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WINDING MACHINES USED IN THE MANUFACTURE OF STRINGS FOR MUSICAL INSTRUMENTS

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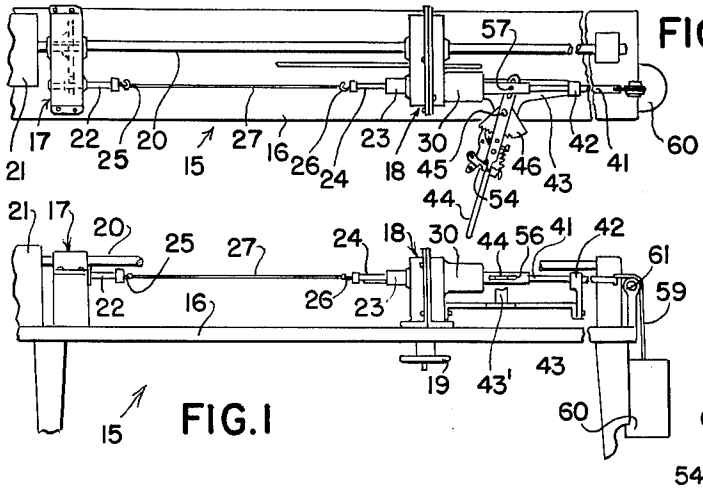


FIG.2

FIG.1

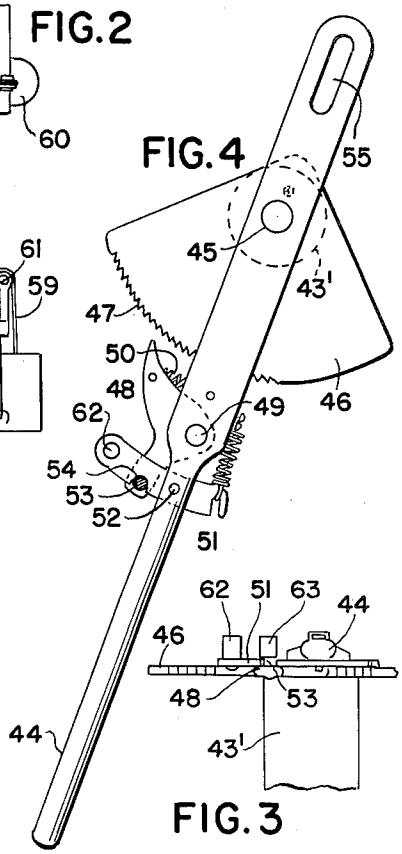


FIG.4

FIG.3

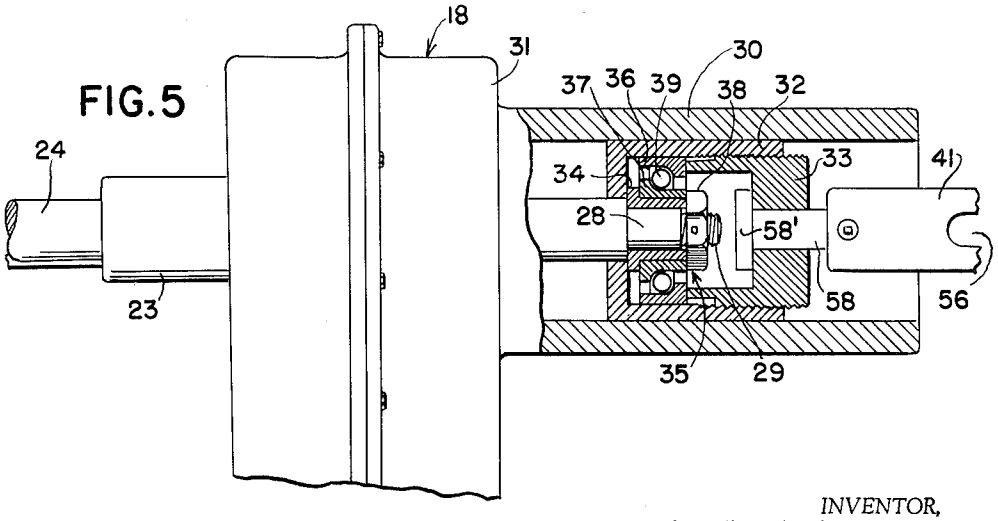


FIG.5

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WINDING MACHINES USED IN THE MANUFACTURE OF STRINGS FOR MUSICAL INSTRUMENTS

