May 13, 1958 KATSUJI NISHIMURA 2,834,179

THREAD TWISTING MACHINE

Filed April 28, 1953 4 Sheets-Sheet 1

Fig. 1.

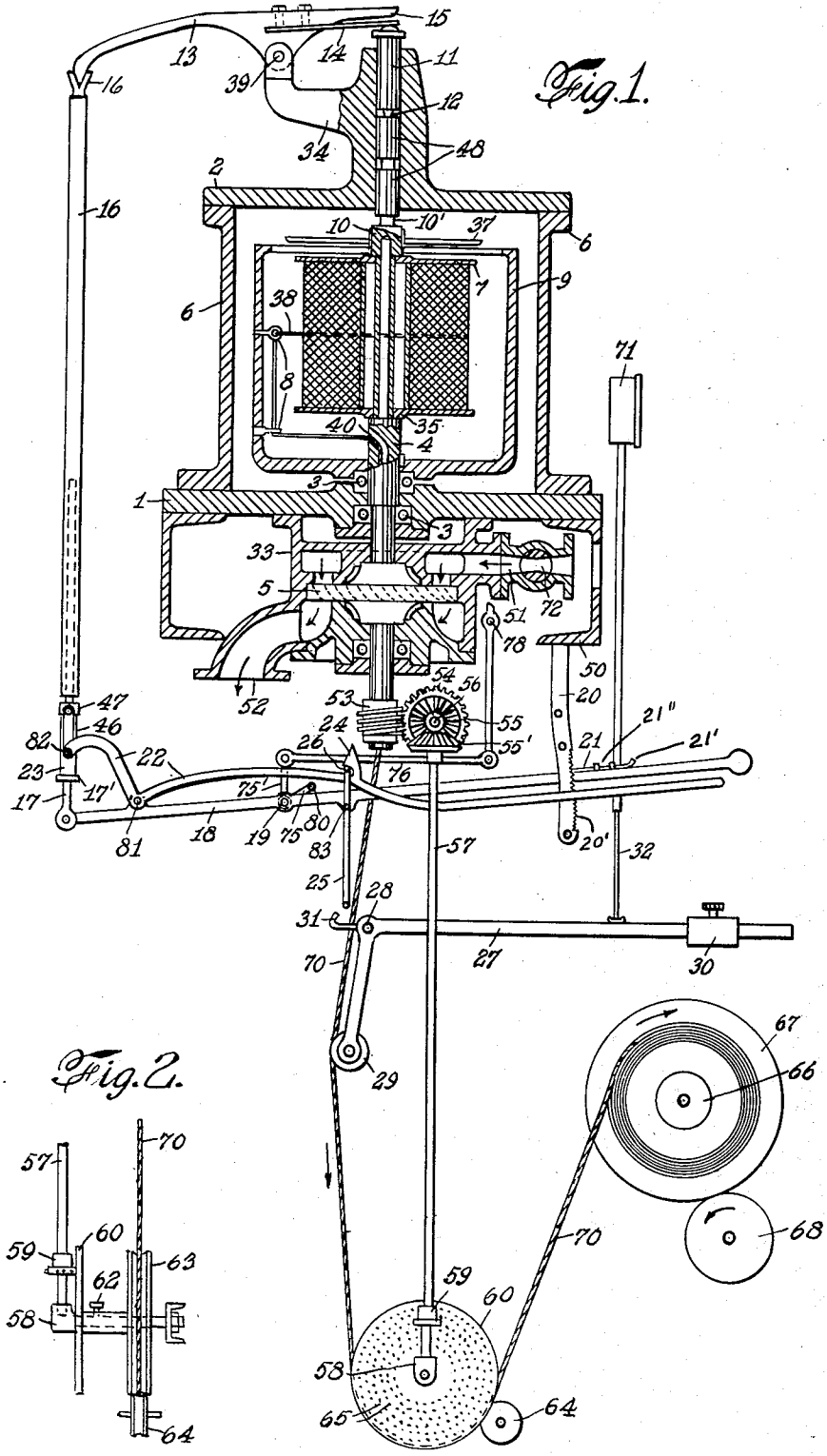


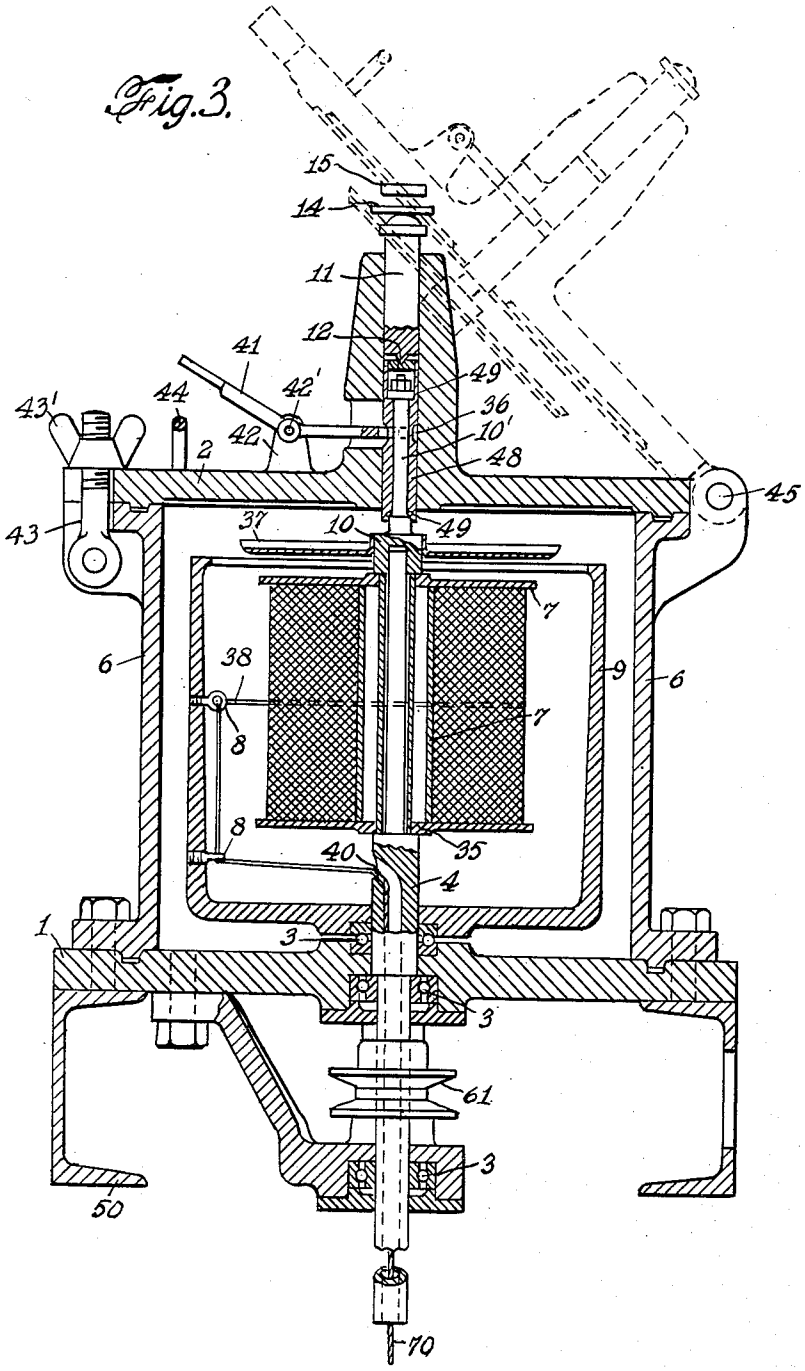
Fig. 2.

