

Dec. 7, 1965

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3,221,389

TEXTILE SPINDLE

Filed Sept. 22, 1964

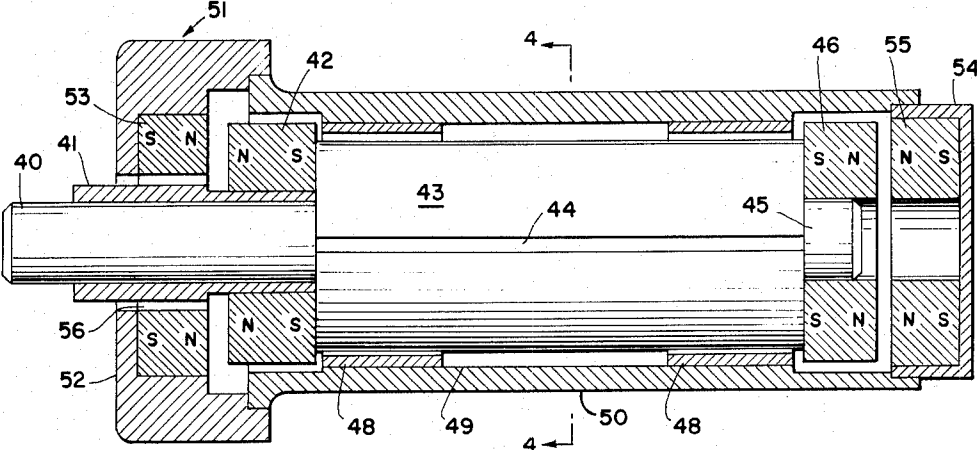
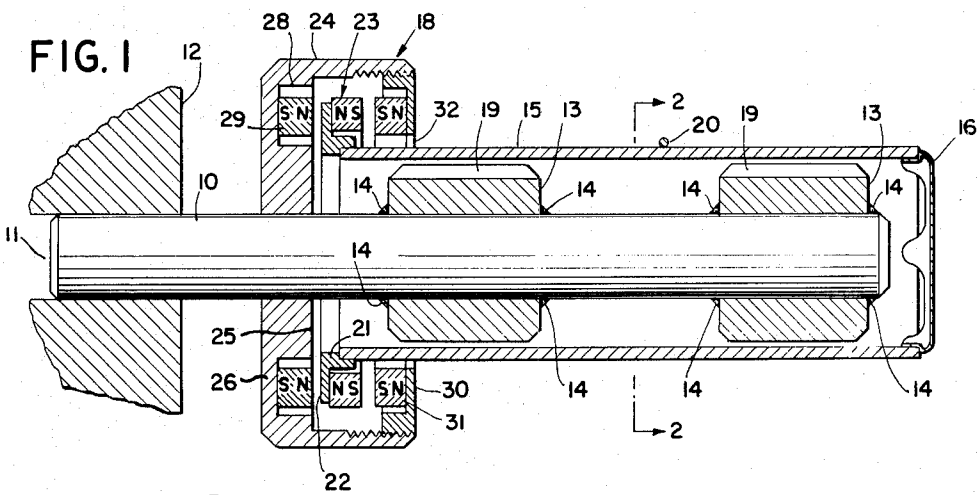


FIG. 3

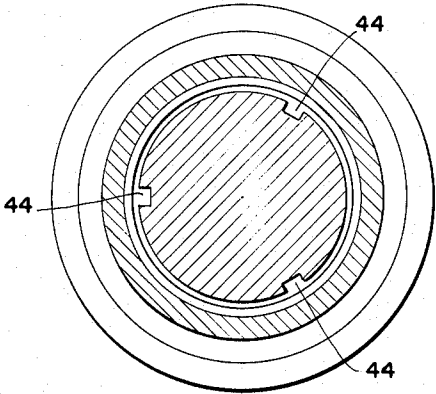


FIG. 4

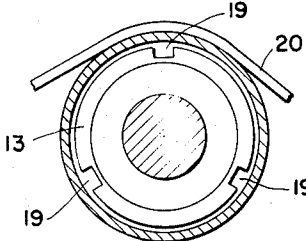


FIG. 2

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3,221,389

TEXTILE SPINDLE

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Filed Sept. 22, 1964, Ser. No. 398,271
5 Claims. (Cl. 29—116)

This invention relates to rotary devices such as are employed as guide rolls for filaments or thread composed of nylon, cotton or other textile material.