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3 Claims. (Cl. 57—11)

The present invention relates to winding machines for the manufacture of musical instrument strings of the type comprising a pliant longitudinal core on which a round or flat wire is closely and tightly wound as a coil thereon.

Generally in these machines, there are two spaced power-driven shafts in axial alignment, between which the core wire is spanned. Both shafts turn in unison after an end of the cover wire is attached at one end region of the core and then led therealong to wind spirally thereon. One of these shafts is longitudinally slidable and is associated with means to move and hold it so the core wire is maintained taut during the winding operation and then to release and move it back so the work can be removed and a new core mounted. A thrust bearing connection associates said longitudinally slidable powered shaft with the means to shift and hold it. Collateral action occuring in this thrust bearing as heretofore employed, in conjunction with wear occuring in the bearing structure supporting said shaft, occasions an appreciable rattle in said shaft, which causes uneveness and kinks in the wound wire. This, of course, makes the string useless. At best, the machine has to be run at comparatively low speed. The spoilage and the time element seriously enhance the price at which the good strings are to be sold.

It is therefore the principal object of this invention to provide a novel and improved construction and association for said longitudinally movable power-driven shaft and the appurtenances therefor for shifting and holding same, which will allow the machine to wind at high speeds, wind evenly and without kinks so the production time is substantially reduced and the quality of the product is proper.

Another object thereof is to provide the mentioned improvement so that at a reasonable cost, existing machines of this type can be easily reconstructed to embody this invention.

A further object thereof is to provide a novel and improved winding machine of the character described, which is simple in construction, reasonable in cost and efficient in carrying out the purposes for which it is designed.

Other objects and advantages will become apparent as this disclosure proceeds.

For one practice of this invention, the thrust bearing is carried within a hollow casing which is slideably fitted piston-wise in a sturdy cylinder securely fixed to the frame of the machine. This maintains the trueness of the slidable shaft, avoids the occurance of centrifugal forces for action on the thrust bearing mass and hence obviates the heretofore incident rattle and wobble of the slidable shaft and allows for high speed operation of the machine.

In the accompanying drawing forming part of this specification, similar characters of reference indicate corresponding parts in all the views.

FIG. 1 is a front view of a winding machine for use in the manufacture of strings for musical instruments, embodying the teachings of this invention.

FIG. 2 is a top plan view thereof.

FIG. 3 is a fragmentary front view of part of the means to shift, hold and release the slidable shaft.

FIG. 4 is a top plan view of FIG. 3.

FIG. 5 is an enlarged front view of the slidable shaft and all the parts of the machine with which it is associated. This is a fragmentary view and is shown partly in section.

In the drawing, the numeral 15 designates generally a winding machine whose frame includes an elongated horizontal bed 16 on which there is a fixed headstock which may be a combination bearing and gear box structure denoted generally by the numeral 17 and a tailstock which may be a combination bearing and gear box structure indicated generally by the numeral 18, slidable along said bed and releasably securable thereto as for instance, by a handwheel nut 19. Said gear boxes have a common input shaft 20 positioned along the machine and driven by the motor 21. The output shaft 22 of the gear box 17 and the hollow output shaft 23 of the gear box 18 rotate in the same direction and in unison. A shaft 24 extends through and out of both ends of the said hollow shaft and is keyed thereto so it shall rotate therewith and be longitudinally slidable therein. The ends of the shafts 22 and 24 which are towards each other have provision, as for instance the respective hooks 25, 26, to attach an end of the core wire 27 respectively thereto. As thus far described, the construction is common in machines of this class, and of course there is also included a means to guide a wire along the machine, which is to be wound as a tight coil on said core wire; such guiding means being not shown herein because this invention is not concerned therewith and same is well known in this art. As mentioned, the subject matter of this invention concerns itself with means to control the slidable shaft 24 and so my provision therefor will now be set forth.

