To all whom it may concern:

Be it known that I, SEBASTIAN ZIANI DE FERRANTI, a subject of the King of Great Britain and Ireland, and residing at Grindleford, in the county of Derby, England, have invented certain new and useful Improvements in and Relating to Spinning, Twisting, and Doubling Machinery, of which the following is a specification.

This invention has for its object improvements in the apparatus for and the methods of doubling and twisting whereby greater production and better work may be obtained than at present.

Hitherto in machines of the type employing a cup or chamber for spinning, it is found that if the cup is slowed down or stopped for piecing up or other purposes, there exists a tendency for snarls to be formed, which interferes with the proper laying of the material on the machine being restarted.

This invention has for its object to provide improved processes and apparatus by means of which this disadvantage in cup spinning is obviated.

According to the present invention a part only of the ultimately desired twist is imparted to the material, as it is being spun twisted or doubled into the cup, and the remainder of the ultimately desired twist as it is being spun twisted or doubled out of the cup.

As the greater the amount of twist in the material the greater is the tendency to snarl according to my improvements, as only part of the twist is put into the material as it is being twisted into the cup, the tendency for snarling to take place is diminished if not altogether eliminated.

Referring now to the accompanying drawings which illustrate the invention and form part of my specification:—Figures 1 and 2 are plan and elevation of a form of six-cord thread machine; Fig. 3 shows a machine for spinning in and out of a cup, Fig. 4 shows a similar machine but with the material wound back on to the same bobbin from which it was drawn, Fig. 4 is a plan of the machine shown in Fig. 4, Fig. 5 is a plan view of a detail of the machine of Fig. 4, showing the method of throwing the yarn into gear with the automatic winder; Figs. 6 and 7 are end views of a modified form of bobbin drive in the machine of Fig. 4.

I wish it to be understood that the drawings accompanying and forming part of this specification are of a diagrammatic nature and are not to be taken as working drawings.

When desirable the same reference symbols have been used to denote corresponding parts in the different drawings.

According to one method of manufacturing six cord thread the three high speed rotating spindles may be fitted with pinions and placed around a single wheel in the manner indicated in Figs. 1 and 2, this single wheel being used direct or through gearing to operate the draw-off or feed rolls. Thus the double ends from the bobbins, 11, are led first, preferably through the wetting troughs, 23, to the feed rolls whence they pass by way of the reciprocating guides, 24, to their respective cups, 25, 26, and 27, receiving a further part of the required relative twist during this operation. The cup spindles are fitted with pinions, 28, each meshing with the single wheel, 29, which is also geared by way of the spiral gearing, 30, and bevel wheels, 31, to the feed rollers, 32, which in this machine are preferably mounted on the same spindle. After sufficient material has been spun into the cups, the three ends of the now partially twisted doubling are taken through the feed rolls, 33, to the large cup, 34, into which they are led by the reciprocating guide, 35, the doubling and the two original ends from each bobbin being thereby completed while at the same time the three double threads receive some part of their final relative twist. The driven feed roller, 33, in this operation is conveniently mounted direct on the spindle of the gear wheel, 29. Finally, after the cup, 34, has received sufficient material, the three double threads partially twisted together are led by way of the guide roll, 37, to the bobbin, 41, on which the completed six-cord thread is wound, the balance of the material being wound back on to the same bobbin from which it was drawn. Fig. 4 is a plan of the machine shown in Fig. 4, Fig. 5 is a plan view of a detail of the machine of Fig. 4, showing the method of throwing the yarn into gear with the automatic winder; Figs. 6 and 7 are end views of a modified form of bobbin drive in the machine of Fig. 4.

UNITED STATES PATENT OFFICE.

SEBASTIAN ZIANI DE FERRANTI, OF GRINDLEFORD, ENGLAND.

SPINNING, TWISTING, AND DOUBLING MACHINERY.

1,007,907.