In the manufacture of such thread, it is often necessary to provide such guide rolls whose rotatable surfaces are adapted to be driven by the thread at high speeds and engaged therewith without risk of contamination. However, it has been found that conventional guide rolls are ill-adapted for these purposes because they require substantial lubrication which, while permitting rotation of the guide rolls, also raises the possibility that the lubricant employed may leak from its intended place of lubrication and contaminate the thread engaged with the guide rolls. Moreover, even where a high viscosity lubricant (such as grease) be used so as to avoid such leakage and contamination, it has been found that the frictional torque on the guide rolls tends to increase and thereby produce excessive tension on the thread.

Beyond this, at very high speeds of rotation, conventional guide rolls may become unstable and inoperative by reason of damage resulting from such instability.

The present invention solves these difficulties.

Thus, an object of the present invention is to provide an improved guide roll of the character described which requires no lubrication and which remains stable throughout a great range of operative speeds.

Another object of the invention is to provide such a guide roll which presents no risk of contamination to any thread engaged therewith.

Another object of the invention is to provide a guide roll which minimizes the likelihood of imparting a static electrical charge to any thread with which it is used.

Another object of the invention is to provide an improved guide roll which is easily installed for operative use and which requires little or no maintenance.

Another object of the invention is to provide an improved guide roll which undergoes little or no wear during use and which operates in a substantially frictionless manner.

Another object of the invention is to provide an improved guide roll which is of simple, economical design and which is of sturdy construction.

In the drawing:

FIGURE 1 is a cross-sectional view of one embodiment of the invention;

FIGURE 2 is a cross-sectional view taken about the line 2—2 of FIGURE 1 and depicting a thread in operative association with such embodiment of the invention;

FIGURE 3 is a cross-sectional view of a modified form of the invention;

FIGURE 4 is a cross-sectional view taken about the line 4—4 of FIGURE 3.

Other objects and advantages of the invention will be apparent from the following detailed description of one embodiment thereof, as read in connection with the accompanying drawing, submitted for purposes of illustration only and not intended to define the scope of the invention, reference being had for that purpose to the subjoined claims.

As shown in the accompanying drawing, FIGURE 1 discloses a preferred embodiment of the invention. As seen in this figure, the said embodiment of the invention comprises a fixed shaft or rod 10 which may be mounted

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as, for example, by frictional engagement with the surface of an aperture 11 provided in a vertical member 12 such as a wall or other suitable supporting member.

The rod 10 is provided with a pair of annular bearings 13 which are preferably composed of graphite and which are suitably secured to the rod 10, as by cementing at 14, for example. The bearings 13 are also housed within a hollow rotatable tube 15 which is preferably composed of steel.

A cap 16 is frictionally engaged with one end of the tube 15, the cap 16 being removable, if desired, so as to permit access to the interior thereof; and, as is hereinafter set forth in detail, a thrust bearing assembly, generally designated by the numeral 18, is provided in the vicinity of the other end of the tube 15.

An important feature of the invention resides in the provision of a plurality of longitudinal grooves 19 upon the circumferential periphery of the bearings 13. As may be seen in FIGURE 2 of the drawing, these grooves 19 are spaced at equal angular intervals upon said circumferential periphery which is also of a smaller diameter than the internal diameter of the tube 15 so that, as hereinafter explained, the circumferential periphery of the bearings 13 will be in spaced relation with respect to the internal periphery of the tube 15 when the latter is rotated at high speeds.

With the foregoing arrangement, it will be seen that I have accomplished an air bearing whereby, upon rotation of the tube 15, a film of air will be interposed between the circumferential periphery of each of the bearings 13 and the internal periphery of the tube 15, said film serving as a lubricant and minimizing wear upon the bearings 13. Moreover, in accordance with principles known to those skilled in the art of bearings, the aforesaid longitudinal grooves 19 will impart stability to the tube 15 even though it be operated at high speeds. For example, it has been found in practice that such a tube having an overall diameter of one-half inch may be rotated at 15,000 r.p.m. without such rotation being characterized by instability.

It will also be seen that not only is such rotation substantially frictionless, but any tendency to create a charge of static electricity upon the external surface of the tube 15, by reason of the contact which would otherwise exist between the bearings 13 and the tube 15, will be eliminated by reason of the spacing between the bearings 13 and the tube 15. Hence, at such a speed, the movement of the tube will produce a minimum accumulation of static electricity on the thread or filament 20.