The other end of the shaft 24 in the embodiment shown, is reduced at 28 and terminates in a screw 29. Said shaft end extends into a stationary, sturdy sleeve 30 which is concentric with said shaft 24. This sleeve may be part of the casing 31 of the gearbox and bearing structure 18 and serves as a cylinder for a piston which is a cup 32 whose mouth is away from the hook-carrying end of said shaft 24 and interiorally threaded so it is closed by an exteriorally threaded plug which is a cup 33 whose mouth is towards the hook-carrying end of said shaft 24. This shaft fits rotatably through a hole in the bottom wall of the cup 32, so said reduced end of such shaft is within said cups where it carries a flanged bushing 34 on which fits a thrust bearing indicated generally as 35, for receiving the pull imparted on said shaft 24 while the core 27 is being wound on.

It is important that the parts 36 and 37 of the bearing 35, which afford a raceway for a series of steel balls 39 between them, shall have no lateral movement with respect to the axis of the shaft 24. So, the part 36 fits in the cup 32 while the part 34 fits on the flanged bushing 34 which is on the reduced end 28 of the shaft 24. Part 37 is held fast to said shaft by the nut 38, and the flange of said part 37 may be deemed a collar on said shaft, against which the balls 39 bear. Part 38 has a flange which may also be deemed a collar around said shaft, and such flange also bears against said balls; said balls being between the flanges of parts 36, 37 and the flange of the part 37 being nearer to the hook-bearing end of the shaft 24. The plug 33 is tight up against the flange of part 36, so said balls 39 are pinched by the flanges of said bearing parts 36, 37. It is evident that said cup 32 will slide as a piston within the sleeve 30 when the shaft 24 is slid.

I will now describe a means which may be used to tense the core 27 and then to release it to allow the finished work to be removed and a new core mounted. Such means includes the rod 41 which is slidably mounted in a bearing 42 offered on a frame piece 43 which latter has a fixed post 43' atop of which is pivoted the lever 44

on an axis bolt **45**; said post having fixed thereto, the sector **46** having the ratchet teeth **47**. A pawl **48** pivoted on said lever at **49**, is biased by a spring **50** to engage said teeth, but can be withdrawn and held therefrom by the spring-biased latch **51** pivoted at **52** on said lever **44**; a pin **53** on said pawl being adapted to be entered in the notch **54** in said latch. Said lever **44** extends forwardly of the machine and its rear end has a longitudinal slot **55**. This slotted end fits slidingly in a longitudinal slot **56** in said rod **41**, which rod has a pin **57** fixed therethrough; such pin being positioned through both said slots **55** and **56**. A pin **58** extending from the end of the rod **41**, is revolvably mounted through a central hole in the plug **33** and extends into the cup **32** where it has a head **58'** opposite the distal end of the screw **29**. Said head has some clearance within the cup which it need travel to reach said screw and the length of said pin **58**, is sufficient to allow such travel. Tension in the core **27** is effected by having a cable **59** which is attached at one end to the slidable rod **41**, pulled by springs, or as shown, by a weight **60** at the other end of said cable. The numeral **61** indicates an idler pulley to support said cable. The means shown in FIG. 4 is used to shift said bar **41** whereby the shaft **24** is slid towards the shaft **22** to slacken the core **27**, to hold said bar in such shifted position and then to release said bar.