May 13, 1958 KATSUJI NISHIMURA 2,834,179

THREAD TWISTING MACHINE

Filed April 28, 1953 4 Sheets-Sheet 2

Fig. 3.



May 13, 1958 KATSUJI NISHIMURA 2,834,179

THREAD TWISTING MACHINE

Filed April 28, 1953 4 Sheets-Sheet 3

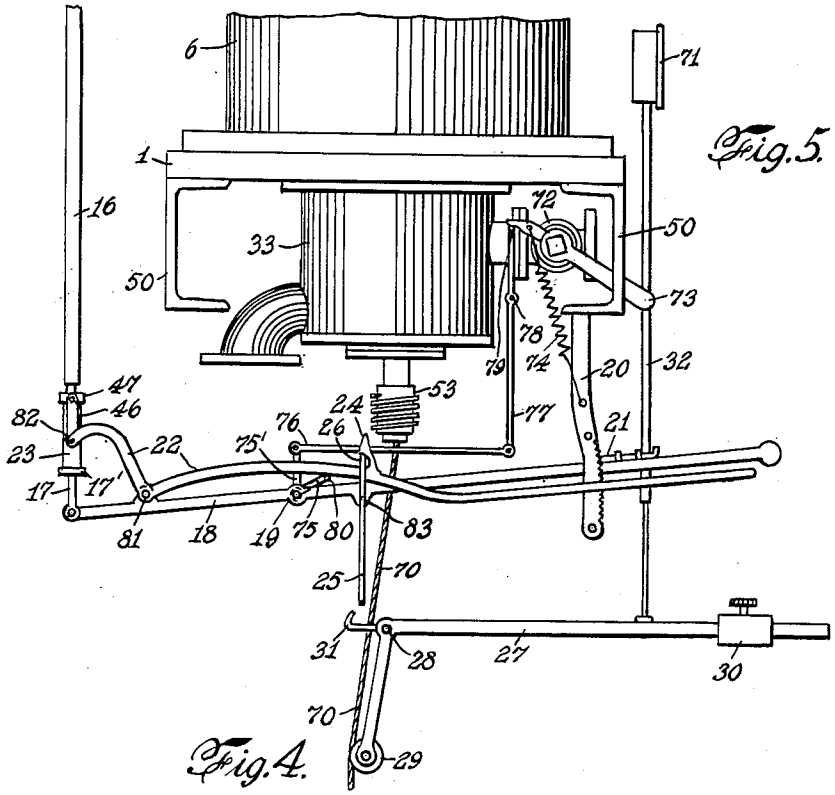
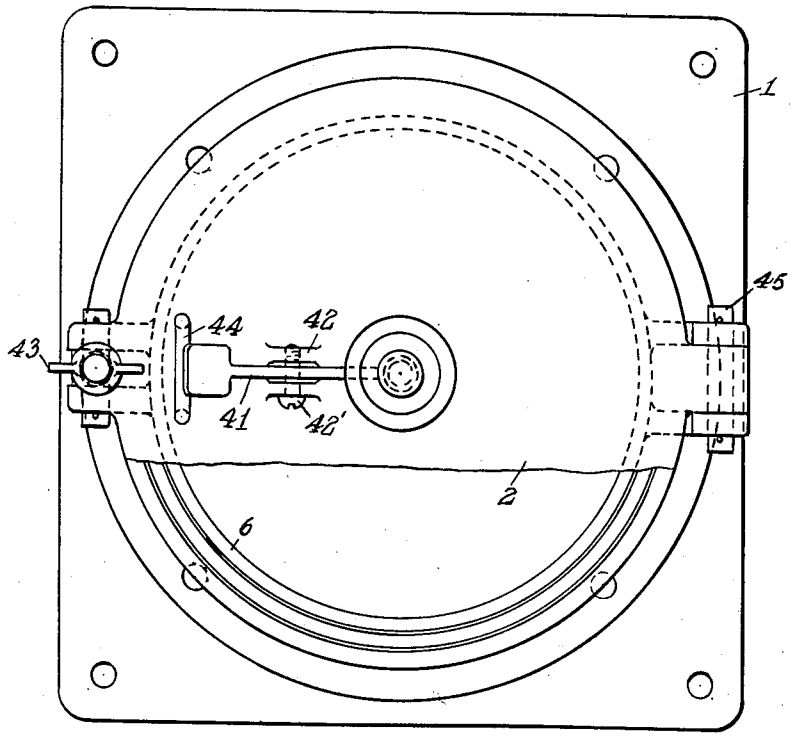


Fig. 5.

