Nov. 15, 1960 C. M. NEAL 2,959,908

LIVE SPINDLE

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Fig. 1

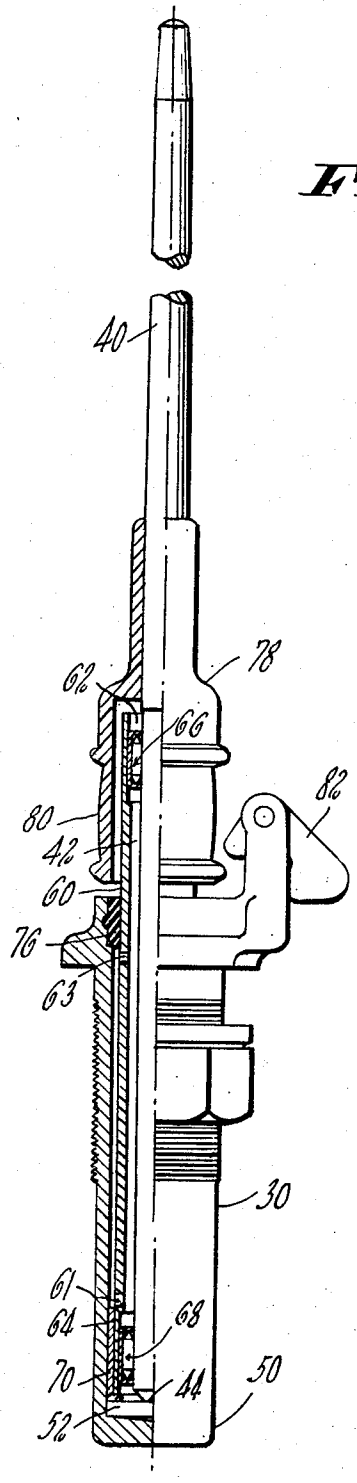
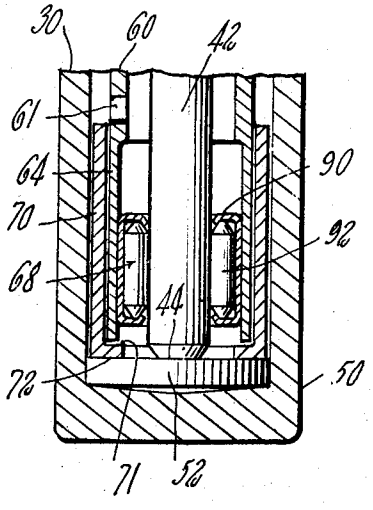


Fig 2



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LIVE SPINDLE

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4 Claims. (Cl. 57—134)

This invention relates to textile spindles used in spinning and in particular to an improved spindle construction.

Modern spindles operating at high speeds together with the characteristic unbalance of conventional yarn packages thereon present a number of problems. Thus, to achieve dynamic balance during operation of the assembly, a pendulous suspension of the lower portion of the spindle from an upper support has been provided, and damping is accomplished by using oil in a chamber around the lower end of the spindle to permit limited lateral damped swing of the rotary elements in response to the dynamic forces occurring on rotation of the spindle. Viscous damping by the oil restrains the resulting lateral and gyrational movement of the free end of the blade at operating speed.

Such a spindle is driven by a moving tape engaging a cylindrical driving surface, characterized in the trade as a "whirl," attached to the spindle blade below the yarn package and, in order to operate at high speeds, utilizes one or more anti-friction bearings. In live spindle constructions of the type with which the present invention is concerned, two such bearings are utilized and the whirl extends from the blade, concentrically around the upper support bearing of the blade. Thus, problems of bearing diameter arise because of the desirability of providing a small diameter whirl, as well as problems of lubrication of the upper bearing, particularly if oil rather than grease lubrication thereof is required. Too, some form of thrust support must be provided, but if this be accomplished by the upper support bearing, the result may be a bearing that makes necessary a larger whirl diameter than is desirable.

