ABSTRACT OF THE DISCLOSURE

A bobbin drive gear train for a textile roving frame including a bobbin spur gear and an intermeshing drive shaft spiral face gear wherein the spur gear has a plurality of bobbin-engaging projections which are formed integral with the gear to minimize the cost of manufacture thereof, and to provide increased bobbin stability resulting in improved package formation and less variation in the size of the roving being wound; and wherein the vertical length of the bobbin spur gear teeth initially extend a substantial distance above the spiral face gear teeth to insure proper intermesh of the gears during downward displacement of the spur gear caused by wear, thereby prolonging the effective life thereof.

This invention relates to an improved gear train for textile roving frames, and more particularly to a bobbin drive gear train providing improved bobbin package build, less variation in the roving being packaged, and longer operational life without replacement.

As is known, textile roving frames simultaneously treat a plurality of textile slivers to produce rovings of the required strength for spinning, which rovings are packaged on bobbins rotatably mounted on the roving frame.

The bobbins are supported for rotation on the upperstanding shafts of a row of bobbins and are driven by a horizontally-extending drive shaft connected to each bobbin by a gear train. Each gear train includes a relatively large gear, mounted on the bobbin drive shaft adjacent each bobbin, and a smaller intermeshing bobbin gear located on the roller shaft below the bobbin and rotatably supported by an enlarged shoulder of the bolster. The upper portion of the smaller bobbin gear has a radially-extending flange on which the base of the bobbin is seated, and conventionally a single key-like projection secured on the upper face of the flange engages a corresponding groove in the base of the bobbin to impart rotation thereto.

Since the cooperating bobbin and drive shaft gears rotate about perpendicular axes, it previously has been a common practice to employ bevel gears in the train; however, bevel gears have not proved completely satisfactory, due to the tendency of a bevelled bobbin gear to "ride-up" on its supporting bolster shaft during rotation by the drive shaft gear, causing undesired variations in the formation of the roving package and also increasing the variation, generally expressed as "C/V" or coefficient of variation, in the size of the roving being wound on the bobbin.

To overcome the problem of "ride-up," it has been a more recent practice to employ a gear train composed of a metal bobbin spur gear and a spiral face gear for the drive shaft gear. Due to the intermeshing relation of the gear teeth of the bobbin spur gear with the teeth of the offset spiral face gear on the downwardly-rotating side of the face gear, the spiral face gear exerts a downward force on the bobbin spur gear to prevent the undesired "ride-up" of the bobbin gear on the bolster shaft.

Although the intermeshing spur and spiral face gear arrangement eliminates "ride-up," the gear train still has not proved entirely satisfactory in operation because, up to now, it has been considered necessary to machine at least the upper and peripheral surfaces, and the teeth, of each bobbin gear as manufactured heretofore, with the result that the projection which transmits rotation to the bobbin had to be formed separately and attached to the bobbin-supporting flange by means of a thin or reduced, finger-like extension on its base which was inserted into a hole drilled through the flange and then engaged at the bottom of the hole to secure the projection to the flange. Fabricating and attaching said projection to the flange in this manner has been so expensive and time consuming that it has been economically impracticable to provide but a single key-like projection on each bobbin gear.

Also, due to the resultant minimal support of the projection by the flange, such projections have been deformed and/or broken quite easily in handling or by torsional forces exerted on the projection by the bobbin during rotation. Additionally, tests have shown that because the base of the bobbin was engaged by only the single projection, there has been a tendency for the bobbin to move irregularly or to wobble on the bobbin during rotation, resulting in non-uniform package formation and increased variation in the weight per unit length of the roving being wound on the bobbin.

It has also been necessary heretofore to provide a substantial gap between the flange of the conventional prior art bobbin spur gear and the adjacent ends of the teeth thereof to accommodate the tool employed in swaging the projection and the tool used for cutting the gear teeth. Thus, since the construction of a roving frame limits the overall length of the bobbin gear, the teeth of the bobbin gear have necessarily been relatively short.

The downward force applied to the bobbin gear during rotation greatly increases the wear on the shoulder of the bolster and/or the lower surface of the bobbin gear. Therefore, it can be appreciated that, as the gear moves downwardly on the bolster shaft due to wear, the limited vertical length of the spur gear teeth causes the teeth to disengage from the spiral face gear teeth after a relatively short period of operation of the gear train. The length of the spiral gear teeth cannot be appreciably increased, due to the inwardly converging relationship of adjacent teeth required to properly intermesh with the bobbin spur gear. Therefore, the effective life of the gear train is directly dependent upon the length of the spur gear teeth initially extending above the spiral face gear.