In FIGS. 1 and 2, deem the machine to be at rest, the winding of the tight coil layer (not shown) on the tensed core wire **27** completed, the lever **44** in position towards the left as shown, but the pawl **48** is held by the latch **51**, away from the ratchet sector **46**, and the suspended weight **60** is pulling on the slidable bar **41** so the head **58'** is bearing against the plug **33** as shown in FIG. 5. Now, to release the work from off the hooks **25**, **26**, the latch **51** is shifted by taking hold of and moving its handle **62** to the position shown in FIG. 2, so the pawl **48** shifts into engagement with the ratchet teeth **47** towards the left of the sector **46**. Thereupon the lever **44** is manually shifted towards the right in FIG. 2. This will cause the bar **41** to be shifted towards the left, thereby pulling the weight **60** upward. When the head **58'** contacts and pushes the distal end of the screw **29**, the shaft **24** will be shifted to the left, thereby slackening the string. This condition is maintained because of the pawl's engagement with the ratchet teeth towards the right of the sector **46**. The operator's hands are free, so he can now remove the string and suspend a new core wire **27** on the hooks **25**, **26**.

To attend to the work to be done, the pawl **48** is shifted by taking hold of its handle **63** and moving it so the pawl leaves the ratchet teeth **47**, until the pin **53** becomes engaged in the notch **54** of the latch. The weight **60** will descend and of course will cause the rod **41** to shift towards the right, whereupon the head **58'** thereof will come into contact with the plug **33** and thereby pull the shaft **24** to the right, thereby tensing the newly mounted core **27** which is now ready to have a coil winding applied thereon. So, the motor **21** is run and the machine will operate. The constant pull will be received by the bearing **35** while the motor is running and the core **25** is tensed. The clearance provided for lost motion before there is contact by the head **58'** with the screw **28** to push the shaft **24**, avoids a bearing relation between them while the machine is operating. The steps to be taken by the operator after the core **27** has been wound, have been set forth.

Important to note is that by holding the shaft **24** and the bearing **35** as provided herein, all rattle, wobble and intense vibration of the shaft **24** are entirely eliminated because the bearing **35** is held against the play of centrifugal forces which were incident in all machines of this class prior to my invention. Whereas heretofore, said machines worked defectively at a speed of 5,000 r.p.m., such machines reconstructed by me to include this invention, now do perfect work at 15,000 r.p.m. The winding on the core is even and without kinks.

This invention is capable of numerous forms and various applications without departing from the essential features herein disclosed. It is therefore intended and desired that the embodiment herein shall be deemed illustrative and not restrictive and that the patent shall cover all patentable novelty herein set forth; reference being had to the following claims rather than to the specific description and showing herein to indicate the scope of this invention.

I claim:

1. In a machine for winding a wire on a pliable core of the type including a frame, a first shaft and a tubular shaft in alignment with the first shaft and spaced therefrom, both journalled on said frame, means for rotating both said shafts in unison in the same direction, a second shaft fitted in said tubular shaft for lengthwise sliding movement, keyed thereto to rotate therewith and extending from both ends thereof, means on each of the facing ends of the first and second shafts to hold an end of the core respectively, a bar mounted on the frame for longitudinal movement thereon along the line of said shafts; said second shaft being intermediate said first shaft and said bar, a means biasing said bar away from the first shaft, means adapted for shifting said bar towards the first shaft, the end of said bar nearest the second shaft being in alignment therewith and means associating said bar and the second shaft whereby on movement of said bar towards the first shaft, said second shaft will be pushed by said end of the bar towards said first shaft whereupon a suspended core will be slackened and upon movement of said bar by said biasing means, said bar will pull the second shaft away from the first shaft whereupon the suspended core will be tensed; said associating means including a bearing structure to receive the pull of said bar, the improvement consisting of sturdy means fixed on the frame, maintaining the second shaft and said bearing structure against lateral movement with respect to the common axis line of said shafts.

2. A machine as defined in claim **1**, wherein said bar when free and acted on by said biasing means, is held spaced from said second shaft.

3. A machine as defined in claim **1**, wherein said sturdy means comprises a sleeve fixed on the frame and concentric with said shafts, a hollow cup fitted in said sleeve for sliding movement therein in the manner of a piston within a cylinder, said bearing structure being housed within said cup and held therein on said second shaft and by said cup to prevent lateral movement with respect to the common axis line of said shafts, and means connecting said bar to said cup to pull it when said bar is free and acted on by said biasing means.

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