Fig. 4.



May 13, 1958 KATSUJI NISHIMURA 2,834,179

THREAD TWISTING MACHINE

Filed April 28, 1953 4 Sheets-Sheet 4

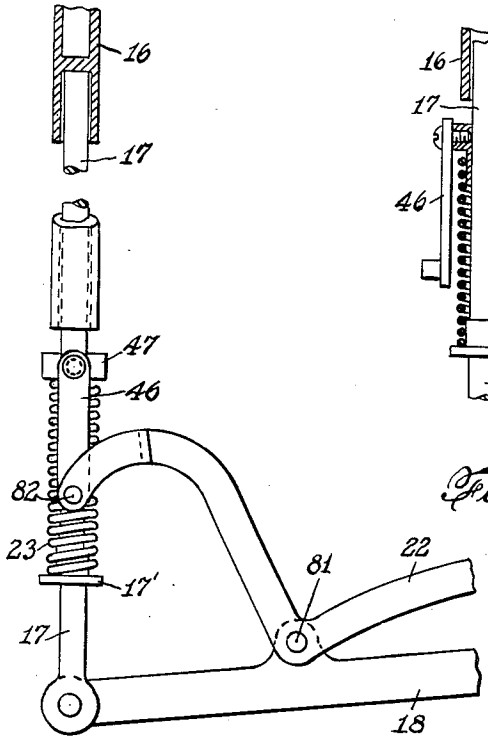


Fig. 6.

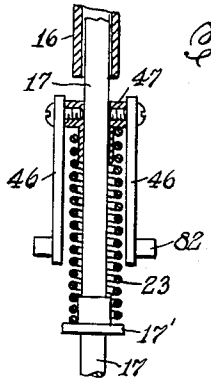
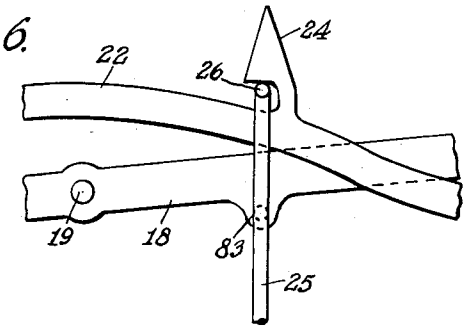


Fig. 7.



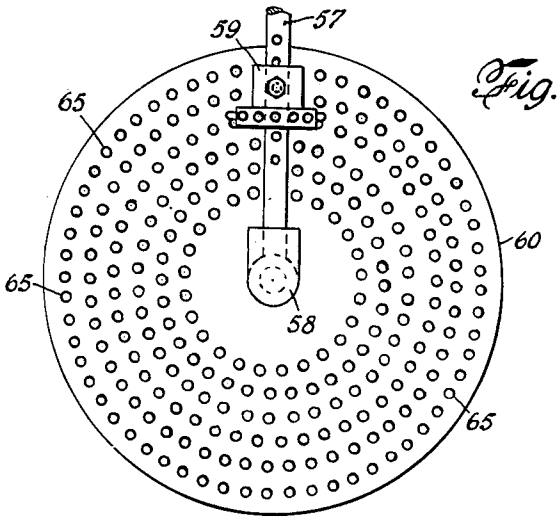


Fig. 8.

