FIG. 6
The present invention relates to an installation for winding the roving on the bobbin while giving a twist to the roving and, more particularly, to an arrangement for winding the roving on the bobbin with more firmness than conventional winding arrangements so that the wound roving may not become loosened.

In known arrangements for winding a roving onto a rotating bobbin while imparting a twist to the roving, a substantially fixed and constant distance is maintained between draft means for feeding the roving and a presser or guide to which the roving is fed. This guide is maintained at a substantially fixed elevation, and the bobbin, while being rotated about its axis, is reciprocated longitudinally of its axis and thus longitudinally relative to the presser or guide. Twisting is effected by means of a flyer which is rotated coaxially with the bobbin and around the latter, there being a difference in speed between the rotational speed of the bobbin and the rotational speed of the flyer.

It will be appreciated that, with installations of this type, a distance of at least twice the axial length of the bobbin is required for the bobbin insulation due to the axial reciprocation of the bobbin. This, in turn, results in an increase in the overall height of the machine, which has been found to be inconvenient from the operational standpoint.

Various suggestions have been made for eliminating additional space requirements or reducing them, the known suggestions have been ineffective from another standpoint in that it has not been possible to maintain uniform tension on the roving on the bobbin unless the presser foot has been maintained at a fixed distance from the drafting or feeding mechanism for the roving.

In accordance with the present invention, the foregoing difficulties are avoided by providing an arrangement in which the presser or roving guide is reciprocated axially of the bobbin which, in turn, is not shifted axially but remains in a fixed axial position. Thus, the overall height required for the bobbin insulation is reduced to the axial length of the bobbin.

To avoid the aforementioned difficulties of maintaining the roving wound tightly on the bobbin, despite the shifting of the presser foot relative to the drafting means and the bobbin, means are provided for maintaining a uniform tension on the roving irrespective of the relative position of the presser or feeding means relative to the drafting means from which the roving is drawn. This latter means may either be of a resilient tension nature or may be in the form of a guide which is accurately shifted in accordance with the position of the presser or roving guiding means so as to maintain the roving, as wound on the bobbin, at a uniform tension irrespective of the relative position of the presser axially of the bobbin or of the amount of roving which is wound onto the bobbin.

For an understanding of the principles of the invention reference is made to the following description of typical embodiments thereof as illustrated in the accompanying drawings.

FIG. 1 shows in outline the rough mechanical arrangement of the roving frame of the present invention.

FIGS. 2 to 5 show the two examples of the principal parts of the roving frame that are brought into practice.

FIGS. 2 and 4 are the side views—a part is cut.

FIG. 3 is a part-cut, enlarged section view at the 3–3 line in FIG. 2.

FIG. 5 is a part-cut enlarged section view at the 5–5 line in FIG. 4.

FIG. 6 is the mechanical rough arrangement of gearing that shows another example of bringing the present invention into practice.

FIGS. 7 and 8 are the partly sectional elevations of the essential parts of other examples.

The newly invented method actually will take the form as illustrated in FIG. 1, as follows:

The rotary shaft 24 of the bobbin is inserted into the lower part of the flyer 1.

The bobbin is mounted on the machine frame so as to rotate about its axis but without shifting longitudinally of its axis. The bobbin is driven from the driving shaft 5 through the medium of a worm gear 2, shaft 3, and driving means 4. Shaft 5 drives the shaft of the top cone drum 6 through a train of gears indicated at 7, and rotation of the shaft 9' of the cone drum 9, which cone drum is driven from the cone drum 6 by means of the belt 3, is transmitted by gear means 10 and 11 to a differential gearing 13. Thereby, there is imparted to a shaft 24 a particular speed, with relation to the speed of driving shaft 5, which is determined by the adjustment of the belt 8 along the cones 6 and 9. Shaft 24 of bobbin 23 is driven from the internal sun gear 15 of the differential gearing through a gear train 16, a shaft 21 and a worm gear 22 driven by a worm on the shaft 21. The planetary gearing includes an input pinion which, through the medium of a double pinion 12 carried by a planet carrier 12', drives the planet pinion 14, one of which is meshed with the double pinion 12 and the other of which is engaged with the internal ring gear 14.

In addition, a gear fixed to the rotary shaft 9' of the bottom cone drum 9 is geared to a train of gears 10, bevel gears 25, a reversing clutch 26, a train of gears 27, a worm 30' and a screw shaft 34. Shaft 34 is fitted through a ring 32, or an extension of this ring, so as to reciprocate ring 32 laterally along guide rails 33. The screw shaft 34 is rotated by a worm gear 36' driven by the worm 30.

