of FIG. 1 and which features drive means for rotating the sliver band storage container.

FIG. 9 is a perspective view of a spinning plant machinery arrangement wherein the sliver band output of a plurality of carding machines is fed to a single stretcher, with a sliver band storage device of the type shown in FIGS. 3 and 4 being interposed in the sliver band feed path between each carding machine and the stretcher.

Referring now to FIG. 1, a fibrous sliver band 1 is delivered from the output of a sliver processing machine M, such as for example a card or a line-section machine and is fed through a pair of calender rollers 2 and a guide loop 21 to a sliver infeed device 4, which is positioned at the lower inlet end E1 of a tubular sliver container 5.

Successive lengthwise portions of the sliver band 1 are deposited in coiled layers stacked within the container 5 by the infeed device 4 as the container 5 is rotated relative thereto about its longitudinal axis. The container 5 under normal operating conditions serves for temporarily accumulating sliver band between the output of one processing machine M and the intake of another (not shown).

At the outlet end E2 of the container 5, successive lengths of previously stored sliver band 1' are paid out and passed around a deflection roller 12 and thence through a pair of transport rollers 10 along a band-guide table 9 to the succeeding sliver processing machine (not shown).

According to the embodiment of the invention exemplified by FIG. 1, the straight tubular container 5 is disposed in a predetermined inclined position with respect to the vertical so as to correspondingly reduce the effective weight component of sliver band stored therein acting in the direction of the inlet E2, i.e., along the center line axis X of the container 5.

To deposit the sliver band 1 in coiled layers for compact storage within the container 5, the infeed device 4 and container 5 are rotated relative to each other, i.e., either the rotary plate (see FIGS. 7 and 8) of the infeed device 4' is rotated relative to the container 51 as in FIG. 2, with said container 51 being disposed in a stationary position with respect to a base surface such as the plant floor F, or the infeed device 4 is disposed stationary with respect to the base surface F and the container 5 is rotated relative to said infeed device as in FIG. 1.

Any suitable means, such as for example, a bevel gear ring 141 affixed to the outside surface of the container 5 and a pinion 14 driven by a motor D can be used to rotate the container 5 relative to the infeed device 4.

By reason of the inclined arrangement of the sliver container 5, the sliver band 1 entrance side, i.e., the bottom, of the infeed device is readily accessible so as to permit the sliver band 1 to be conveniently inserted through the guide loop 21, and for removing any snags or entanglements which might occur therebetween.

The infeed device 4 can be any suitable conventional infeed device, such as for example a rotary-plate infeed device of the type according to British Patent 730,691, or U.S. Patent 2,770,016. For convenience and for safety in operation, the rotary plate infeed device 4 is provided
with an external housing which is pivotally connected to a stand 42 so that the band inlet side of the container S can be exposed for servicing purposes. Alternatively, the infed device 4 can be mounted on the stand 42 so as to be slidably displaceable therewith in relation to the container 51, the container 51 may also, in a reverse manner, with the rotary plate infed device 4 being held stationary by the stand 42, be separated from the infed device by either pivoting or sliding displacement.

As can be seen better from FIG. 2, by reason of the inclination of the storage container 51, the weight of the storage container column 13 is disposed partially against the rotary plate infed device 4' whereby an easy and disturbance-free sliver band deposit is assured, and in the opening of the sliver band inlet side E1 of the container 51, fall-out of the stored sliver band 1' is easily avoided. On the other hand, at the outlet side E2 of the container 51, as well as the container 5, the loosely coiled sliver band 1' can be lifted out of the container 5, 51, without straining it beyond its own weight.

FIG. 2 represents another embodiment of the sliver band storage device according to the invention, somewhat similar to the embodiment shown by FIG. 1, but wherein the container 51 is disposed for normal operation in a predetermined position relative to the base surface F and the infed means 4' for rotation relative to the container 51 about its longitudinal axis which is inclined with respect to the approximately horizontal base surface F. The sliver band storage container 51 is developed as a stationary straight tubular container 51 and is preferably made of a transparent material such as plexiglass.