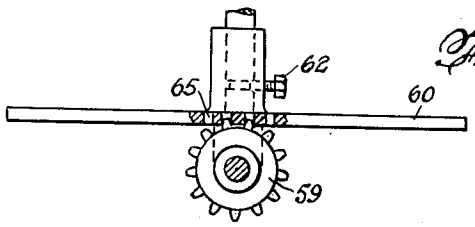


Fig. 9.

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THREAD TWISTING MACHINE

Katsuji Nishimura, Simada City, Shizuoka Ken, Japan

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11 Claims. (Cl. 57—59)

This invention relates to improvements in thread forming apparatus and is directed more particularly to improvements in thread twisting machines.

Heretofore in thread twisting machines there is a practice to have the thread guide means designed in the shape of a fork and rotated in the open air. Accordingly, the resistance of the air and the vibration of the thread guide means at high speeds make it very difficult to obtain a twisted thread of uniform quality. Moreover, the excessive resistance at high speeds tended to break the thread thus greatly reducing the speeds at which the machine can be operated and the output quantity thereof is accordingly reduced.

It is an object of the invention to provide an improved thread twisting machine operable at high speeds yet delivering a twisted thread of a uniform quality.

Another object is to provide a machine operable at high speeds wherein the thread being twisted is not subjected to excessive air resistance and oscillations of the members performing the twisting so as to be broken thereby.

Still another object is to provide a simple and inexpensive thread twisting machine improvement greatly enhancing the output of the machine and improving the yield and efficiency thereof.

Another object is to provide a uniformly tensioning device providing continuous indications to the operator as to the thread tension.

A feature of the machine in accordance with the invention is that it has the various elements or members completely enclosed in a stationary housing so that none of the elements are rotated out in the open so as to subject the thread to excessive air resistance.

Still another feature is that the machine is stopped automatically when the thread is parted or broken or when it is completely expended.

Other objects, features and advantages of the invention will be understood from the following description and claims in conjunction with the accompanying drawings which illustrate by way of example preferred embodiments of the invention and in which:

Fig. 1 is a front elevation view partly in section of a thread twisting machine in accordance with the invention.

Fig. 2 is a side elevaton view of a guiding means for the twisted thread as it leaves the machine shown in Fig. 1.

Fig. 3 is an enlarged sectional view of the invention showing parts not shown in Fig. 1 and a modification of the driving means in Fig. 1.

Fig. 4 is a plan view of the machine shown in Fig. 3 with the cover shown with a portion broken away so as to show details beneath.

Fig. 5 is a partial front elevation view of the operating mechanism of the thread twisting machine shown in Fig. 1.

Fig. 6 is an enlarged fragmentary front elevation view

of a detail of the operating mechanism of the thread twisting machine shown in Fig. 5.

Fig. 7 is a sectional side view of a detail of Fig. 6.

Fig. 8 is an enlarged side view of a guide pulley in the thread twisting machine shown in Figs. 1 and 2.

Fig. 9 is a plan view partly in section of the pulley shown in Fig. 8.

The embodiments of the machine as shown in Figs. 1 to 9 have a stationary housing 6 fixed on the machine by a base 1 and covered by a cover 2 with a rotatable spindle 4 projecting inwardly of the housing 6. A bobbin 7 is supported on spindle 4 by resting on a shoulder 35 formed thereon. The bobbin 7 is held in frictional engagement with the shoulder 35 by a member 10 integral with a shaft 10' rotatable on bearings 49, housed in sleeves 48 which are movable in a longitudinal direction. A pressure applying shaft 11 provided with a point contact 12 bearing on sleeve or housing 48 urges the bobbin into frictional engagement by means of a mechanism for varying the frictional engagement of the bobbin 7 with spindle 4 to be later herein described.