The roving is fed from a draft roller 36 to a presser 31. The reversing clutch 26, in FIG. 1, is operated by a mechanism (not shown) as is also the means for shifting the belt 8 along the cones 6 and 9.

When the driving shaft 5 revolves, the flyer 1 will be made to revolve around the bobbin 23 through the gearing 4, the shaft 3, the worm and the worm gear 22. Consequently the presser 31 will also revolve together with the flyer.

On the other hand, the rotary driving shaft 5 will make the bobbin rotate through the train of gears 7, the cone drums 6 and 9, the belt 8, the train of gears 10 and 11, the differential gear 13, the gears 16, the shaft 21, the worm gear 22 and the reversing shaft 24. Through the cone drums 6 and 9, the belt 8 and the differential gears 13, the relative speed of the presser against the circumferential surface of the winding bobbin can be adjusted the same as in the case of the conventional method.

In this condition, the roving that has a given draft in the set of draft rolls 36 is given a twist by the roving of the flyer 1 and is fed into the presser 31 that rotates while rising and sinking, and then is taken up by the bobbin by virtue of the difference in the revolving speeds of the bobbin 23 and the presser 31.

In the described arrangement, the roving that comes out of the draft rolls is given a twist by the flyer and guided to the presser which revolves around the bobbin while moving up and down, so that the roving is taken up onto the bobbin. Consequently a longer bobbin than regarded usually to be justifiable for the space occupied by...
the installation can be used and also a longer length of roving than usual can be taken up onto a long size bobbin without using a specially large winding installation.

As shown in FIGS. 2 and 3, the roving frame may be well arranged as follows: the flyer 1 is so inserted into the spindle 42 as to revolve together with the spindle, and can be replaced when necessary. The bobbin 23 that is loosely mounted on the spindle 42 is mated with the above-mentioned bobbin revolving shaft 24 in a manner that both of them can be freely put together or taken apart as the case may require. The bar-shaped body 43 on one side of the flyer 1 is hollow and its cross section shape is made to form the letter C, inside of which is the guide shaft 45, that has an endless spiral groove engraved on its circumferential surface, so is loosely arranged as to be freely rotatable, and the presser-base part cylindrical body 31’ is so loosely arranged on the above-mentioned C form bar-shaped body 43 as to freely glide.

The projection 46 coming out from inside of the cylindrical body 31’ is loosely received in the spiral groove 44 of the guide shaft 45, and to a part of the guide shaft 45 is attached a gear which, through the idler gear 47, is meshed with the gear attached to the bobbin revolving shaft 24, so that the turning force of the flyer 1 is provided through the spindle 42 and the turning force of the bobbin 23 is given to the bobbin revolving shaft 24, while the guide shaft 45 is moved by the relative rotation of the rotation of the flyer to the bobbin, and the presser that is loosely attached to the flyer is moved in the direction of the axial center line of the bobbin by the rotation of the spiral groove 44. This particular arrangement provides a simple, small, light and compact means for moving the presser along the presser axiality of the bobbin. In other words, the installation that makes the presser move up and down in the direction of the axial center-line of the bobbin is provided on the flyer, and this movement of the presser is caused by the relative rotation of the spindle against the bobbin, so that the whole revolving path of the presser can be extremely simple, small and light, and so that it can satisfy the purpose of the present invention very well.

In the above case, the guide shaft can be made to be fixed or replaced and, by using different guide shafts that have different traverses and different spiral grooves with different pitches, the winding width of the bobbin can be suitably determined, and also it is made possible that the different sized roving can be suitably wound onto the bobbin.

In order to make the presser rise and sink along the direction of the axial center line of the bobbin and move around at the same time, the bobbin is kept in a given position to rotate in place, and the presser is loosely mounted on the above-mentioned bar-shaped body that is connected to the flyer so as to move freely in the direction of the axial center-line of the bobbin, while an outside part of the presser is mated with the ring that is provided around the flyer, so that the ring may be made to play up and down vertically. With such an installation, the present invention can be simply and easily brought into practice.