The slope of the container 51 may, through an adjustable support means 17, be adjusted to suit the requirements in each particular application in regard to the height of the band outlet E2. A deflection roller 18 is expediently mounted to the outlet side E2 of the container 51 to provide suitable guidance and such deflection of the sliver band 1' being discharged therefrom.

In order to prevent a falling over or upsetting of the layers 13 of the stored sliver band 1', in the preponderantly horizontal position of the container 5 or 51, there is additionally laid upon the upper side of the stored sliver band column 13, a supporting plate 15. The supporting plate 15 is slidably disposed within the container 5, or 51, and settles either through its own weight or with the aid of a spring 16 against the uppermost layer of the sliver band column 13.

As shown better by FIG. 5, in the case wherein the weight of the supporting plate 15 alone is relied upon to maintain it in contact with the band column 13, said supporting plate 15 is slidingly guided along the axis of the container 51 by means of rollers 19, which are supported by a member extending through a slot 20 in said storage container 51.

FIGS. 3 and 4 exemplify a sliver band storage apparatus according to a preferred embodiment of the invention wherein the lower portion of the band storage container 52 is curved longitudinally so that the plane of the band end E1 is approximately vertically positioned, and that the plane of the upper band end E2 is approximately horizontal. As is indicated by FIG. 4, the plane of the curved center line X1 of the container 52 need not be exactly vertical, but can be inclined away from the vertical to place the outlets E2 of the container 52 for sliver band 1' discharge at the same elevation as the band-guide table 9.

The band storage container 52 is expediently tubular with circular transverse cross section, and like the previously described containers 5 and 51, can be made of transparent material such as plexiglass.

In order to render the inlet E1 of container 52 accessible for servicing, the infed device 41 and said container 52 are either pivotally connected or slidably connected to each other, or otherwise adapted for separable displacement relative to each other. For example, in FIG. 3 the dash-dot outlined container 52' represents the position assumed by the container 52 when it is swung away from the infed device 41, which can be stationary as indicated by the solid outline in the device 41.

To provide a greater accessibility to the inlet E1, the infed device 41 can be mounted upon its stand 42 for slidable displacement relative to the normal operating position of the container 52, into the position indicated by the dash-dot outline 41'. While either an infed device 41 or a container 52 displacement capability can be provided, it is preferable to support the container 52 with means (not shown) for pivotally displacing the container 52, into the normal operating position, and also to provide a slidable displacement capability for the infed device 41, so that both may be displaced relative to each other for a greater extent than would be possible if only one were displaceable with respect to its normal operating position.

For greater convenience in servicing under normal operation, the container 52 is provided with one or more apertures 7 disposed through its wall to permit an operator to reach in and splice any breaks present in the stored sliver band column 13.

In the operation of the sliver band storage apparatus exemplified by FIGS. 3 and 4, a continuous sliver band 1 is fed from a machine M via a feed loop 21 to the infed device 41 which is preferably of the rotary plate type. Initially, the sliver band 1 is deposited in loose coils within the lower, approximately horizontal portion of the container 52, which is adjacent to the inlet end E1 thereof.

With a completely empty container 52, the initial sliver coils will tend to collapse and lie against the wall of the container 52 until a sufficient amount of sliver band 1 has been deposited so that the weight of such sliver band 1 will bear against the incoming sliver coils and thereby cause them to be deposited in level windings, approximately lying in planes perpendicular to the container 52 longitudinal center line X1.

The outlet end E2 of container 52 is preferably covered with a lid 8 having a lateral guide opening 51 through which the outfed sliver band 1' passes to the deflection roller 12' and through the transport rollers 10, to be supplied via the band guide table 9 to a subsequent processing machine (not shown), the sliver intake rate of which is controlled in relation to the infed rate of sliver band 1, and the quantity of sliver band stored within the container 52.

This particular preferred embodiment of the invention has the advantageous features that the sliver outfed from the container 52 is equally suitable for practical purposes to that provided by a vertically standing, straight stationary column (not shown), and also by reason of the horizontally lower portion of the container 52, the band inlet side E1 is readily accessible and in the opened state no falling out of sliver band results from the total pressure exerted by the sliver band column 13.