Original application filed August 13, 1904, Serial No. 221,595. Divided and this application filed May 29, 1906, Serial No. 496,132. Renewed April 10, 1912, Serial No. 602,593.
being drawn out of the large cup, 34, and wound on the bobbin, d. The contents of these cups are then transferred to the single large cup and the above operation repeated.

I may, however, in some cases transfer any of the cups bodily to another machine for subsequent treatment.

In carrying my invention into effect according to one form, I may provide cups as already described running at a high speed and feed the doubling into same at say twice the rate in relation to the speed which would ordinarily be practised. For example, if I wish to put in 22 turns per inch to say No. 50’s doubling, I would so arrange the speed in relation to the feed rolls that 11 turns per inch were put in during the process of twisting which goes on as the material is being fed into the cup. As the material is withdrawn from the cup I still continue the same speed of the cup and the same relative speed of the feed roll and put in the balance of the 11 turns, during the withdrawal from the cup making 22 in all during the whole process.

Preferably only a minimum of twist is put into the material as it is spun into the cup, since then if an end breaks and the cup has to be stopped for piecing up the stability of the bobbin is not endangered by “snarling” taking place. In the example described above I have shown that I may put in half the twist going into the cup and the remaining half coming out but it will be evident that in doubling or the like I can put in any proportion of the twist at either operation so long as the total twist is the desired amount. Where, however, the same roll and feed mechanism is used for the unwinding and the winding, half the twist must clearly be put in at each operation in order to obtain the simplest mechanism.

The feeding is done through a reciprocating guide or tube, so as to lay the doubling evenly within the cup; I prefer to give the guiding tube a winding motion or cheese winding motion so as to make the coil formed within the cup as much self-locking as possible. Large bobbins of doubling can be dealt with in this way, and so as to accomplish the result with the least possible labor I may employ feed rolls situated by preference above the cup and feeding from a bobbin direct into it by means of the bobbin itself resting on the feed rolls and by their rotation emptying into the cup. The feed rolls may also be used to wet the bobbin and the yarn during this process, so that it is wetted before the first twisting operation begins and delivered in a wet state into the cup.

Referring to Fig. 3, an example of the above process is shown in which the roving is first passed through the usual attenuating or drawing rolls, 59, and is then led through the guide, 24, actuated by any of the well known mechanisms, into the cup, 2, preferably only a small portion of the total twist being imparted to the material during this part of the process. To enable the yarn to lie better in the cup, it may be wetted during this part of the twisting process. After all the material has been spun into the cup, the inside end is led over the guide roller 40, to the bobbin, d, on which it is wound, the bobbin d, being driven by direct surface contact, from the roll, c, against which it is held by the pressure roll, 22, thus insuring constant surface speed. During the process of withdrawing the material from the cup, the balance of the desired total twist is put into the material. In the figure the cup is shown driven by a motor, 41, the spindle being positively connected on the one hand to the draw rolls through the spiral gearing, 42, and bevel wheels, 43, and on the other hand direct to the driving roll, c.

I will now describe an example of the general process in which the material is twisted out of the cup back on to the bobbin from which it was drawn.