The bobbin 7 charged with untwisted thread 38 is enclosed by a substantially circular member 9 rotatable on bearings 3 and fixed to spindle 4 so as to be rotatable therewith. The member 9 is provided with thread guides 8 guiding thread 38 having a plurality of untwisted strands or filaments to be twisted by the machine in a manner to be later described. The spindle 4 is provided with a thread entry 40 leading to a hollow portion of the spindle and is fixed to an air turbine 5 housed in a turbine housing 33. The turbine or turbine wheel 5 receives air from an air supply (not shown) through a valve 72 and inlet 51 so that the air enters the turbine housing in a direction for turning the turbine wheel 5 and is expelled through outlet 52. The spindle 4 is provided at the end opposite the bobbin with a worm screw 53 engaging a gear 54 mounted on shaft 56. The shaft 56 carries a bevel gear 55 engaging another bevel gear 55' substantially at 90° thereto. The gear 55' is integral with a shaft 57 rotatably mounted on a support member 58. The shaft 57 is provided with a pinwheel 59 movable along the longitudinal axis of the shaft 7 (Figs. 2, 8 and 9) and held in fixed relationship with shaft 57 by means of a set screw 59' so as to be rotatable therewith. Immediately adjacent and in engagement with pinwheel 59 is positioned a wheel 60 having perforations 65 thereon. The perforations 65 are positioned in wheel 60 as concentric circles as shown. Thus it can readily be seen that the speed of perforated wheel 60 is a function of the position of pinwheel 59 and the speed of shaft 57. The speed of the wheel 60 can be reduced by moving the pinwheel 59 into engagement with the perforations or holes of wheel 60 which form the circles of greater diameter thereon. Thus the slowest speed is obtained when the pinwheel 59 cooperates with the perforations forming the outermost circle adjacent the periphery of wheel 60. Alternatively the speed of wheel 60 is increased by moving the pinwheel 59 into engagement with the holes comprising the circles of lesser diameter adjacent the center of wheel 60. Accordingly, it can be seen that the range of speed variations can be great depending upon the design of wheel 60 and the number of circles of perforations thereon. Adjacent wheel 60 (Fig. 2) is positioned a thread guiding pulley 63 rotatably mounted on member 58 and adjustable relative to the wheel 60 and member 58 by means of a set-screw 62. The twisted thread 70 comprises the formerly untwisted thread 38 which is twisted while being pulled out from the lower end of the rotating spindle 4 because of the design of entry 40 and passes around the guiding pulley 63 under the action of a pressing roller 64 in constant engagement with

pulley 63 rotating it in a direction to urge the thread 70 to be drawn through the twisting spindle 4. The twisted thread 70 is wound on a takeup reel 66 provided with a flange 67 in frictional engagement with a driving wheel 68. The reel 66 is continuously rotated at a speed proportionate to the speed of wheel 60. Accordingly, the reel 66 functions with a minimum of slippage between it and driving wheel 68 with slippage being incurred only when the quantity of twisted thread on the reel becomes large.

The twisting machine is provided with a thread tensioning device comprising an L-shaped lever 27 pivoted on a pivot 28 and provided with a V-shaped roller in engagement with thread 70. The lever 27 carries a weight 30 movable along the lever so as to permit adjustment of the length of the weight arm thereby determining the effective pressure by which roller 29 bears against thread 70. The tension on thread 70 is continuously indicated by meter 71 cooperating with lever 27 by means of a connecting rod 32.

The machine is provided with adjustable means or a mechanism for damping oscillations of the bobbin 7 when rotated at high speeds by spindle 4. The same means acting as damping means also acts as a frictional brake in stopping the rotation of the bobbin 7 when the thread 70 is parted or broken or completely expended from bobbin 7. The mechanism comprises a spring 14 bearing against shaft 11 to apply pressure on member 10 and carried by a lever 15 pivotally mounted at 39 on a bracket 34 integral with the cover 2. The lever 15 is provided with a bent portion 13 having one end resting on a V-shaped member 16' carried by a tubular member 16 movable longitudinally by a rod 17 (Figs. 1 and 6). The rod 17 is moved longitudinally or upward and downwardly by a handle 18 pivoted at a pivot 19 held in adjusted position by engaging a serrated member 20 fixed on a stationary portion 50 of the machine. The serrated rod 20 is provided with serrations 20' engaged by a locking pin 21 having a bent portion 21' which can be pulled by the operator compressing a spring 21'' permitting disengagement with the serrations and once the desired frictional engagement between bobbin 7 and shoulder 35 of spindle 4 has been established by adjusting handle 18 the pin 21 is released thus engaging serrations 20' and holding handle 18 in a set position.