In order to further utilize the storage capability of the container 52 and also to avoid a complete emptying of over filling thereof, there are positioned at the periphery of said container 52 switches 6', 6" and 6''' which regulate the sliver band inflow rate to said container and/or the sliver band outflow rate said container 52 in response to the degree of filling of the container. For example, if the sliver band withdrawal rate from the container as established by the subsequent processing machine (not shown) is lower than the sliver band supply rate provided by the previous processing machine M, the filling of the container 52 from below continues until the band column 13 has reached the level of 6' Whereupon such switch 6'' which is operatively connected to the drive motor (not shown) of the sliver supply machine M, operates to switch said machine M to a reduced sliver band output speed such that both said machine M and the subsequent machine (not shown) can be operated continuously and simultaneously without danger of overfilling the container 52, although the production of the machine M is somewhat throttled.
If in the meantime, from the container 52 no sliver band has been withdrawn, or an insufficient amount of sliver band has been withdrawn to place the level of the band column 13 below that of the switch 6", then the drive motor of the machine M continues to run at such reduced speed until the band column 13 reaches the level of the switch 6". The switch 6" then disconnects the drive motor of the machine M in order to prevent an excessive filling of the container 52. This of course interrupts the production of the machine M.

In the event that sliver band should be withdrawn from the container 52 at such a rate as to cause the band column 13 to sink down to the lever level of the switch 6", the sliver band withdraw from said container 52 is switched off, in order to prevent a complete empty of said container 52. For this purpose, the switch 6" is operatively connected to interrupt the sliver band intake of the subsequent processing machine (not shown), such as for example by connecting the switch 6" to open the power supply to the drive motor (not shown) of such subsequent processing machine (not shown).

This same basic type of fill control can be provided for the storage containers 51 and 52 illustrated in FIGS. 1 and 2 respectively.

The switches 6", 6", 6" can be any conventional switching devices suitable for the purpose, such as for example photocells which are connected with corresponding relays (not shown) or alternatively loop contact or buffer contact actuated switches (not shown) which are operated by contact with the band column 13.

As shown in FIG. 6, a plurality of sliver band storage devices according to the invention can be connected to discharge their respective sliver band sets 1' in parallel onto a band guide table 9 to supply such sliver band set 1' in parallel to a subsequent processing machine (not shown). Such an arrangement effects a considerable simplification over the conventional sliver band storage arrangements known in the prior art, and also reduces the number of operators required for servicing a given number of machines.

By positioning the band guide table 9 above the machines, such as for example for carding machines (see FIG. 9) a considerable saving in space required for sliver band transport and for servicing can be realized. Of course, it is to be understood that it is equally permissible to arrange the band guide table 9 to run alongside the working machines which feed it instead of over them, since the sliver band storage arrangements of the invention can be readily adapted to accommodate various band guide table 9 positioning arrangements.

FIGS. 7 and 8 illustrate for purposes of example, the detailed construction of typical rotary plate infeed devices 4 and 41 which can be used in the sliver band storage apparatus of FIGS. 1 and 3 respectively. These particular infeed devices 4 and 41 are somewhat similar to those shown and described in U.S. Patent No. 2,770,016 and in British Patent No. 730,691.

The infeed devices 4 and 41 are necessarily operated in synchronism with the sliver supplying machine M otherwise there would be the problem of either pulling and breaking of the sliver band 1 between the supply machine M and the infeed device 4, 41 in cases where the sliver demand rate of the infeed device 4, 41 is greater than the sliver output rate of the machine M, or on the other hand, piling up of sliver band 1 in back of the infeed device 4, 41 in cases where the sliver output rate of the machine M is greater than the demand rate of the infeed device 4, 41. For this purpose, the infeed devices 4, 41 are adapted to be driven by mechanical power derived from the supply machine M.

The infeed device 41 of FIG. 7 is particularly adapted to fulfill the requirements of a stationary storage container such as the containers 51 and 52 which are stationary with respect to the floor F.