FIGS. 4 and 5 illustrate an alternative arrangement for shifting the presser axiality of the bobbin. In the arrangement shown in FIGS. 4 and 5, the rotary body 37 that supports the flyer 1 is so concentrically attached to the outside of the bobbin-revolving shaft 24 as to revolve together with the said shaft 24, and both of them are surmounted on the frame of the machine, while the lower end of the flyer 1 is connected to the rotary body 37 and the upper end of the flyer 1 is mounted on the frame of the machine 38’. The lower end of the bobbin 23 is attached to the bobbin revolving shaft 24, while the upper end of the bobbin is mounted on the supporting body extending from the flyer. The cross section form of the bar-shaped part on one side of the flyer is made to form the letter C, around which is set the cylindrical body 31’ that is the base part of the presser 31 and the projection 39 that extends from the inside of the cylindrical body 31’ is loosely inserted into the slit of the bar-shaped part, and the cylindrical body 31’ is so loosely set around the bar-shaped body that is set into the cylindrical body 31’ and the projection 39 extending from the cylindrical body 31’ is freely inserted into the concave groove that is inside of the ring 32 which is in the form of channel in its vertical section shape, and the screw shafts 34 and 34 are screwed into the holes, and the running threads provided in the frame 33 that supports the ring 32, and these screw shafts are geared to the rotary shaft of the prime motor through the reversing gear rotated by the building motor.

No. 41 in these figures is a long hole made in the bar-shaped body and the roving that is guided to the flyer is fed to the presser through this long hole. While the bobbin revolving shaft 25, the rotary member 37 that supports the flyer and the screw shafts 34 and 34 are set to revolve, the roving is twisted by the rotation of the flyer and is taken up onto the bobbin by means of the presser that moves around the bobbin and, at the same time, rises and sinks in the direction of the axial center-line of the bobbin. When the presser is loosely attached to the flyer to move in the direction of the axial center-line of the bobbin as mentioned above and in its position in the direction of the axial center-line of the bobbin is controlled from the outside of the rotary locus of the flyer, the shift of the presser to revolve by the above-mentioned bobbin can be so easily managed as to meet various requirements. This is no doubt a great advantage. In other words, the presser can be made to shift its position in the direction of the axial center-line of the bobbin in such a condition that suits any size of the roving. Besides, the winding breadth of the bobbin can easily be controlled, because both the size of the roving and the winding breadth of the bobbin can be suitably determined in the part that is outside of the rotary locus of the flyer. In a further example, where the ring that is attached to the feeding presser is electromagnetically driven, it is possible that can control the position of the presser in the direction of the axial center-line of the bobbin, are made to move up and down in the direction of the axial center-line of the bobbin, the turning point in the plying movement of the above-mentioned ring can be controlled through the building motor or a limit switch, an electromagnetic switch or other installation. Needless to say, it is also possible that the limit switches can be used to fix the limits of the plying movement of the presser.

The above-mentioned presser is the ultimate feeder of the roving to the bobbin and it also acts as the guide roller to determine the winding point on the bobbin.

In addition to the above, the present invention can be brought into practice in various other modes in its improved application.

The projection 46 in FIG. 3 and the projection 39 in FIG. 5 are not always necessary.

In the fly frame where the flyer revolves at a given speed, while the bobbin is made to rotate with the relative rotating speed of its winding surface to the flyer being fixed, so that the roving, that is supplied from the top of the flyer and guided by the presser which goes up and down in the direction of the axis of the bobbin, is wound onto the bobbin, the running speed of the roving that is drawn into the flyer when the presser moves away from the draft equipment along the flyer, i.e., when the presser sinks, is greater than the one when it rises, i.e., when it approaches the draft equipment.

In this case, the roving drawn from the draft installation varies as the presser moves up or down in the direction of the axis of the bobbin.

