June 20, 1944. H. GLEITZ 2,351,951

SPINDLE FOR TEXTILE MILL USE

Filed Aug. 1, 1940

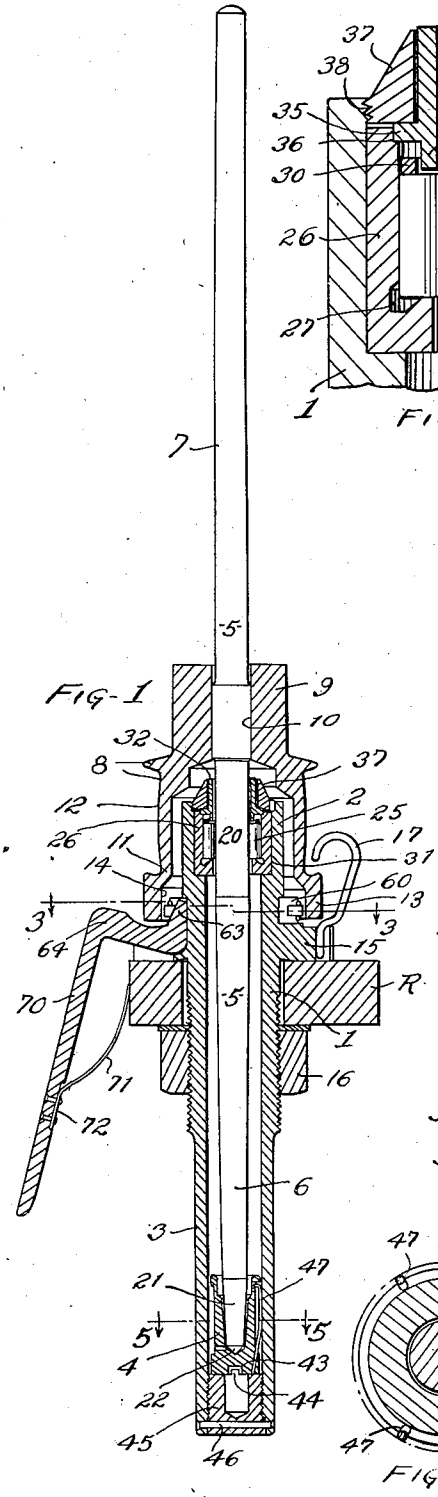


FIG-1

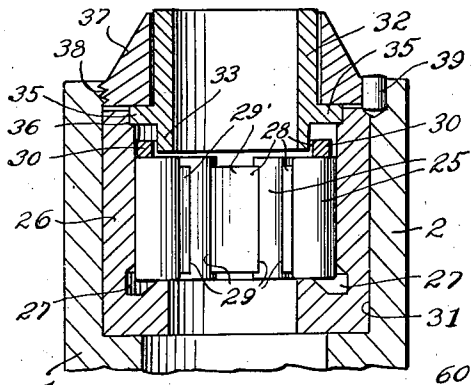


FIG-2

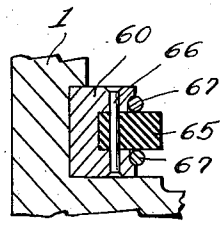


FIG-4

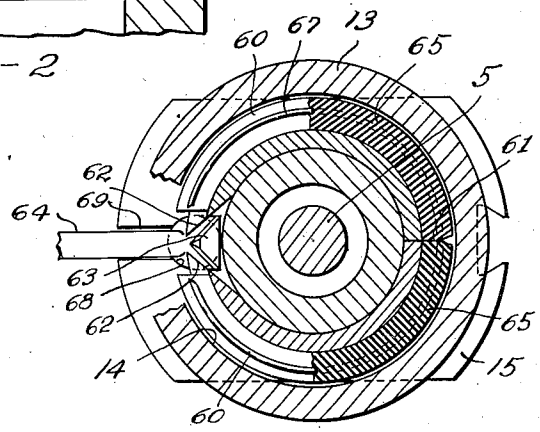


FIG-3

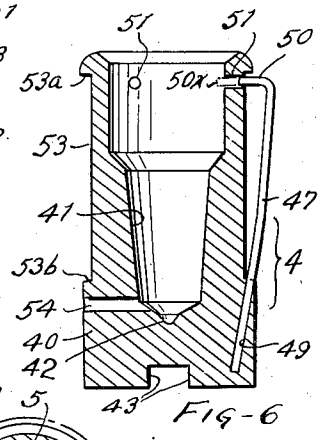


FIG-6

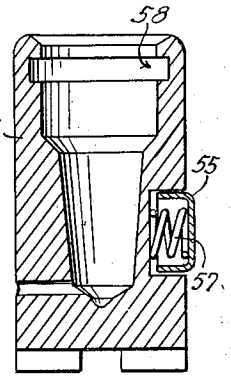


FIG-7

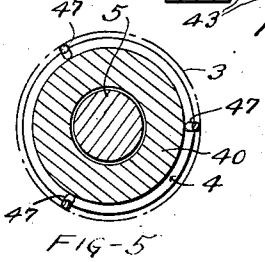


FIG-5

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SPINDLE FOR TEXTILE MILL USE

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3 Claims. (Cl. 308—228)

This invention relates to a spindle such as used in textile mills, as for spinning or twisting.

An object of the invention is to provide a textile mill spindle construction which will be simple and economical to manufacture and which can be operated at high speed for great lengths of time and withstand eccentric loading without destructive vibration.

Another object is to simplify the construction of the bolster for a collar bearing equipped with anti-friction rollers and to eliminate wearing of the collar bearing rollers and races.

Further objects include the provision of a novel resiliently acting support f(foot step bearings of high speed spindles and an improved brake construction for spindles.

Other objects will become apparent from the following description of the preferred embodiment illustrated herewith.

Textile spindles have, in a sense, been over-developed and made more complex than they need to be to perform the work for which intended. Since the general adoption of anti-friction rollers for collar bearings of textile spindles a great deal of attention has been given the matter of reducing wear on and distortion of rollers and roller races.

The bolster which is provided inside the bolster case for supporting the collar bearing has been allowed considerable freedom for lateral pivoting or wobbling movement relative to the fixed bolster case on the theory that such would allow the spindle to adjust itself relative to the effective longitudinal center of mass under conditions of eccentric loading or eccentrically applied driving impulses, whereby to reduce localized wearing and wear-corrosion on the collar bearing. I have found that, by simplifying the construction, wear-corrosion can be greatly reduced if not entirely eliminated without allowing the bolster any play or freeom of pivotal or gyrating movement in the bolster case, and that the collar bearing rollers and races will not be subject to distortion and wear regardless of speed within a reasonable range.