Mechanical power for operating the infeed device 41 is derived from the machine M via a drive shaft C, which can be expeditiously connected for rotation in synchronous relation to the same drive means (not shown) which rotates the sliver outfeed calender rollers 2. In order to permit the sliding displacement required for separation of the rotary plate infeed device 41 from the container 52 as in FIGS. 3 and 4, the shaft C is suitably constructed from two or more telescoping sections (not shown).

The rotation of shaft C is transmitted by bevel gear 427 to another bevel gear 426 seated on a shaft 429 disposed at right angles to the shaft C. A worm gear 425, also engaged to the shaft 429, engages a worm wheel 424 mounted on an shaft bushing 428 which is rotatably seated centrally in the housing 411 and carries a gear wheel 423. The shaft 428 simultaneously serves as a bearing for the shaft 430 which carries the overdrive gear wheel 415, which connects the outer gear wheel rim of the circular gear wheel 414 with the drive shaft C via the gear wheel 416 mounted thereon.

The infeed device 41 is appropriately designated as a rotary plate infeed device by reason of its planetary or epicyclic gear driven sliver depositing mechanism which comprises the rotary plate wheel 422, the funnel wheel 413 which is provided with a funnel passage 412 through which the sliver band 1 passes for deposit into the container 52, and the ring gear 414 which is rotatably seated in the rotary plate 422.

On the rotary plate wheel 422 there is attached a support 421 which carries a transmission case 420. This transmission case 420 contains the drive mechanism for the calender roll pair 410 which advances the sliver band into and through the funnel passage 412. Furthermore, the funnel wheel 413 is rotatably seated in the rotary plate 422.

The housing 411 is closed at its bottom end by means of a cover plate 230 which is capable of being swung open by means of a hinge which connects it to the housing 411. The sliver band intake guide loop 21 is supported upon a rod attached to the cover plate 230. In the cover plate 239 a circular opening is provided for receiving a disk 233 attached at the transmission case 420 and provided with an additional sliver band guide loop 232.

The operation of the various parts which comprise the infeed device 41 can be better explained by the following:

Line A defines the rotation axis of the circular gear wheel 414, of the rotary plate 422, and of the parts attached on this wheel 422 by means of the support 421, i.e. the transmission case 420 with the calender roll pair 410 as well as the disk 233 turn about this axis A, which also is the center axis of the intake loop 21, of the disk 233 and of the container 52. The guide 232 is eccentricly positioned on the disk 233 and lies centered along the line B which defines the rotation axis of the funnel wheel 413.

The rotation of the shaft C is imparted to the circular gear wheel 414 at its outer rim by means of the gears 415 and 416. Both the inner and outer rims of the gear wheel 414 are provided with gear teeth.

The funnel wheel 413 is rotatably seated in the rotary plate 422, is also provided with gear teeth that engage those on the inside rim of the ring gear 414. Thus, when the gear 414 is rotated, the funnel wheel 413 is correspondingly rotated.

A gear 417 disposed for rotation in engagement with the inner rim of the gear 414 drives the calender roll pair 410 via the bevel gears 418 and 419.

As compared with the general operation of a planetary gearing arrangement (not shown), the gear 417 and the funnel wheel 413 function as planetary wheels, and are seated on the rotary plate 422 which functions as a carrier.
Proceeding from the gear 423, the rotary plate 422, because of the strong reduction in gear ratio through the worm gear set 425 and 424, is put in substantially slower rotation as against the gear wheel 414, so that the transmitter S, in combination with the cradle P, and the funnel wheel 413 already rotating around the axis B, simultaneously rotates about the axis A. In this manner the sliver band 1 arriving through the guide loop 232 passes through the funnel passage 412 and is deposited in the container 52 in the well-known circular spiral coil form.

In the rotary plate infeed device 4 shown in FIG. 8, the calender roll pair 410' together with its drive mechanism, does not receive any additional rotation, since this is carried out through the sliver band storage container 5. The container 5 is rotatably driven as shown in FIG. 1, by means of the pinion 14 which engages the ring bevel gear 141 mounted to the container 5. The container 5 is supported for rotation by a ring bearing 143 disposed around its upper portion, and at its lower end by the housing of the infeed device 4. A shaft Q which is journaled at one end to the ring bearing 143 and which carries the gears 142, 417' and 418', serves for transmitting rotary power from the container 5 to drive the infeed device 4. The gear 417' drives a ring gear 414' which in turn drives the funnel wheel 413' which it engages. The funnel wheel 413' is rotatably seated in the rotary plate 422' which as distinguished from the rotary plate 422 of FIG. 7, is rigidly mounted to the housing 411 of the infeed device 4.

