Oct. 5, 1926. 1,601,911

F. S. GODFREY

TEXTILE MATERIAL GEAR AND BLANK AND METHOD OF MAKING THE SAME

Filed Sept. 22, 1924

Fig. 1.

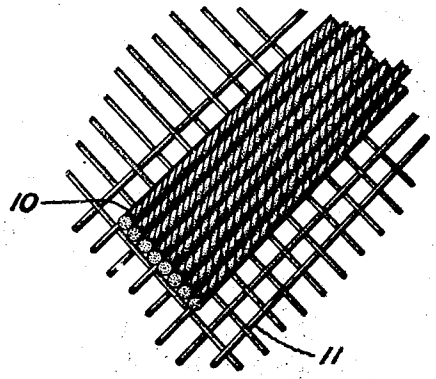


Fig. 2.

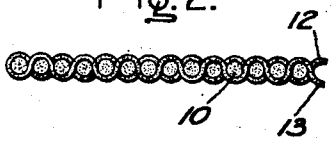


Fig. 3.

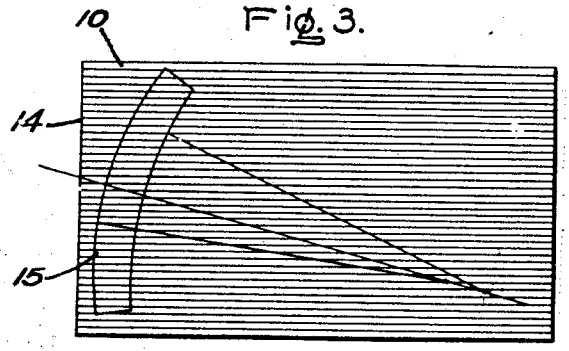


Fig. 4.

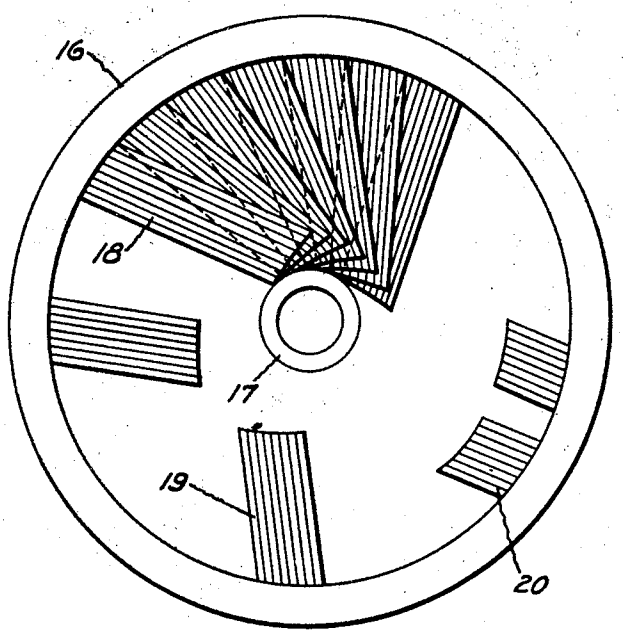


Fig. 5.



Fig. 6.

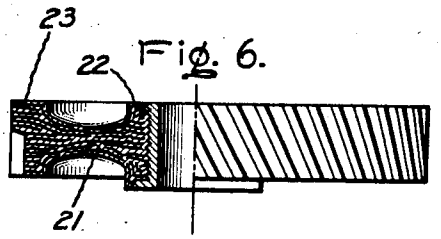
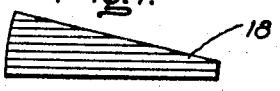


Fig. 7.



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UNITED STATES PATENT OFFICE.

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TEXTILE-MATERIAL GEAR AND BLANK AND METHOD OF MAKING THE SAME.

Application filed September 22, 1924. Serial No. 739,231.

The present invention relates to gears and blanks therefor which are made of spinnable textile fibers and a binder, the latter serving to hold the fibers in a highly compressed state.

It has been discovered that such gears and blanks when made of textile material cord as distinguished from elementary fibers of such material or of woven fabric possess substantial advantages among which may be mentioned increased strength, greater flexibility of teeth and web and decreased cost of material. On the other hand the problem of assembling such material in a mold or fixture on a production basis preparatory to the subsequent operations is one which presents many difficulties and requires much care. This is especially so of the short cords which are necessary to provide for the relatively thick rim and hub as distinguished from the relatively thin web. To attain the best results the cords should extend at an angle to diametrical planes as distinguished from being truly radial which further increases the difficulty of manufacture.

The objects of my invention are to improve the construction of gears made of spinnable textile fiber cords and a binder, and also to improve the method of making the same. For what I believe to be novel and my invention attention is directed to the accompanying specification and the claims appended thereto.