It is an object of the present invention to provide an improved gear train for driving the bobbins of a roving frame which overcomes, to a great extent, the problems of the prior art.

It is another object to provide an improved bobbin gear train which increases dimensional stability of a rotating bobbin driven thereby, and thus reduces irregular and undesired package formation and reduces the C/V of the roving in the package.

It is a further object to provide an improved bobbin gear train having longer operational life and requiring less frequent replacement of the bobbin gear of the train.

The objects of the present invention are accomplished by the provision, in a textile roving frame, of a bobbin drive gear train including a metal bobbin spur gear having gear teeth of increased length and extending a considerable distance above the intermeshing teeth of the spiral gear to provide extended engagement of the two gears during relative frictional wear between the bobbin gear and bolster, thereby extending the effective operational life of the gear train, and by further provision of a plurality of integrally-formed, bobbin-driving projections on the upper face of the bobbin support flange of the
gear to minimize wobbling of the bobbin and thereby improve stability of the bobbin during rotation.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds, when taken in connection with the accompanying drawings, in which

FIGURE 1 is a partial, vertical sectional view through a portion of one side of a roving frame and illustrating the driving means and gear train arrangement for rotating the bobbin and flyer elements of the frame. FIGURE 2 is a fragmentary, enlarged elevational view of a portion of the bobbin drive gear train seen in the right-hand central portion of FIGURE 1, showing in greater detail the metal bobbin gear and its intermeshing engagement with the drive shaft spiral face gear of the roving frame.

FIGURES 3a and 3b are fragmentary, vertical sectional views of the bobbin spur gear and spiral face gear taken generally along line 3—3 of FIGURE 2, showing the relative positions of the gear teeth before and after frictional wear of the bobbin gear and bolster; and FIGURE 4 is a plan view of the bobbin gear looking along line 4—4 in FIGURE 2.

Referring more specifically to the drawings, the gear train of the present invention is shown in combination with the drive means of a conventional roving or fly frame, and only those portions of the roving frame are shown in FIGURE 1 which are necessary to an understanding of the invention.

The roving frame includes a vertically-reciprocable bolster rail 10 and a lower, fixed spindle rail 11 which are attached to the main body of the frame in a conventional manner (not shown). A plurality of spindles are suitably spaced in staggered relation along opposite sides of bolster rail 10. Only two bolster 13, 14 are shown in FIGURE 1 and their description is intended to apply to the other bolsters of the roving frame.

Bolsters 13, 14 comprise respective generally horizontal portions 13a, 14a which extend outwardly from bolster rail 10 and have respective fixed, upwardly-extending tubular bolster shafts 13b, 14b thereon. The row of spindles on opposite sides of bolster rail 10 are served by respective horizontally-extending bobbin drive shafts 16, 17, each of which, as best shown by the right-hand bolster 14, is rotatably supported on an outwardly-extending journal arm 18 of the bolsters.

Loosely extending through the tubular bolster shafts are respective rotatable spindles 21, 22 having flyers 23, 24 mounted on their upper ends. The lower ends of the spindles are supported adjacent opposite sides of the spindle rail 11 and rotated by respective spindle drive shafts 25, 26 drivingly connected to the spindles by gear trains 27, 28.

Encircling a lower portion of each bolster shaft 13b, 14b, for rotation thereabout, is the improved bobbin spur gear 31. Only the bobbin gear associated with bolster 14 will be described in detail, although all the bobbin gears may be identical. As seen in FIGURES 1, 2 and 3a, the lowermost surface 31a of bobbin gear 31 rests upon an enlarged horizontally-extending shoulder 14c of bolster 14, and the bobbin gear is rotated by an intermeshing spiral face gear 32 fixed on bobbin drive shaft 17. The upper surface of bobbin gear 31 supports a bobbin 33 at a predetermined position relative to the flyer 24 to properly receive a roving strand therefrom during relative rotation of the bobbins and flyers. Bobbin 33 loosely encircles bolster shaft 14 and is rotated by projections on bobbin gear 31 which engage respective key slots in the base of the bobbin, as will be explained.