The improved and simplified construction hereof, notwithstanding that there is no provision for wobbling movement of the spindle at the collar bearing, includes the provision of a foot step bearing for the spindle shaft, which latter permits limited universal horizontal movement of the lower end of the shaft while normally resisting movement of said lower end out of concentricity with the bolster case. Yieldable centering means are common in textile spindles, but ordinarily the permitted extent of movement of the lower end of the shaft center is much greater than in the present construction wherein the permitted movement is less than sufficient to allow the working clearance between the elements of the collar bearing to be taken up by any possible wobbling movement of the spindle shaft. Such off center movement is strongly resisted and preferably by forces which increase at a high rate in proportion to the movement off center on part of the lower end of the spindle shaft. The invention includes a specific improvement in that respect. By maintaining a predetermined relationship between foot step bearing movement and total radial collar bearing element clearance and, further, proper damping resistance to wobble or gyration of the lower end of the spindle shaft, the necessity for a floating collar bearing can be overcome. Consequently, one can eliminate a large percentage of the cost of high speed spindles and can eliminate wear-corrosion by substituting simply a fixed short roller race for the usual bearing-supporting bolster construction, greatly reducing total cost and, by the same means, adding capacity for lubricating oil in standard size bolster cases.

The improvement in brakes for textile mill spindles presented herewith relates to means whereby strong uniform braking force can be applied to spindle shaft assemblies nearly entirely around the same as at an inner circular surface of the whorl, the arrangement being simple to manufacture and assemble; such that no eccentric force is applied to the spindle shaft during braking, and such that there is no likelihood of the brake being applied except when desired by the operator, whereupon he can apply adequate braking force instantly to stop the spindle.

Referring to the drawing, Fig. 1 is a longitudinal central sectional assembly view of a spindle embodying the principles of the invention in one form; Fig. 2 is a relatively enlarged sectional detail view of the bolster and collar bearing portion of the spindle; Fig. 3 is a cross sectional view taken at 3—3 on Fig. 1, showing the brake and associated spindle parts; Fig. 4 is a transverse, detail, sectional, relatively enlarged view of one of the brake shoes and an adjacent portion of the bolster case on which the brake shoes are supported; Fig. 5 is a relatively enlarged, transverse, sectional view of the footstep bearing shown in Fig. 1, taken as at 5—5 on Fig. 1; Fig. 6 is a relatively enlarged longitudinal sectional detail view of said footstep bearing according to

Fig. 1, and Fig. 7 is a similar view of another form of footstep bearing.