In the accompanying drawing which is illustrative of my invention, Fig. 1 is an enlarged perspective view of the cords employed and which are mounted on a carrier; Fig. 2 is a cross-section showing the cords and a modified form of carrier; Fig. 3 shows how segmental pieces may be formed for the rim; Fig. 4 is a plan view of a mold or fixture showing how the cords are assembled therein; Fig. 5 is a detail view showing how the segmental pieces are laid up for the rim portion; Fig. 6 is a sectional view of a gear, blank or roll, and Fig. 7 is a detail view showing another way of cutting the cords and their carrier.

In carrying out my invention, the cords 10 which form the web, rim and hub are made of textile material, such as cotton, and are preferable relatively hard and are coated with a binder which possesses the necessary characteristics. Among binders suitable for the purpose are those composed of phenolic condensation products. To attain the best results the cords should be only surface-coated so that the elementary fibers composing them will retain their natural elasticity. After the cords are suitably treated with a binder, they are mounted on a carrier 11 which is also made of spinnable textile fibers and ordinarily of the same kind of fibers which are used in the manufacture of the cord. The carrier can be made in a variety of ways and is preferably of material much lighter or thinner than the cords themselves. That shown in Fig. 1 comprises a very thin, coarse woven material such as cheese cloth or coarse mesh netting. In either case the threads are relatively fragile. The carrier will generally be treated with a limited amount of binder but this may be unnecessary if there is a sufficient amount of binder on the cord. After the cord and carrier have been properly treated and this may or may not include a drying operation, the cords are placed on top of the carrier, arranged side by side and preferably in contact with one another. They are then subjected to sufficient pressure to hold the cords in position on the carrier and also to sufficient heat to cause the binder to soften sufficiently to stick the cords on the carrier, after which the binder is permitted to harden sufficiently to permit of handling in subsequent operations. In the event that bakelite is the binder care should be exercised to see that it does not attain its final stage where it is hard and insoluble. In carrying out this part of the process I may make the material in the form of sheets or in the form of ribbons of more or less width.

In Fig. 2 is shown a modified form of carrier. 10 indicates the cords on an enlarged scale which are arranged side by side and 12 and 13 represent threads which are woven back and forth between the cords which threads are very much smaller in cross section than the cords and are relatively fragile. The spacing of these threads may be varied. In some cases they may be for example one-half inch apart, and in others a lesser spacing may be used. In general, it may be stated that I prefer to use the fewest number of threads which will permit of the material being freely

handled in subsequent operations. In some respects the arrangement of cords and carrier is quite similar to the cord material which is used in the manufacture of automobile cord tires. The carrier, however made, should be of such a character that the threads of which it is composed will break when subjected to substantial pressure in the molding or forming operation, thereby permitting the individual cords which are of various lengths in the mold to freely adjust themselves one to the other to the end that the density of the final product is substantially uniform. This form of carrier has the advantage over that previously described in the way of simplification and decreased cost because the sheets as received from the mill can be treated as such with the binder. Care should be exercised in the coating operation to use as little binder as possible for the strength of the gear or blank depends on the textile fibers and not on the binder. Bakelite is a satisfactory binder for this purpose.

In Fig. 3, 14 illustrates a sheet composed of cords 10 and a carrier of either of the forms illustrated. From this sheet and by means of suitable dinking dies, segments or elements 15 are cut in such manner that the short pieces of cord instead of being radial when assembled in the fixture or mold are located at angles to the radii. By preference this angle corresponds approximately to the angle of the side faces of the finished gear teeth. In order to economize stock the inner and outer edges of each segment are cut on the same radius of curvature so that there is no lost material between one segment and the next in the cutting operation. These segmental pieces as will be noted, have a somewhat less radial dimension at the ends than in the middle. The segmental pieces are then stacked one on top of the other as indicated in Fig. 5, the joints between adjacent segments in one layer being arranged to break joint with those in the adjacent layers. The thickness of each stack will depend upon its location with respect to the cords forming the web and the thickness of the rim or hub or both.

In Fig. 4, 16 indicates a fixture or mold of suitable shape and construction and which is designed to receive the cord. 17 indicates a metal hub which is commonly employed with gears of this character, although its use is not necessary in all cases.

In assembling the material in a fixture, it is necessary to use cords of varying lengths on account of the fact that the area increases rapidly from the center outwardly and on account of the fact that the density of the fibers should be as nearly uniform as possible, throughout the finished structure. In this figure, 18 indicates the long cords, 19 the intermediate cords and 20 the short cords. It is to be understood, however, that depending upon the shape and size of the finished blank a greater or lesser number of different lengths may be employed and I may use cords in one or more layers which differ in diameter from those in other layers.