However, such a defect or difference in tension of the roving can be removed by an arrangement to make the rotating speed of the bobbin greater when the presser approaches the draft installation than when it moves away in the opposite direction. In other words, slackness of the roving brought about when the presser approaches the
feeding draft can be cancelled by slightly increasing the rotating speed of the bobbin so that its winding speed may slightly be accelerated to absorb the slackened volume of the roving. Consequently all the defects arising from the partial slackness of the roving, such as its unexpected breakage caused by a sudden change in the tension of the roving or the roving becoming easily breakable due to its decreased tension or the winding of the bobbin becoming uneven, can be wholly removed. When the present invention is brought into practice as shown in FIG. 6, a differential gear system 48 is included in a train of gears 16 interposed between the shaft of the internal sun gear 15 and the shaft 21, in order to transmit the driving force from the shaft of internal sun gear 15 of the differential motion 13 to the shaft 21. In other words, a gear axle of the train of gears 16 is directly connected to the input sun gear 49, and the planet gears 59 and 60, that mesh with the sun gear 49, are supported by the gear 51 that is loosely set around the sun gear shaft as to rotate freely and the revolving axle of the output sun gear 52 that meshes with the other planet gears 50' and 50'' that are directly connected to the above-mentioned planet gears 59 and 50, is geared to the shaft 21 through a train of gears 53. On the other hand, an interlocking between gears 27 of the driven shaft of the reversing clutch 26 and the shaft 29 is further interlocked to the gear 55 which meshes with the above-mentioned gear 51 through a train of gears 54. Consequently revolving force of the bobbin supplied from the internal sun gear 15 is transmitted to the input sun gear 49 through the train of gears 16, so that all the planet gears 50, 50', 50'' and 50''' are made to rotate. Meanwhile, revolving force of the screw shaft 34 supplied from the reversing clutch 26 is transmitted from a train of gears 54 to the gear 51 through a train of gears 55, so that all the planet gears 50, 50', 50'' and 50''' are made to rotate around the sun gear 49. As a result, when the revolving directions of all the planet gears are the same as the rotation direction of the input sun gear 49, the rotating speed of the output sun gear 52 will be the result of the combined speed of the rotating speed of the input sun gear 49 and the revolving speeds of all the planet gears. The rotation of gear 25 is transmitted to the bobbin 23 through a train of gears 53, a shaft 21 and a worm gear 22 and the bobbin rotating axle 24. When the rotating direction of the input sun gear 49 is opposite to the revolving direction of the planet gear, the revolving speed of the planet gear 50 will be deducted from the revolving speed of the gears 16 and a lowered speed is transmitted to the output sun gear, and thus the bobbin 23 is driven with a slightly slower speed than before. As a result, all the above-mentioned favorable effects can be attained by constituting train of gears 27 and 54 so that the gear 55 may rotate in such a way as to make the gear 51 rotate in the same direction as the input sun gear 49. Needless to say, in this case, the rotating speed of the bobbin is adjusted in consideration of absorbing the slackness of the roving—of winding the slackened volume of the roving additionally.

In the foregoing arrangement, it is only necessary to introduce a differential gear into the gearing effecting rotation of the bobbin, and the twisting strength of the roving remains substantially constant as it is wound onto the bobbin. To correlate the reciprocating speed of the presser with the relative rotating speeds of the bobbin and the presser, either differential gearing may be used or electrical means may be used.

As the means of absorbing partial slackness of the roving, there are various methods other than the above mentioned one:

For instance, when an equipment to control the length of the path of roving is interposed in the moving path of the roving in the above-mentioned roving frame, the tension of the roving can be made uniform when wound onto the bobbin. The actual mode of the practice may be illustrated as follows:

In the partial construction of the flyer in FIG. 7, the bar-shaped member 56 on one side of the flyer 1 is made to form the letter C in its cross section and, as shown in FIG. 7, the upper end of the spring 57, that has a very great coefficient of expansion, is firmly attached to the internal upper part of the bar-shaped member 56, while the lower end of the spring is connected to one end of the cord-shaped member 58. The other end of the spring is connected to the axle of the pulley 59, and the roving A that passes through the bar-shaped member 56 is led to the pulley 60 that is mounted on the lower end of the bar-shaped member 56 and a variable by-pass of the roving is constituted. Thus the by-pass of the roving, when the presser 31 is at its lowest position, is made small to draw down by means of the spring 57 the roving slackened when the presser goes upward. Of course, the pulley 59 is slightly pulled up gradually in resistance to the spring 57 as the presser 31 rises. Therefore, without slackness, the roving can be kept at a uniform tension and is wound onto the bobbin without changing its tension.

In the FIG. 8, the object is to keep the length of the path of the roving restrained to an almost fixed length. In this arrangement, the supporting bar of the pulley 59 is extended outwardly so as freely move and is loosely inserted into the circumferential groove of the sectionally channel-shaped ring 61 that is arranged around the rotating locus of the flyer 1, while the screw shaft 62 has the same pitch as the screw shaft 34 for driving the presser 31 is threaded through a suitable opening in the said ring 61. Both the screw shafts 34 and 62 are interlocked to the shaft 29 in such a way as to make the ratio of the revolving speeds of both of the screw shafts 34 and 62 remain nearly 2 to 1. Consequently as the presser 31 moves up and down according to the rotation of the shaft 29, the pulley 59 will likewise rise and sink through a range half as large as that of the presser, so that the length of the bypass of the roving A will forcibly be determined nearly uniform and a similar favorable effect as above-mentioned can thus be attained. In this example, the roving supplied from the top of the flyer is led to the presser through the pulley mounted on the base of the flyer and the above-mentioned pulley supporting position is made to shift along the longitudinal bar of the flyer as the presser will rise and sink in the direction of the axis of the bobbin.