The intermeshing engagement of the bobbin spur gear 31 and the driving spiral gear 32 of the present invention is shown in detail in FIGURE 2. The spur gear 31 preferably is formed of iron, steel or other metal which is unitarily cast, as by compression molding or shell molding, and has a bobbin-supporting flange 41 which extends radially outwardly from the upper portion of the main body portion of the gear. Flange 41 has an upper face 42, adapted to engagingly support the base of a bobbin 33 and a plurality of gear teeth 43, adapted to engage corresponding radial key projections 43a (not shown) which is unitarily cast, as by compression molding or shell molding in the base 33a of the bobbin (see FIGURE 1) and serve to transmit rotation from the bobbin gear 31 to bobbin 33. Centrally disposed on the upper face of flange 41, and integral with the flange, is an upwardly-extending cylindrical sleeve 44 (FIGURES 2 and 4) which surrounds bolster shaft 14. The projections 43a are integrally joined along their base 43a and an upwardly-extending side 43b to the upper face 42 and to the upwardly-extending cylindrical sleeve 44 of flange 41, respectively.

By integrally forming the projections in this manner, the strength of the projections is greatly increased and deformation, bending or breaking of the projections during handling, doffing, donning, and/or during bobbin rotation is practically eliminated. Also, by providing a plurality of projections, the stability of the bobbin on the bobbin gear is greatly increased, resulting both in more uniform package formation and in less variation of the size of the roving. As seen in FIGURE 4, four projections are provided and are preferably spaced about sleeve 44 approximately 90 degrees apart.

Integrally formed about the main body portion of bobbin gear 31 and below flange 41 are the gear teeth 43. Since the key-like projections 43a are cast integral with flange 41 and sleeve 44, it is no longer necessary to provide a gap between the teeth 51 and the flange 44 to accommodate a swaging tool, as has been required heretofore in the manufacture of bobbin gears having separately formed key-like projections fastened thereto. Thus, as can be seen, the upper ends of the gear teeth 51 are integral with the lower face 45 of flange 41, and the overall length L of the teeth is such that they extend from the flange to a point closely adjacent the lowermost surface 31a of the bobbin gear.

It has been found that, by compression molding or shell molding the metal bobbin gear 31, the teeth 51 thereof may be of the desired configuration to mesh properly with the spiral gear teeth without the necessity of cutting the bobbin gear teeth, thus further reducing the cost of manufacture of the bobbin gear 31. The lowered cost of a gear 31 with a non-cutting meshing engagement results in a gear which is better for a gap between the flange 41 and the upper ends of the teeth 51, as has been required heretofore.

The teeth of the bobbin gear and spiral face gear intermesh at the portion or side of the spiral gear which moves downwardly during rotation (direction of rotation indicated by arrow R) so the bobbin gear is biased downwardly by the rotating spiral gear. Thus, when a bobbin gear 31 is operated for an extended time, the lowermost surface 31a of the bobbin gear and/or the upper surface of the bolster shoulder 14c engaged thereby become worn away so the bobbin gear gradu ally moves to a lower position relative to the adjacent spiral gear.

As can be seen in FIGURES 3a and 3b, which show the relative positions of the gear teeth of the spur and spiral face gears 31, 32 before and after frictional wear, respectively, the extended length of the bobbin spur gear teeth 51 provides continued and full intermeshing engagement of the teeth during extended wear and thus extends effective operation of the gear train. When the bobbin gear 41 is located initially on the bolster shaft 14b in full intermeshing engagement with the teeth of the spiral gear (FIGURE 3a), a full 30% or more of the total length of the teeth meshing in the area of intermesh of the teeth. This "reserve" length L' of the bobbin gear teeth also is equal to about 40% or more of the distance from the upper face 42 of flange 41 to the
upper edge of the intermeshing spiral face gear teeth. It has been found that this arrangement increases by more than 50% the reserve length of the teeth as compared to that heretofore available in the prior art machined bobbin gear teeth. It is this additional "reserve" tooth length which enables the gear train to be effectively operated for greater periods, and thereby extends the useful life of the gear train.

By the provisions of the present invention, the bobbin drive gear train of a roving frame can be more effectively stabilized to produce an improved wound roving package having roving thereon of uniformly high weight per unit length, and the effective life of the gear train during wear of the bolster and lowermost surface of the bobbin gear also is increased.