The machine is provided with a mechanism for automatically stopping rotation of the spindle 4 and bobbin 7 when the thread 70 is either broken or completely expended. The automatic stop-mechanism comprises a handle 22 pivotally mounted at pivot 81 and having a bent portion 22' pivotally connected at 82 to levers 46 (Figs. 1, 6 and 7). The levers 46 are connected to a collar or member 47 slidable on rod 17 so as to compress a spring 23, surrounding a portion of rod 17 and resting on a flange 17', when rod 22 is lifted upwardly so as to place the automatic stop-mechanism in readiness for operation. The handle 22 is held in a raised position so as to keep the stop-mechanism in readiness by means of a lever 25 pivoted at 83 and having a bent portion 26 engageable with a recess formed by a hook portion 24 of handle 22. The lever 25 is of such a length so as to extend downwardly to cooperate with a hook 31 carried by lever 27 and cooperating therewith in a manner to be later herein described. The machine is further provided with an L-shaped lever 75 pivoted at pivot 19 and having a bent portion 80 lying in the path of handle 22 when it moves downwardly. The lever 75 has a portion 75' pivotally connected to a lever 76 which is in turn pivotally connected to a lever 77 pivotally mounted at pivot 78. The lever 77 is provided with a bent portion 79 (Fig. 5) engaging the underside of a valve operating handle 73 used for opening and closing valve 72 controlling the air inlet to turbine wheel 5. The valve or cock handle 73 is constantly urged downwardly by a spring 74 connected at one end to the handle 73 and at the other end to the serrated rod 20. Thus it can be seen that the handle is constantly biased into a closing position.

The operation of the automatic-stop-mechanism is as follows: when the thread 70 is either broken or is completely expended, the weight 30 urges lever 27 into a clockwise rotation whereby hook 31 engages the lower end portion of lever 25 and rotates in a counterclockwise direction releasing the bent portion 26 from engagement with hook 24. Since spring 23 is in a compressed condition when the handle 22 is initially moved upward to ready the stop mechanism for automatic operation the release of hook 24 permits the spring 23 to urge collar 47 upwardly thus moving handle 22 downwardly so as to engage the bent portion 80 of lever 75. Lever 75 is rotated in a clockwise direction thus rotating lever 77 in a counterclockwise direction so as to move bent portion 79 out of engagement with handle 73. The spring 74 urges the handle 73 toward a counterclockwise rotation thereby closing valve or cock 72 so as to cut off the air supply to the turbine. Simultaneously with the cutoff of the air supply a braking action is applied to the bobbin 7. This is accomplished by the upward movement of member 47 when urged upwardly by spring 23. The member of collar 47 engages the tubular member 16 urging it upwardly so as to move lever 15 downwardly to bear against shaft or pin 11 thereby increasing the pressure of member 10 against the bobbin so as to increase the frictional engagement between the bobbin and shaft 4 thus tending to stop both the bobbin 7 and the shaft or spindle 4. Of course, the handles can be actuated to stop the mechanism manually.