In Fig. 1, the bolster case 1 has an upper tubular portion 2 containing the collar bearing assembly, a lower tubular portion 3 containing the footstep bearing 4 and lower end portion of the spindle shaft 5. The bobbin-supporting or free end portion 7 of the shaft projects upwardly from a driving whorl 8 which has a hub 9 fixed as by press fitting to the shaft at 10. The lower part 11 of the whorl surrounds the portion 2 of the bolster case (free therefrom), and has a circular surface at 12 for engaging a driving belt or band. Below the surface 12, the whorl has an enlarged rim or flange portion 13, the inner circular surface 14 of which may constitute an internal braking face of a drum complementary to brake shoe members to be described later.

A flange 15 of the bolster case projects outwardly below the lower rim of the whorl and is clamped against the top side of the usual fixed spindle rail R as by a nut 16 engaging the lower side of the rail and threaded to the portion 3 of the bolster case. A hook 17 is shown as mounted on the flange 15 overhanging the lower portion 13 of the whorl. The hook can be swung outwardly from the position in which shown, in order to enable removal of the whorl and spindle shaft.

The spindle shaft is tapered upwardly from the whorl as usual; has a cylindrical portion 20 extending for some distance downwardly from the hub of the whorl for supporting engagement with the collar bearing, and the portion 6 is tapered downwardly to the footstep bearing where the shaft has a conical portion 21 within the footstep terminating in a thrust "point" 22. The cylindrical portion 20 preferably serves as the inner race surface in respect to a set of rollers 25 contained in the bolster 26 and preferably bearing directly on the inner polished cylindrical surface thereof.

Referring especially to Fig. 2, the bolster 26 is a steel cup having a hole in the bottom larger than the spindle shaft portion which projects through it, and being circularly undercut as at 27 to form an oil reservoir for the rollers. The bolster is secured in a counterbore 31 of the bolster case as will be hereinafter described.

The lower ends of the rollers 25 are supported on the smooth inner rim wall of the oil reservoir provided by the undercut 27. A roller retainer and spacer 28 occupies the space horizontally between the race-forming inner wall surface of the bolster and the race portion 20 of the spindle shaft and which is unoccupied by the rollers. The retainer 28 has vertical parallel bores 29 loosely receiving the rollers and intercepting its inner and outer peripheral surfaces. The retainer can be a bronze ring of well known form which is separated into spaced fingers 29' by the bores 29 which extend upwardly from the bottom edge of the ring, leaving enough of the ring intact at the top thereof (at 30) to support the fingers. The retainer ring has its inner and outer peripheral surfaces spaced from the bearing races, this spacing being accomplished by the rollers at the parallel bores of the retainer. Any other suitable roller retainer could be used instead of the one shown.

The bolster 26 is made, for example, .001" larger in diameter than the counterbore 31 of the bolster case, so that the bolster can be held rigidly in place primarily by a press fit. There are, of course, other ways than that shown in which to secure the bolster fixedly in the bolster case, for instance, by welding. A bearing cover, best shown in Fig. 2, comprises a sleeve 32 which loosely receives the spindle shaft and has a narrow rim 33 in the same horizontal plane as the annular upper part 30 of the roller retainer and which limits upward travel of the rollers 25 to a very slight movement. Adequate clearance is provided between the retainer part 30 and said rim 33 as well as between the retainer and the bearing race surfaces so that the retainer can turn freely.

To hold the cover sleeve 32 and the bolster firmly in place, the cover sleeve has an external perimetral flange 35 between its ends bearing on a shoulder 36 of a shallow counterbore of the bolster, and a hollow conical nut 37 threaded into the top of the bolster as at 38, bears downwardly on the flange 35. The flange clamps against the bolster at the shoulder 36 and the nut can be locked as by a pin 39 in a vertical hole which is drilled into the nut and bolster at the threaded connection after the nut has been seated. The nut can have spanner holes, not shown, entering its conical face for enabling the nut to be screwed firmly into place.

Irrespective of the type of footstep bearing which is used, the amount of radial travel of it in any one direction is preferably limited to a distance approximately the same as or slightly greater than the total radial clearance tolerance between the bearing elements in a corresponding direction. This relationship prevents wear on the rollers and races in the event the footstep gyrates to its fullest possible extent during turning of the spindle while carrying an unbalanced load. Extreme movement of the footstep cannot cause the rollers to become wedged; yet the rollers are never loose, i. e. out of effective rolling contact with the inner and outer race surfaces through the lubricating oil film.