As previously observed, one end of the tube 15 is provided with a thrust bearing assembly 18. Here again, the arrangement is such that there is a spaced relation between all moving parts. Thus, as may be seen by reference to FIGURE 1 of the drawing, the tube 15 is engaged with an annular sleeve 21 provided with a radial flange 22. An annular magnet 23 is seated upon the sleeve 21 and flange 22, and said magnet is disposed within a cup-shaped housing 24 engaged with the rod 10. Thus, said sleeve 21, flange 22 and magnet 23 constitute a magnetic rotor whose function will be more clearly understood from the following discussion.

The internal surface 25 of the base 26 of the housing 24 is provided with an annular groove 28 wherein a ring-shaped magnet 29 is affixed, as by a suitable adhesive, for example. So, also, the mouth of the housing 24 is threadedly engaged with a circular plate 30 whose inner surface is depressed to accommodate an annular magnet 31, such magnet 31 being suitably affixed to said inner surface as by an adhesive, for example.

In the case of each of the magnets 23, 29 and 30,

their magnetic poles are disposed upon their radial peripheries, i.e., upon their planar surfaces, the disposition of the poles is such that adjacent of such poles repel each other, thereby tending to maintain the magnet 23 in spaced relation with respect to the adjacent magnets 29, 30. The disposition of the poles of said magnets 23, 29, 30 is indicated by the letters N and S shown in FIGURE 1 and representing the North and South poles of such magnets.

By this arrangement, it will be seen that the very light or non-existent axial loads which might be imposed upon the tube 15, when acting as a guide or idler for conducting the filament or thread 20, will be effectively met by the above described magnetic thrust bearing. Here again, the spaced relations between the moving parts disposed upon the tube 15 and the parts engaged with the stationary housing 24, permit a substantially friction-free movement of the tube 15 and avoid the creation of a static electrical charge on the tube 15. In this regard, it will also be observed that the plate 30 is provided with a central aperture 32 through which the tube 15 extends into the housing 24, the edges of said aperture 32 being in spaced relation with respect to the tube 15.

It will be noted that the foregoing arrangement entirely eliminates any necessity for using a grease or liquid lubricant therein. In this way, the risk of contaminating the filament or thread 20 with such a lubricant is avoided and, by the same token, any resistance to high speed rotation which the viscosity of such grease or liquid lubricant might impose, is also avoided.

FIGURES 3 and 4 of the drawing depict a modified form of the invention. As may be seen in these figures, this form of the invention comprises a stationary rod 40 disposed within a sleeve 41 upon whose external periphery is seated an annular magnet 42. The rod 40 is provided with an expanded portion 43, characterized by a plurality of longitudinal grooves 44, and a reduced portion 45 which seats a second annular magnet 46.

The expanded portion 43 of the rod 40 is journaled within a pair of annular bearings 48 which are frictionally engaged with the internal periphery 49 of a rotatable tube 50, said bearings 48 being rotatable together with said tube 50.

One end of the tube 50 is frictionally engaged with a cup-shaped housing 51 whose base 52 seats an annular magnet 53 disposed in the vicinity of, but in spaced relation with respect to, the magnet 42. The other end of the tube 50 is frictionally engaged with a cap 54 which also seats an annular magnet 55, in this instance, said magnet 55 being disposed in the vicinity of, but in spaced relation with respect to, the magnet 46.

The aforesaid rod 40 and sleeve 41 extend through an aperture 56 provided in the housing 51 and through the annular magnet 53, said sleeve 41 being in spaced relation with respect to the surface of said aperture 56 and with respect to said magnet 53.

In this arrangement of the invention, it will be seen that the rod 40 may be suitably mounted, as in the case of the previously described form of the invention, and that the rotatable bearings 48, tube 50, housing 51, cap 54, and magnets 53, 55, will all be disposed in spaced relation with respect to the stationary parts of the device; and that their rotation will be lubricated by a film of air between the rod 43 and the bearings 48 (said rod being circular in cross-section) and that the rotating members will be stabilized, as in the case of the previously described form of the invention, by the longitudinal grooves 44.

Here also, the magnets are disposed so that adjacent said magnets will mutually repel each other, thereby functioning as a pair of thrust bearings disposed at opposite ends of the rod 40.

Thus, this arrangement of the invention also permits high rotational speeds without the necessity of any po-

tentially contaminating grease or liquid lubricant and, at the same time minimizes any tendency to accumulate a static electrical charge on thread or filament conducted thereby.