When a pulley is used as described, a constant tension on the roving can be maintained in a very simple manner by arranging the pulley to be shifted axially of the bobbin at half the speed of the presser.

It should further by added that the mode of controlling the length of the path of the roving is not limited to the above mentioned case only. It can be constituted in any construction. In any case where the equipment to control the length of the path of the roving is adopted, there is no need to make a drastic reconstruction of the roving frame, and with a very simple equipment, all the above mentioned advantages can be achieved.

Any shape of cross section may be well employed as the longitudinal bar of the flyer shown in FIGS. 3 and 5, for the roving may be supplied to the presser from the top of the flyer.

It may be good to employ, instead of the pulley shown in FIGS. 7 and 8, a hook or something like a hanger that guides the roving in a sliding relation.

The above-mentioned "roving frame" is called "the speed frame" or "fly frame" in America and "the roving frame" in England. The above-mentioned "roving frame" means all kinds of spinning machines for the twisting and winding of roving, such as a slubbing frame, fly frame, simplex frame, etc.

What I claim is:

1. Mechanism for winding and twisting a roving on a
bobbin comprising, in combination, a draft device operable to feed the roving at a selected substantially constant speed; a bobbin; a flyer; means for rotating said bobbin and said flyer while retaining the same against axial displacement; a presser for guiding the roving from said draft device to said bobbin; means for reciprocating said presser axially of the bobbin along the flyer; and means for varying the tension on the roving in accordance with the axial displacement of said presser relative to said draft device to maintain a constant tension on the roving wound on the bobbin.

2. Mechanism for winding and twisting a roving on a bobbin, as claimed in claim 1, in which said means for rotating said bobbin and said flyer rotates these elements at different angular velocities so as to effect a relative rotation therebetween; and means operable to decrease the tension on the roving being fed to the bobbin through the presser as a function of the increase in the diameter of the roving on the bobbin to maintain a constant tension on the roving wound on the bobbin.

3. Mechanism for winding and twisting a roving on a bobbin, as claimed in claim 2, including means operable to vary the tension on the roving being fed to the bobbin by the presser responsive to variations in the path of travel of the roving, from the draft device to the bobbin, due to reciprocation of said presser.

4. Mechanism for winding and twisting a roving on a bobbin, as claimed in claim 1, including a ring reciprocable axially of the bobbin and substantially concentric of the axis of rotation thereof; said presser being mounted in said ring for axial reciprocation with the latter.

5. Mechanism for winding and twisting a roving on a bobbin, as claimed in claim 1, including a device for reciprocating said presser axially of said bobbin; a driving shaft for said device; a driving shaft for said bobbin; and differential gearing interconnecting said driving shafts to operate the same at a selected relative speed ratio.

6. Mechanism for winding and twisting a roving on a bobbin, as claimed in claim 5, including a ring embracing said bobbin and reciprocable axially thereof; said presser being mounted on said ring for axial reciprocation therewith; said device for reciprocating said presser axially of the bobbin comprising a rotatable shaft in threaded engagement with said ring and operatively driven by the driving shaft of said device.

7. Mechanism for winding and twisting a roving on a bobbin, as claimed in claim 6, in which the means for maintaining the tension on the roving constant comprises a pulley interposed between said draft device and said presser; a mounting for said pulley reciprocable axially of said bobbin; a second rotatable threaded shaft threaded through said mounting; and gear means interconnecting said threaded shafts and having a ratio such that the shaft reciprocating said presser is rotated at substantially twice the speed of the shaft reciprocating said mounting.

8. Mechanism for winding and twisting a roving on a bobbin, as claimed in claim 1, including a driving shaft for rotating said bobbin; one end of said bobbin being disengageably and operably connected to said driving shaft, and said bobbin being disengageable from said driving shaft by axial movement; the other end of said bobbin being rotatably engaged in a bearing in said flyer and being detachable from said bearing by movement axially of said bobbin.

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