Referring to Fig. 4, the bobbin, 44, on which the material has been previously wound is arranged horizontally and is driven direct by friction from the feed roller, 45, a second roller, 22, being arranged above the bobbin to insure a driving contact. The cup, 2, into and out of which the material is spun, is indicated in the figure as driven by an electric motor, 41, the shaft of the motor being positively geared by means of the worm gearing, 46, and bevel wheels, 47, to the feed roller, 45. I attach the inner end of the doubling or the like to the wooden or other bobbins upon which the doubling is wound for the process. It then results that although the bobbin is constantly rotated in the same direction by the feed rolls, when it has done unwinding into the cup (as shown by the arrow heads in Fig. 6) and being twisted by this operation, it is then by the continuous action of the rolls wound on again to the same bobbin until the whole material has been finally twisted from the cup and drawn out again on to the same bobbin on which it was originally wound in the untwisted state. The doubling is drawn off the bobbin without the assistance of any guiding mechanism. As soon, however, as the reverse process commences, it is necessary that the doubling should be automatically guided in proper order on to the bobbin according to the form of winding it is desired to adopt. I accomplish this result by means of the different positions which the doubling takes up in relation to the bobbin and rolls when it is being wound and unwound; these posts:
tions are clearly shown on the drawing, the arrowheads indicating the direction in which the thread is supposed to be moving. By this difference of direction, I cause the yarn automatically to fall into a slot or notch, 48, formed on the rounded or taper surface of a traveling piece, 49, (see scrap view, Fig. 5,) fitted to a constantly moving automatic winding motion which may be actuated by a separate motor 54. The motor, 54, actuates a heart-shaped cam, 55, which conveys with the spring, 56, to impart a reciprocating motion to the rod, 57. The rod, 57, is attached to the lever, 53, which is pivoted at one of its ends and has a slot, 58, formed at the other. The slot, 59, is engaged by a pin, 60, on a traveling piece, 49, so that the rotation of the motor, 54, causes the traveling piece, 49, to lay the material on the bobbin, 45. I form my feed rolls by preference with a ribbed or fluted surface so as to prevent the yarn which is being unwound from sticking to them, as it is only subject to very slight pull due to the centrifugal action within the cup.

A modified form of bobbin drive is shown in Figs. 6 and 7, the bobbin, 44, resting on two feed rollers, 50, geared to rotate in the same direction by means of the spur gearing shown in Fig. 7, one of the rollers being connected to the cup spindle in the manner described above through the bevel wheels, 51. The method of bringing the traveling piece into action as the position of the material changes is indicated in Fig. 6, and will be readily understood from the description already given.

By the process above described, I may not only double a pair of ends wound together off a single bobbin into a cup, but I may take separate ends off separate bobbins and double and twist them into the same cup, e. g., in the manufacture of six cord thread as above described. Feed rolls must then be employed for feeding into the cup and separate draw-off rolls for feeding out of the cup on to a bobbin.

In some cases I feed from two cups into one and in others from three cups into one by means of feed rolls geared to the several cups in question, in all cases rotating all the cups so as to put in a portion of the desired twist whether the material is being wound into, or taken from, the cups. The final cup in any process involving a set of cups may deliver to a bobbin or swift according to requirements.

In some cases I prefer to mount the cups on conical spindle-ends, the friction drive being sufficient for the purpose. The cups which I employ may either be cylindrical or conical or a combination of both. In some cases I may make the cups with the lower part conical and the upper part parallel and by means of any well known cup winding means lay the winding inside the cup in conical layers to assist in keeping it in its place.

If I use an electric motor I prefer to employ a multiphase induction motor with short circuited rotor as this form of motor is most suitable for any for high speed rotation. When this form of motor is employed, the speed of all the rotating parts will very closely correspond to that due to synchronous running with the high periodicity generator, less a slip in these small motors of 5% to 15% according to the work being done and the size which is given to the motor.

It will be noticed that to perform the operation of twisting the doubling an exceedingly small power is required, as the only power absorbed in this operation is that actually taken for twisting the threads, whereas at present the bulk of the power is absorbed by drawing around the traveler which performs the winding operation at very considerable surface speed against the heavy load due to centrifugal force. Moreover, the load on the traveler in doubling is largely affected by the varying lubrication of the rubbing surfaces. There is thus at present to be overcome a considerable amount of work and moreover a varying load which is entirely absent according to the method I am now describing.

The work to be done according to my process consists in twisting the doubling, which is negligible, and that due to bearing friction principally owing to want of balance in the rotating part notwithstanding the flexible bearings that are used and air friction of the high speed rotating or twisting part.