Accordingly, it is an object of this invention to provide a novel live spindle structure of simple yet effective construction wherein each of the above mentioned problems is effectively dealt with.

The object of the invention is achieved by employing a straight tube bolster open at each end and surrounding the lower portion of a spindle blade. A closed bottom base member forming an oil chamber surrounds the lower portion of the blade and bolster. The blade extends through the bolster, resting upon a bearing surface in the bottom of the chamber which allows lateral slipping movement of the blade end, and is rotatably mounted with respect to the bolster by a pair of spaced apart anti-friction needle-bearing members held internally in the ends of the straight tubular bolster. Resilient, impermeable supporting means spaced from the bottom of the chamber swingably grips the bolster, restraining its rotation within the base member as well as acting as an oil-sealing member for retaining the damping and bearing lubricating oil within the base and bolster. A desirable narrow clearance in the bottom between the bolster and base is provided by a tubular damping element interposed therebetween. This permits limited swinging of the blade end about the holding means and the double viscous restraint provided, that is on each side of the damping element, is most effective to dampen any such movement.

The invention will be better appreciated with reference to the following detailed description taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a partially cut away side view of the spindle construction of this invention, and

Fig. 2 is a magnified section of the bottom portion of the apparatus of Fig. 1.

Referring to the figures, the spindle construction there shown comprises a base **30** adapted to be clamped onto a rail with others to form a frame of spinning spindles. The base defines a hollow cylindrical chamber suitable to be filled with oil, and is preferably a die casting of aluminum alloy or the like. A spindle blade **40** extends upward from the base, adapted to receive a bobbin. A lower portion **42** of the blade extends down into the chamber and the blade bottom **44** rests upon a flat bearing surface at the bottom of the chamber, preferably formed by a hardened thrust plate **52**.

A straight, open-ended metal tube having an outer circumference substantially smaller than the bore of the chamber surrounds the lower portion of the blade to provide a bolster **60**. The interior of each end of the bolster is bored at **62** and **64** to a close tolerance. Into each bore there is pressed a needle bearing member **66** and **68**, respectively, with inner surfaces mated to matching surfaces of the spindle blade, so as to rotatably space the blade internally and concentrically with the bolster.

In the top of the base there is held a resilient supporting means **76** of synthetic rubber or like material which tightly surrounds the bolster **60** supporting the bolster in the base and restraining rotation of the bolster with respect to the base, yet permitting slight swinging of the bolster and spindle relative to the base. Upon a slightly tapered portion of the spindle blade **40** a whirl hub **78** is pressed. From this hub a small whirl **80** adapted to receive a driving tape, extends downwards concentric with and spaced apart from the counterbored portion of the straight tubular bolster **62** into which the upper needle bearing **66** is pressed. A catch **82** prevents inadvertent removal of the blade and whirl.

Referring specifically to Fig. 2, a cylindrical damping sleeve **70** is placed in the bottom of the base chamber. The damping sleeve has an outer diameter smaller than the bore of the chamber by about 0.01 inch. The sleeve is substantially concentric with the lower portion of the bolster, and is oversized as to fit loosely around the bolster again to provide a diameter difference of about 0.01 inch. As a preferred means of restraining the damping sleeve from working upwards on the bolster during operation, a bottom flange **72** extends inwards from the sleeve **70** under the lower end of the bolster. The bolster being supported from above generally does not rest upon the flange, but whenever the sleeve tends to move upwards, the flange contacts the bolster and the sleeve is restrained.

Damping and lubricating oil is maintained in the bolster and chamber, filling the spaces between the damping sleeve, the chamber walls and the bolster and covering the upper bearing **66**. Preferably a lower hole **61** and an upper hole **63** are provided through the bolster wall to aid in filling the bolster and chamber with oil.

The resilient supporting means **76** positions the blade and bolster upright but permits slight swinging. It absorbs substantial amounts of vibration when the blade is first turned, and additionally seals the chamber and bolster, yet permitting ready assembling and disassembling simply by sliding the bolster through it.