Hence, it will be seen that in each of the above-described instances, the objects of the invention are achieved in a simple, direct and ingenious manner.

The embodiments of the invention illustrated and described hereinabove have been selected for the purpose of clearly setting forth the principles involved. It will be apparent, however, that the present invention is susceptible to being modified in respect to details of construction, combination and arrangement of parts which may be resorted to without departure from the spirit and scope of the invention as claimed.

I claim:

1. In a guide roll having a rotatable tube adapted to conduct a filament upon the external periphery of said rotatable tube, the combination comprising:

- (a) a housing;
- (b) a rod engaged with the housing;
- (c) said rod being provided with air bearing means;
- (d) said air bearing means being journaled in said rotatable tube;
- (e) said air bearing means being provided with a plurality of longitudinal grooves, whereby said tube is stabilized during rotation and is supported on a film of air between said bearing means and said tube;
- (f) said tube being provided with magnetic thrust bearing means at at least one end thereof.

2. In a guide roll having a rotatable tube adapted to conduct a filament upon the external periphery of said rotatable tube, the combination comprising:

- (a) a housing;
- (b) a rod engaged with the housing;
- (c) said rod being provided with at least one annular bearing;
- (d) said annular bearing being disposed within said rotatable tube, there being a spaced region between said tube and said annular bearing during rotation of the tube;
- (e) the circumferential periphery of said air bearing being provided with a plurality of longitudinal grooves, whereby said tube is stabilized during rotation;
- (f) said tube being provided with magnetic thrust bearing means.

3. In a guide roll having a rotatable tube adapted to conduct a filament upon the external periphery of said rotatable tube, the combination comprising:

- (a) a housing;
- (b) a rod engaged with the housing;
- (c) said rod being provided with at least one annular bearing composed of graphite;
- (d) said annular bearing being disposed within said rotatable tube, there being a spaced region between said tube and said annular bearing during rotation of the tube;
- (e) the circumferential periphery of said air bearing being provided with at least three longitudinal grooves spaced at equal angular intervals, whereby said tube is stabilized during rotation;
- (f) said tube being provided with magnetic thrust bearing means.

4. In a guide roll having a rotatable tube adapted to conduct a filament upon the external periphery of said rotatable tube, the combination comprising:

- (a) a housing;
- (b) an annular sleeve engaged with one end of said rotatable tube;
- (c) a first annular magnet seated upon said annular sleeve;
- (d) a second annular magnet being seated within said housing;

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- (e) a plate engaged with said housing,
 - (f) a third annular magnet being seated upon said plate;
 - (g) said first annular magnet being disposed in spaced relation with respect to said second and third annular magnets; 5
 - (h) said first annular magnet presenting repellent polarities to said second and third annular magnets.
5. In a guide roll having a rotatable tube adapted to conduct a filament upon the external periphery of said 10 rotatable tube, the combination comprising:
- (a) a rod provided with a sleeve;
 - (b) said rod including an expanded portion provided with a plurality of longitudinal grooves spaced at equal angular intervals; 15
 - (c) said expanded portion being journaled in at least one rotatable bearing;
 - (d) said rotatable bearing being seated upon the internal periphery of said rotatable tube;
 - (e) said rotatable tube being disposed concentrically 20 of said rod and engaged with a rotatable housing;
 - (f) said rotatable bearing being in spaced relation with respect to said expanded portion during rotation of said bearing;
 - (g) an annular magnet provided at one end of the expanded portion of said rod; 25
 - (h) a second annular magnet being seated within said housing and disposed in spaced relation with

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- respect to said annular magnet provided at one end of the expanded portion of said rod;
- (i) a third annular magnet depending from the internal periphery of said rotatable tube;
- (j) a fourth annular magnet provided at the other end of the expanded portion of the rod, said fourth annular magnet being adjacent to said third annular magnet and disposed in spaced relation thereto;
- (k) said annular magnets provided at the ends of the expanded portion of the rod presenting repellent polarities to said annular magnets disposed in spaced relation therewith.

References Cited by the Examiner

UNITED STATES PATENTS

1,478,338	12/1923	Isom	309—9
2,054,055	9/1936	Klahn	308—9
2,436,939	3/1948	Schug.	
2,670,146	2/1954	Heizer.	
2,756,115	7/1956	Michel	308—9
2,877,066	3/1959	Baumeister.	
2,928,960	3/1960	Macks.	
3,104,917	9/1963	Schwartzwalder	308—9

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