The calender roll 410' receives its drive via the bevel gears 418' and 419'.

The housing cover 220 with the sliver band guide loop 21 and the intake guide loop 222 is connected by a hinge 231' to the housing 411 so as to be capable of being swung aside to open the bottom end of the infeed device 4.

The infeed device 4 as shown in detail by FIG. 8, is particularly adapted for use in the sliver band storage apparatus shown in FIG. 1, wherein the plan view is drawn vertically with respect to the container 5 longitudinally central line axis X in FIG. 8.

FIG. 9 illustrates an application of the sliver band storage apparatus of the invention to a spinning plant machinery arrangement wherein individual sliver band storage devices are interposed between the sliver band outlets of respectively corresponding carding machines and the common sliver band intake of a stretcher S, so in effect to permit the carding machines K and the stretcher S to operate simultaneously. By providing a sliver band storage unit between each card K and the stretcher S, said stretcher S can be kept supplied with a plurality of slivers corresponding to the number of cards K, without the need for changing sliver storage cans as formerly required. The individual sliver bands 1' withdrawn from the storage units are fed continuously and in parallel to the stretcher intake by means of the band guide table 9 and transport rollers 10.

In an arrangement such as that represented by FIG. 9, it becomes particularly advantageous to construct the individual containers 52 of a transparent material such as plexiglass so that a single operator can visually monitor the transitory storage of each sliver band for servicing if necessary.

While the foregoing description serves to illustrate the various features of the invention, the sliver band storage apparatus of the instant invention can be defined in terms of broad, but simplified concepts.

Essentially, the advantages of the invention are achieved by constructing the storage container thereof in the form of a tube, which is either inclined or curved longitudinally to permit an arrangement of the infeed device 4, 41 which is more convenient for servicing and for receiving sliver band from the supply machine M, or the carding machines K, and so that the full weight of the storage sliver band column 13 does not act against the rotary plate 422, 422' and funnel wheel 413, 413' of said infeed device 4, 41. In this manner, it becomes feasible to use an infeed device 4, 41 to container 5, 51, 52 connection which permits them to be displaced apart for access to the interior of the container 5, 51, 52 with a maximum distance of 410, and the funnel wheel 413 already rotating around the axis B, simultaneously rotates about the axis A. Thus, the hazard of the sliver band column 13 spilling out is substantially eliminated.

With an inclined or curved tubular container, a greater storage capacity can be provided for a given tube diameter than where the container is straight and vertical as in the prior art, assuming that the height of the sliver discharge end E3 is the same. The curved tubular container 52 in particular offers the advantages of the vertically standing containers of the prior art (not shown) and in addition, provides the advantages resulting from lower sliver band column pressure against the inlet and E3.

In addition to these basic features, the invention provides means in the form of a support plate 15, which can be spring loaded if desired, for maintaining the successive layers of sliver band coils that comprise said band column 13 in an orderly arrangement, i.e., perpendicular to the container center line, so that the support plate maintains 5, 51, 52, and to assure a minimum of interference with the delivery of sliver band 1' at the outlet end E3.

As can be noted from FIG. 2, the support plate 15 has an aperture through which the stored sliver band can be passed to the outlet end E3. Since the purpose of the plate 15 is to prevent the stored sliver band coils from tumbling of their own weight, particularly in the case of those coil layers that will be the first to be removed from storage, only a relatively light pressure is required to be exerted by plate 15, this pressure being sufficient to prevent such coil layer tumbling but not so great as to impose any undue tension on the outfeed sliver band 1'. Thus, the support plate 15 loading spring 16 is expediently constructed to have a relatively low spring constant, and preferably in the form of a coil spring 16 approximately equal in diameter to the inside diameter of the tubular container 51, so as not to interfere with the passage of sliver band to the outlet end E3.