I find a satisfactory speed for ordinary doubling is about 20,000 revolutions though I think that in practice very much higher speeds will be found commercial, and as may have been seen from the description of my process there is nothing, such as the traveler on the ring, which forms a natural barrier against increasing the speed. I prefer for these high speed motors, to wind them with two poles. Even in this case a speed of 20,000 revolutions requires a periodicity of 155, 350, when making a small allowance for slip. This periodicity is exceedingly high and is probably above a good working limit for electric motors. I therefore prefer when I desire to run at the very highest speeds to drive the spindle by means of a small turbine wheel of the impact type attached to the rotating part driven by any suitable elastic or inelastic fluid.

As the turbine does not put any pull upon the spindle such as is experienced in band driving or electric motor driving, but only puts a torque upon the spindle proportional to the power which the motor is delivering, it is possible to employ a delicately suspended...
self-adjusting bearing, so that the spindle and bobbin or rotating part may run on their combined center of gravity with minimum distress on the bearing and minimum power taken in consequence. The bearing may be made according to any of the well known methods modified in dimensions and form sufficiently to adapt itself to the conditions above described.

The other processes of cotton spinning which are known technically as roving and slubbing may also be carried on with apparatus embodying the same principles as that described, and my invention is applicable to them.

I have described my invention especially in relation to cotton spinning and doubling for the purpose of facilitating the description, but the same apparatus and process is applicable to all other materials besides cotton which require the same sort of treatment.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a spinning, twisting and doubling machine, a twisting element, means for fractionally imparting twist to the material as it is fed to and drawn from said twisting element.

2. In a spinning, twisting and doubling machine, the combination with a twisting element of means for holding fibrous material, together with means for fractionally imparting twist to the material as it is fed to and drawn from said twisting element.

3. In an apparatus for twisting fibrous material, the combination of a chamber, means for rotating said chamber, transfer means, said chamber, rotating and transfer means co-acting as regards the twisting operation to impart to the material part only of the ultimately desired twist, when being laid into said chamber, and the remainder when passing out of said chamber.

4. In an apparatus for twisting fibrous material, the combination of a chamber, means for rotating said chamber; transfer means; said chamber, rotating and transfer means co-acting as regards the twisting operation to impart to the material part only of the ultimately desired twist when being laid into said chamber and the remainder when passing out of said chamber together with gearing interconnecting said chamber and said transfer means.

5. In an apparatus for twisting fibrous material, the combination of a chamber, means for rotating said chamber, a bobbin-like body having fibrous material disposed thereon together with means co-acting with said rotating means for causing material to be rewound on to said bobbin after having been twisted and laid into said chamber.

6. In a twisting apparatus the combination of a chamber, means for rotating said chamber, a bobbin-like body having fibrous material disposed thereon together with means co-acting with said rotating means for causing material to be rewound on to said bobbin after having been twisted and laid into said chamber, said means including a transverse member brought automatically into operative action for laying twisted material on said bobbin-like body.

7. A twisting apparatus comprising in combination a chamber, means for rotating said chamber, transfer means, said rotating means co-acting with said transfer means for causing a part of the ultimately desired twist to be put into the material as it is transferred into said chamber and by a continuous rotation of said rotating means completing the twist as the material is transferred from said chamber.

8. A twisting apparatus comprising the combination of a chamber, means for rotating said chamber, co-acting feeding means geared thereto, a bobbin-like body having material to be twisted wound thereon, said combination by continuous rotation acting to unwind the material from said bobbin-like body into said chamber and to return the material from the chamber on to said bobbin-like body.

9. A twisting apparatus comprising the combination of a chamber; co-acting feeding means geared thereto, and a bobbin like body having material to be twisted wound thereon, the inner end of said material being secured to said bobbin like body, the elements of said combination by continuous rotation acting automatically to unwind the material from said bobbin like body into said chamber and to return the material from said chamber on to said bobbin like body.

In testimony whereof, I affix my signature in presence of two witnesses.

SEBASTIAN ZIANI DE FERRANTI.

Witnesses:
EDWARD KNIGHT GRATURCK,
WILLIAM DUNCAN DAVIDSON.