Each needle-bearing member in the preferred embodiment of the drawings comprises a bearing retaining member **90** pressed into each end of the bolster, into the counterbored portion thereof as in Fig. 2. Each retain-

ing member is comprised of an outer cylindrical race and spaced apart, opposed retaining rims extending inwardly therefrom. A circular series of anti-friction needle-bearing elements **92** are rotatably held between the opposed retaining rims. The inner bearing surface of each bearing member is formed by the inner surface of each of the series of needle-bearing elements.

This bearing construction gives substantial advantages in assembly and maintenance of the apparatus. The bolster **60** with bearing members **66** and **68** in each end is inserted into the base being slidably pushed through the gripping supporting member **76**. Oil is then poured into the bolster which enters the space between the bolster and the base through the cooperation of holes **61** and **63**. Thereafter, the spindle blade is inserted into the bolster, through the bearing. Some oil is displaced by the blade rising in the bolster above the upper bearing therein to lubricate it. Oil leakage out of the base is avoided by the sealing effect of the supporting member. Re-lubrication is easily accomplished by lifting the spindle blade from the bolster and replenishing the oil within the chamber and bolster to its desired level.

In operation, upon rotating the spindle blade, off-center loading creates a dynamic force tending to wobble the spindle blade about the resilient supporting means. The lower end of the bolster blade assembly is permitted to swing laterally by the clearances provided by the loose fitting damping sleeve, but for each increment of movement, oil on both sides of the sleeve is shifted. This double movement of oil through the effectively narrow clearances provided, creates a substantial damping drag which is effective to control package unbalance. During any shift of position the bottom surface of the spindle blade slides upon the thrust plate **52**, lubricated in movement by the surrounding damping oil. At all times then, the major portion of the weight of the blade and package rests upon the thrust plate so that the spaced bearings need not supply thrust. Hence, needle-bearings are preferably used in both upper and lower portions to effectively reduce the overall diameter of the elements, particularly the whirl.

As the foregoing is a single illustration of the invention, it should be understood that many variations are within the spirit of the invention, the scope thereof as set forth in the following claims.

What is claimed is:

1. A spinning spindle construction comprising a base forming a vertical fluid chamber and adapted to be attached to a spindle frame, a bearing surface in the bottom of said chamber, a spindle blade having its bottom end resting on the bearing surface transferring its weight thereupon, a tubular open-ended bolster surrounding the lower portion of the blade, spaced apart bearings rotatably centering the blade concentrically with the bolster, said blade extending up beyond the bolster a substantial distance providing a bobbin receiving portion, means for rotating said blade, and resilient supporting means spaced apart from the bottom of said chamber and cooperating with said base, resiliently circularly gripping said bolster while permitting slight tilting movement thereof in response to dynamic forces, said chamber being adapted to receive fluid for viscously restraining lateral movement of said blade, for lubricating the bottom of the spindle blade and the bearing surface permitting free relative movement therebetween, and for additionally lubricating each of the spaced apart bearings within the bolster.

2. The spindle of claim 1 wherein the bolster comprises a section of open-ended tube surrounding said blade, and concentrically and rotatably supported about said blade by bearing members in each end of the tube, each bearing member comprising a circular series of needle bearing elements rotatably held in contact with the blade by opposing retaining rims extending inward from a cylindrical race, said race being pressed into the tube, lubrication of the upper bearing being achieved by oil maintained in said tube at a suitable level.

3. The spindle of claim 1 wherein the lower portion of the open-ended tube extends down said blade to a point close to the lower end of said blade, a damping sleeve loosely surrounds said lower portion of said tube and is loosely confined by the bottom of said chamber whereby on spinning of the blade the blade is isolated from contact with substantial amounts of fluid in the base eliminating undesirable rotation drag, and the tube, damping sleeve and chamber are adapted to cooperate with oil to dampen lateral movement of the blade.

4. The spindle of claim 3 wherein from the lower portion of the damping sleeve extends a flange inwards, and the lower end of the tube is positioned directly above the flange, whereby the sleeve is restrained from working upwards.

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