The fly-wheel or gyroscopic stabilizing action of the whorl may also be a factor in preventing destructive vibration from being transmitted to the bolster or collar bearing. Since the spinning whorl tends to hold the spindle shaft axis stationary just above the collar bearing the tendency for the shaft to wobble at the collar bearing is further reduced. Even when the footstep moves horizontally to its fullest possible extent the collar bearing stays cool, indicating that no more than normal pressure is being imposed on the rollers and races. The spindle shaft above the whorl evidently flexes sufficiently to permit the bobbin to become dynamically balanced when actually somewhat eccentrically loaded.

The upper and lower portions of the shaft can be especially metallurgically treated so as to increase flexibility of the free end portion upwardly beyond the collar bearing and between the collar bearing and footstep bearing, while at the same time providing against a tendency for the shaft to crystallize at critical flexing points; e. g. adjacent the whorl and collar bearing. The shaft is made very hard in the region of the two bearings and softer substantially at all other portions.

Referring to the footstep bearing 4 shown in Figs. 1, 5 and 6, the body 40 thereof is appropriately bored and polished at 41 and 42 to receive the tapered and blunt-pointed lower end portions of the spindle shaft, the taper at 41 being slightly more per inch than the taper of the adjacent part of the shaft, but the shaft and tapered hole being in close running fit at the

lower part of the shaft portion 21. To hold the body 40 of the footstep bearing against turning, the lower end of it is cross slotted as at 43 loosely to receive tongues 44 on a threaded closure plug 45. The plug and bolster case joints are made fluid tight as by suitable gaskets (or sealing material at the threads), and the plug can be additionally secured in place as by a cross pin 46.

The centering means is arranged yieldably to constrain the body 40 toward centered position in the bolster case by forces which progressively increase at a high rate in proportion to the distance the body becomes displaced eccentrically of the bore of the bolster case occupied by it. A simple and effective means for accomplishing this is the provision of a plurality of spring wire arms 47 anchored to the body as in holes 49 which diverge at a narrow angle relative to the body axis and with their free portions bearing on the bore surface of the case lengthwise of it. Thus the spring arms adjacent the anchored ends may project freely from the holes 49 which are inclined upwardly and outwardly at about 7° relative to the spindle shaft axis, but a short distance from the points at which the arms extend from the holes the peripheral wall surface of the bolster case engages the arms and presses them inwardly into approximately parallel relation to the shaft axis. The inwardly bent upper extremities 50 of the arms freely enter radial holes 51 in the body 40. The original setting or adjustment of the springs is such that, in unstressed condition, the bent ends of the arms slightly enter the radial holes 51 thus guarding the springs against becoming damaged by handling before insertion of the footstep bearing into working position, and making certain that the bearing-centering portions of the spring arms will always be properly positioned. The bent ends are short enough so that they can never touch the spindle shaft, but when the arms are all pressed inwardly by the bolster case wall (see broken line position 50*x*, Fig. 6 of one of the extremities 50) then the ends 50 can be engaged by an expansible end portion of (or bayonet lock device on) an extracting or inserting tool for the footstep.

Any number of arms 47, greater than three, can be used. The centering force of the arms increases rapidly as the body 40 is moved off its central position because the effective lever arms of the springs decrease in length greatly out of proportion to the extent of lateral movement of the body. The body 40 may be of one outer diameter from top to bottom (cf. Fig. 7) and the holes 49 continued as channels along the body 40 to the holes 51 thus providing receiving spaces for the free portions of the arms. As shown, however, the body is turned on a smaller diameter at 53 between shoulders 53*a* and 53*b* to afford the necessary free spaces for the spring arms. An oil hole is shown at 54 in the body 40 for maintaining oil in the socket for the thrust point of the spindle shaft.

The other form of footstep bearing, shown in Fig. 7, is similar to the one just described except that in Fig. 7 radially guided spring pressed buttons 55 are provided yieldingly to center the bearing body 56 in the bolster case thereby to oppose gyration and vibration of the lower end of the spindle shaft. The springs 57 are short coil springs which are carefully calibrated to secure equal deflection or "weight" on all the buttons. Three equally spaced spring buttons can be used approximately in the plane of the center of lateral pressure of the shaft on the body, or two rows of equally spaced buttons in planes above and below such center can be used. The buttons have oppositely extending flanges (not shown) to prevent their becoming detached from the footstep by the spring force. The springs can be simple coils, as shown, or compound coils so that, in the latter case, the effective force increases rapidly as deflection occurs. Groove 58 is for engagement with an expansible and contractible extraction and inserting tool for the footstep bearing.