By providing means, such as the switches 6', 6'' and 6''' for monitoring the quantity of sliver band stored within the container 5, 51, 52, the operation of the sliver band supply machine M can be controlled in response to the amount of sliver band stored, so as to prevent the emptying or overfilling of the container 5, 51, 52.

While a variety of circuit connections (not shown) to the switches 6', 6'' and 6''' can be utilized for accomplishing the container fill control function desired, in general it can be stated that the switch 6'' which is positioned closest to the outlet end E3 of the container, serves for preventing overfill, and accordingly is operatively connected with the sliver supply machine M so as to shut off the delivery of sliver band therefrom whenever the container becomes filled to the extent where the sliver band column 13 activates said switch 6''. Similarly, the switch 6', which is positioned the lowest among the switches 6', 6'' and 6''', serves to prevent emptying of the container 5, 51, 52, and accordingly is operatively connected with the subsequent sliver processing machine which receives sliver band 1' from the container 5, 51, 52, so as to shut off said processing machine whenever the level of sliver band within the container has fallen to an extent where said container 5, 51, 52 is in danger of being emptied. The middle switch 6'' serves to regulate the relative sliver output rate and sliver intake rate of the supply machine M and the subsequent processing machine (not shown) respectively. For this purpose, the switch 6'' can be operatively connected to the sliver supply machine M so as to effect a slowing down of its sliver output rate, or alternatively can be operatively connected with the subsequent processing machine (not shown) to effect a speeding up of its sliver intake rate whenever the sliver band
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13 column 13 has risen to such a level within the container 5, 51, 52 so as to activate said switch 6'.

What is claimed is:

1. A sliver band storage apparatus, which comprises a container means for transitory storage of a sliver band, said container means having a lower inlet portion disposed for receiving successive lengthwise portions of a sliver band and an upper outlet portion disposed for discharging successive lengthwise portions of sliver band therefrom, said inlet portion being disposed at a predetermined inclination to the vertical to correspondingly reduce the effective weight component of stored sliver band acting in the direction of said inlet portion, and sliver band infeed means operatively connected to the inlet portion of said container means for supplying successive lengthwise sliver band portions thereto for transitory storage within said container means.

2. The apparatus according to claim 1 wherein said container means and inlet means are disposed for rotary movement relative to each other whereby sliver band portions supplied to said container means by said infeed means are coiled for compact storage within said container means.

3. The apparatus according to claim 1 wherein said infeed means is disposed for normal operation in a predetermined position relative to a base surface and said container means is disposed for rotation relative to said infeed means about an axis having a predetermined inclination relative to the base surface whereby sliver band portions supplied to said container means by said infeed means are coiled for compact storage within said container means.

4. The apparatus according to claim 1 wherein said container means is disposed for normal operation in a predetermined position relative to a base surface and said container means is disposed for rotation relative to said infeed means about an axis having a predetermined inclination with respect to the base surface whereby sliver band portions supplied to said container means by said infeed means are coiled for compact storage within said container means.

5. The apparatus according to claim 1 wherein said infeed means includes a rotary-plate sliver coiling means disposed for depositing sliver band coils within said container means for compact storage therein.

6. The apparatus according to claim 1 wherein said inlet and outlet portions of the container means are disposed in planes having a predetermined angle of inclination with respect to each other.

7. The apparatus according to claim 1 wherein said container means includes a cylindrical tubular sliver band container.

8. The apparatus according to claim 1 wherein said container means includes a tubular sliver band container bent longitudinally to define a lower end inlet portion and an upper end outlet portion disposed in planes having a predetermined angle of inclination with respect to each other, said inlet and outlet portions being disposed approximately perpendicular to the longitudinal center line of said tubular container.