In the drawings and specification there has been set forth a preferred embodiment of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claims.

That which is claimed is:

1. In a roving frame including a row of bobbins, a substantially horizontally-extending bobbin drive shaft adjacent said bobbins and having a plurality of spiral face gears located thereon adjacent respective bobbins, each of said bobbins including an upright tubular bolster shaft adapted to receive and rotatably support thereon a corresponding tubular bobbin having a plurality of radially-extending grooves in its lower end, an enlarged horizontally-extending shoulder at the lower end of the bolster shaft, a driven upright spindle loosely extending through each respective bolster shaft for relative rotation with respect thereto, and a flyer on the upper end of each spindle for guiding a roving strand to a bobbin located on said bolster shaft; the combination therewith of gear means rotatably mounted on each of said bolster shafts and intermeshing with each of said spiral face gears for drivingly supporting a bobbin mounted on each bolster shaft in a more stabilized manner to obtain enhanced uniformity of the roving and a more uniformly wound roving package, said gear means including spur gear teeth extending a considerable distance above the teeth of the spiral face gear at their area of intermeshing during initial operational use of the gear means, whereby the length of the teeth of the gear means compensatively maintains full meshing relationship with said spiral gear as the gear means moves downwardly on the bolster shaft upon wear thereof and, whereby the useful life of the gear means is considerably increased.

2. A roving frame as defined in claim 1 wherein said gears means loosely surrounds each respective upright bolster shaft with the lowermost surface of said gear means resting upon and supported by the respective bolster shoulder, a radially-extending flange on the upper portion of each of said gear means and having an upper face thereon for supporting a respective bobbin, means on said upper face for engaging the base of a bobbin to impart rotation thereto, and the upper ends of said spur gear teeth being integral with and extending downwardly from said flange, and terminating closely adjacent said lowermost surface of said gear means.

3. A roving frame as defined in claim 2 wherein said means for engaging the base of a bobbin includes a plurality of key-like projections extending vertically upwardly from said upper face of said flange for engaging corresponding keyways in the lower surface of a bobbin to transmit rotation movement from said bobbin gear to a bobbin supported on the upper face of the flange.

4. A roving frame as defined in claim 3, wherein said gear means further includes a sleeve integral with and projecting upwardly from the central portion of the upper face of said flange and adapted for loosely receiving thereon the lower end of a bobbin, and wherein said plurality of key-like projections are integrally connected to and spaced about said sleeve and are also integrally connected to the upper face of said flange, thereby imparting greater strength to the projections for rotation of a bobbin placed on said gear means.

5. A roving frame as defined in claim 4 wherein said plurality of key-like projections includes four projections disposed substantially 90 degrees apart about the axis of said gear means.

6. A roving frame as defined in claim 1 wherein, during initial operational use of said gear means, the extent of said spur gear teeth above the teeth of the spiral face gear at their area of intermeshing is at least 30% of the total length of said spur gear teeth.

7. A roving frame as defined in claim 1 wherein said gear means includes a main body portion loosely surrounding each respective bolster shaft, a radially-extending flange on the upper portion of said main body portion and having a bobbin-supporting upper face; and wherein, during initial operational use of said gear means, the extent of said spur gear teeth above the teeth of the spiral face gear, at their area of intermeshing, is at least 30% of the distance between said bobbin-supporting upper face of said flange and said intermeshing teeth of said spiral face gear.

8. In a roving frame including a row of bobbins, a substantially horizontally-extending bobbing drive shaft adjacent said bobbins and having a plurality of spiral face gears located thereon adjacent respective bobbins, each of said bobbins including an upright tubular bolster shaft adapted to receive and rotatably support thereon a corresponding tubular bobbin having a plurality of radially-extending grooves in its lower end, an enlarged horizontally-extending shoulder at the lower end of the bolster shaft, a driven upright spindle loosely-extending through each respective bolster shaft for relative rotation with respect thereto, and a flyer on the upper end of each spindle for guiding a roving strand to a bobbin located on said bolster shaft; the combination therewith of a radially-extending flange on the upper portion of said main body portion and having an upper face thereon for supporting a respective bobbin, means on said upper face for engaging the base of a bobbin to impart rotation thereto, and the upper ends of said spur gear teeth being integral with and extending downwardly from said flange, and terminating closely adjacent said lowermost surface of said gear means.

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