For lubrication, a sufficient volume of oil is poured into the top of the bolster case so that, when the spindle shaft is inserted, the space below the collar bearing will be no more than approximately full. As the oil level recedes, enough oil for lubrication of the collar bearing climbs the slightly tapered shaft portion 6; and, during idle periods, a supply is maintained in the reservoir groove 27 for distribution to the rollers and their race surfaces.

Referring to the brake, Figs. 1, 3 and 4, this, as shown, comprises two identical arcuate shoe members 60, adjacent ends of which lie on opposite sides of an upstanding end or arm 63 of an actuating lever 64. The shoes are channel shaped in cross section so as to receive friction blocks 65 which may be relatively hard (e. g. pressed fibre) and held in place by cement or by pins 66 (one shown in Fig. 4) extending through aligned holes in the flange portions of the shoes and the friction material. The shoes are pressed inwardly by C-shaped spring wire snap rings 67 which lie in grooves formed at the outer corner portions of the brake-material-receiving channel spaces. The rings maintain substantially equal pressure above and below the brake material and around the shoes, and are very easy to assemble into place. The actuating lever 64 is fulcrumed at a spherical portion of the lever lying in a vertical socket 68 in the top of the flange 15 of the bolster case. The lever extends through a radial slot 69 in the flange (intercepting the socket) to one side of the case, and normally occupies the position shown in Fig. 1. A downwardly inclined arm 70 on the lever, by which the operator applies the brake as by inward pressure thereon, is held normally in brake-releasing position by a leaf spring 71 secured as at 72 to the inner side of the arm 70 and having an upwardly curved free portion adapted to bear against the near edge of the rail R. The spring 71 prevents the weight of the lever from stressing the C-shaped springs outwardly, thus insuring that the brake will be inactive at all times except when a positive inward pressure is applied to the arm 70.

I claim:

1. A spindle comprising a bolster case, bearing means in the case, a shaft supported centrally of the case by the bearing means, a drum on the shaft having an inner brake surface, a pair of brake shoe elements with external circular braking surfaces adjacent the drum, circular guides for the shoe elements whereby they can move outwardly toward and inwardly away from the brake surface, means for actuating the brake shoes, external peripherally open circumferential grooves in the shoes lying inwardly from said braking surface thereof, and a spring wire member of C-shape positioned in embracing relation to both shoes, occupying the grooves and located inwardly at all points along said member a substantial distance radially inwardly from respectively adjacent braking surfaces of the shoes.

2. A spindle construction for textile mill use,

comprising a rigid tubular housing open at the top and adapted and arranged to be mounted in fixed upright position as on a spindle rail, a spindle blade extending downwardly into the housing, a bolster bearing at the top of the housing comprising a series of vertical cylindrical rollers around the blade substantially in snug rolling contact therewith throughout the length of the rollers and similarly in snug rolling contact with a fixed cylindrical inner surface of the housing, said rollers being sufficiently short relative to their diameters so that notwithstanding said rolling contact, the rollers establish a pivot center about which end portions of the blade can move laterally substantial distances without locking the rollers against free rolling movement, and a laterally floating footstep bearing for the lower end of the blade in the lower part of the housing, together with means to limit the floating movement radially off center on part of the lower end of the blade to an amount slightly greater than the total tolerance between the bolster bearing elements.

3. A spindle construction for textile mill use, comprising a rigid tubular housing open at the top and adapted and arranged to be mounted in fixed upright position as on a spindle rail, a spindle blade extending downwardly into the housing, a bolster bearing at the top of the housing comprising a series of vertical cylindrical rollers around the blade substantially in snug rolling contact therewith throughout the length of the rollers and similarly in snug rolling contact with a fixed cylindrical inner surface of the housing, said rollers being sufficiently short relative to their diameters so that notwithstanding said rolling contact, the rollers establish a pivot center about which end portions of the blade can move laterally substantial distances without locking the rollers against free rolling movement, and a laterally floating footstep bearing for the lower end of the blade in the lower part of the housing, said footstep bearing including strong spring means acting at uniformly angularly spaced points about the blade axis normally to center the lower end of the blade in the housing.

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