9. A sliver band storage apparatus, which comprises a longitudinally curved tubular container for transitory storage of a sliver band, said container having a lower end portion defining an inlet disposed for receiving lengthwise portions of a sliver band and an upper end portion defining an outlet disposed for discharging successive lengthwise portions of sliver band therefrom, said container having a longitudinally curved center line with a slope at all points therein inclined less than 90° to the horizontal to reduce the effective weight component of stored sliver band acting in the direction toward said inlet, and sliver band infeed means including sliver coiling means operatively connected to said container inlet to deposit successive lengthwise portions of sliver band in coiled layers for storage within said container.

10. The apparatus according to claim 9 including means operatively connecting said infeed means to said container whereby said infeed means and container can be displaced relative to each other for access to the interior of said container.

11. The apparatus according to claim 9 including means pivotally connecting said infeed means to said container whereby said infeed means and container can be pivotally displaced relative to each other for access to the interior of said container.

12. The apparatus according to claim 9 including means slidably connecting said infeed means to said container whereby said infeed means and container can be slidably displaced relative to each other for access to the interior of said container.

13. The apparatus according to claim 9 including means defining at least one aperture disposed through the tubular wall of said container to permit access to the interior thereof.

14. The apparatus according to claim 9 including means slidably disposed within said container for contact with the uppermost coiled sliver band layer therein to maintain said layer and successively underlying sliver band layers approximately perpendicular to the longitudinal center line of said container.

15. The apparatus according to claim 9 including a weighted member slidably disposed within said container for contact with the uppermost coiled sliver band layer therein to maintain said layer and successively underlying sliver band layers approximately perpendicular to the longitudinal center line of said container.

16. The apparatus according to claim 9 including a member slidably disposed within said container for contact with the uppermost coiled sliver band layer therein and spring means operatively connected to said member to urge same into faceable contact with said uppermost layer to maintain said layer and successively underlying sliver band layers approximately perpendicular to the longitudinal center line of said container.

17. The apparatus according to claim 9 wherein said tubular container is constructed of a transparent material to permit visual inspection of sliver band layers stored therein.

18. The apparatus according to claim 17 wherein said tubular container is constructed of Plexiglas.

19. A sliver band storage apparatus, which comprises a tubular container for transitory storage of a sliver band, said container having a lower end portion defining an inlet for receiving successive lengthwise portions of sliver band from an infeed means, and an upper end portion defining an outlet for discharging successive lengthwise portions of previously stored sliver band therefrom for receipt by a sliver band consuming means, said container being bent longitudinally whereby said lower end portion is disposed approximately horizontal and said upper end portion is disposed at predetermined inclination to the vertical to reduce the effective weight component acting in the direction toward said inlet, a sliver band infeed means operatively connected to said container inlet to deposit successive lengthwise portions of sliver band in coiled layers for storage therein, said infeed means being disposed to receive corresponding lengthwise sliver band portions from a supply means, and drive means operatively connected to said infeed means and to such sliver band supply means to synchronize the sliver band deposit rate of said infeed means with the sliver band delivering rate of such supply means.

20. The apparatus according to claim 19 including control means for regulating the quantity of sliver band stored within said container, said control means being disposed for operative connection to the sliver band supply means and responsive to the quantity of sliver band stored within said container to regulate the sliver band
delivering rate of said supply means in relation to said quantity of stored sliver band to prevent emptying and overfilling of said container.

21. The apparatus according to claim 20 wherein said control means includes a first switching means for limiting the maximum quantity of sliver band stored in said container, said first switching means being disposed for operative connection to the sliver band supply means to interrupt the delivery of sliver band thereby upon actuation in response to the presence of a predetermined maximum quantity of sliver band within said container, and a second switching means for limiting the minimum quantity of sliver band stored in said container, said second switching means being disposed for operative connection to the sliver band consuming means to interrupt the consumption of sliver band thereby in response to the presence of a quantity of sliver band within said container below a predetermined minimum quantity.

22. The apparatus according to claim 21 including a third switching means for regulating the delivery of sliver band for storage within said container at storage quantities intermediate between said predetermined maximum and minimum quantities, said third switching means being disposed for operative connection to the sliver band supply means to reduce the sliver band delivery rate thereof in response to the presence of sliver band within said container in excess of a predetermined quantity below said predetermined maximum quantity and above said predetermined minimum quantity.

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