For purposes of simplicity, the embodiment shown in Fig. 1 does not disclose the manner in which the casing or housing 6 is opened so as to insert a loaded bobbin 7 in charging the machine. However, referrring to Fig. 3, it can be seen that the machine may be provided with a cover 2 pivotally mounted at pivot 45. While in operation the cover is kept in a closed position by a pivotally mounted bolt 43 (Figs. 3 and 4). The cover 2 is provided with a boss 42 carrying a lever 41 pivotally mounted at pivot 42' engaging annular recesses 36 formed on the bearing housing or sleeves 48. The machine is provided with an oil drip pan carried by member, thus protecting the thread on bobbin 7 from oil that might drip from bearings 49, and sleeves 48. When it is desired to insert a new loaded bobbin into the machine a wing nut 43' is backed off enough to permit swinging the pivotally mounted bolt 43 outwardly unlocking the cover 2. The handle 41 is then depressed downwardly thus urging the shaft 10' upwardly so as to lift member 10 clear of spindle 4. The entire cover and associated members is then moved upwardly by means of a handle 44 pivoting on pivot 45 and resting as shown in phantom.

The modification in Fig. 3 is provided with a pulley 61 replacing the turbine of Fig. 1 as driving means for the spindle 4. The pulley 61 may be belt driven by a motor (not shown).

While preferred embodiments of the invention have been illustrated and described, it will be understood that the invention is in no way limited to these embodiments and that many changes may be made within the spirit and scope of the invention as defined by the following claims.

What I claim is:

1. In a thread twisting machine in combination a bobbin having an unwound thread comprising a plurality of strands thereon, a driven spindle supporting the bobbin and frictionally rotating the bobbin, a cylindrical member substantially surrounding the bobbin and being rotated by said spindle, adjustable resilient means for biasing the bobbin into frictional engagement with said spindle, a stationary closed member substantially enclosing said cylindrical member and bobbin, said spindle having a hollow portion communicating with a thread entry

portion to receive the unwound thread from the bobbin, said thread entry portion being adapted to twist the thread when said spindle is driven and the threads are pulled therethrough, driving means for driving the spindle.

2. In a thread twisting machine according to claim 1, including an automatic stop-motion mechanism for automatically stopping the means driving the spindle when said thread is broken or completely unwound from the bobbin.

3. In a thread twisting machine according to claim 2, in which said stop-motion mechanism comprises a thread tensioning device and said thread tensioning device actuates said stop-motion mechanism.

4. In a thread twisting machine according to claim 1, including manual means for stopping said means for driving the spindle.

5. In a thread twisting machine according to claim 1, including means for pulling the thread through the hollow portion of the spindle and a meter for continuously indicating the tension on the twisted thread.

6. In a thread twisting machine according to claim 1, including a thread guiding pulley and a gear mechanism operatively connecting the guiding pulley to said spindle.

7. In a thread twisting machine in combination a thread carrying rotatable member for carrying untwisted filaments of thread thereon, a drive spindle supporting and frictionally rotating the thread carrying member, thread guide means substantially surrounding the thread carrying means and rotatable by said spindle, means substantially enclosing the thread guide means and the thread carrying member, means controlling the frictional engagement betwen said thread carrying member and the spindle, said spindle having a hollow portion and a thread entry thereto for twisting the untwisted thread when pulled through the thread guide means, the entry and the hollow portion of the spindle, means for driving the spindle, means for pulling the thread through the spindle at predetermined speeds, said last mentioned means including a guide pulley operatively associated with the spindle, said pulley being provided with means for varying the rate at which said thread is pulled through the spindle.

8. In a thread twisting machine according to claim 7, in which said means controlling the frictional engagement between the thread carrying means and the spindle includes a leaf spring for damping oscillations between the thread carrying member and the spindle.

9. In a thread twisting machine according to claim 7, including means for tensioning the twisted thread and continuously indicating the tension thereon.

10. In a thread twisting machine according to claim 7, further including automatic means for stopping the machine as a function of the absence of any thread for tensioning by said means for tensioning the thread.

11. In a thread twisting machine according to claim 7, including means for automatically stopping said means for driving the spindle when said thread breaks or is expended from the thread carrying member, and said means controlling the frictional engagement between the thread carrying member and the spindle progressively brakes the thread carrying member when said means for automatically stopping the means for driving the spindle is actuated.

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