Assuming that the finished blank is to have the general shape indicated in Fig. 6, i. e., a blank having a relatively thin web 21, a thick hub 22 and thick rim 23, a suitable number of cord segments or elements 15 are placed in the bottom of the fixture, the outer ends of the cords engaging the inner cylindrical wall thereof. On top of these cords is placed a suitable number of elements having long cords 18 and other elements having shorter cords 19. In order to tie the rim to the web it is preferable to intersperse the long, short and intermediate cords as fully as possible. This is conveniently done by interspersing the cords layer by layer, or by stacking a few layers of one kind and then a few of another.

To facilitate the assembly operation, I first cut the sheets of material comprising cords and their carrier into relatively narrow ribbons. These ribbons are then cut into smaller pieces, strips or elements of suitable shape and size which are placed in the fixture in such manner that at their outer ends the sides of one strip contact with those of adjacent ribbons, the inner ends overlapping. This is best shown in Fig. 4. These elements, instead of occupying truly radial positions are each slightly inclined to radial planes, the purpose of which is to have the cords which form the teeth of the finished gear occupying positions which correspond approximately to the side faces of the teeth. A satisfactory way to stack or assemble these cords is to lay one complete layer as shown in Fig. 4 and to lay the second layer on top of the first, but with the angle of inclination reversed. This means that the cords in the different layers whether they be long, intermediate or short, will cross in the teeth, which has the advantage of interlocking or anchoring the fibers of the cords, thereby increasing the tooth strength and increasing the flexibility.

Where the blank is to have a relatively thick hub additional short cords generally similar to the rim forming cords 20 may be assembled around the central portion. The number of these cords will vary depending upon the axial dimension of the hub and upon the degree of overlap at the inner ends of the long cords 18.

In Fig. 7 is shown a slightly different arrangement of the long cords 18 from that described in Fig. 4. In this figure the cords are arranged parallel to each other on the carrier as before but instead of being all of the same length are of different lengths. This results in the formation of segmental pieces

which are relatively narrow at the inner end and relatively wide at the outer end. In assembling these segments in the mold the same angular relation of the cords to each other is followed as in Fig. 4, i. e., the cords in one layer cross those in the adjacent layers at approximately 14½ degrees.

After the necessary number of cords or cord elements, short, intermediate and long, have been laid up in the mold to form the lower part of the rim and the web additional short cords in the form of segments 15 are inserted in the mold to form the upper part of the rim. In addition short cords for the hub are provided where necessary. It will be understood, of course, that the bottom wall and the top or removable wall of the fixture are properly shaped to give the desired shape to the two sides of the finished blank. After the cords are assembled the mold is closed, placed in a press and the material in the mold is subjected to heavy pressure to compress the fibers and to heat to cause the binder to soften and then to set and hold the fibers in compression. In this particular, I may and preferably do follow the standard practice in the manufacture of gears and blanks of this general character.

Owing to the fact that the carrier is made of the same material as the cord it is readily bonded into the finished product and on that account there is no danger of the blank splitting and especially in planes perpendicular to the axis. The fact that the carrier is relatively fragile as compared with the cord, means that the threads of which the carrier is composed will break to a greater or lesser extent when subject to pressure in the mold, thereby permitting the individual cords to freely adjust themselves one with respect to the other, so that the density of the finished product will be uniform.

No claim is made herein broadly to a gear or gear blank made of compressed textile material cord and a binder as it is the invention of another.

What I claim as new and desire to secure by Letters Patent of the United States is:—

1. The method of forming gear blanks from textile material cords which are arranged side by side, are united by a relatively fragile carrier and are coated with a binder which comprises cutting the material into relatively short strips with the cords extending lengthwise, assembling the strips by layers into an annular stack so that the cords in one layer cross those in adjacent layers at an acute angle, the cords extending outwardly from the axis, subjecting the stack to heat and pressure to compress the cords and cause the binder to harden and retain the cords in their compressed state.

2. The method of forming gear blanks from textile material cords which are arranged side by side, are united by a relatively fragile carrier and are coated with a binder which comprises cutting the material into relatively short, rectangular strips in which the cords extend lengthwise, assembling the strips into an annular stack in which cords in each strip extend at an angle to a plane radial to the axis of the stack, subjecting the stack to heat and pressure to compress the cords and cause the binder to harden and retain the cords in their compressed state.

3. The method of forming gear blanks from textile material cords which are arranged side by side, are united by a relatively fragile carrier and are coated with a binder which comprises cutting the material into rectangular strips of varying lengths in which the cords extend lengthwise, assembling the strips into a cylindrical stack with the longest strips extending outwardly from the central region to the periphery of the stack and the shorter strips from regions between the center and periphery to said periphery, the cords in said strips overlapping by layers with cords forming angles to planes radial to the axis of the stack, subjecting the stack to heat and pressure to compress the cords and cause the binder to harden and retain the cords in their compressed state.

4. The method of forming gear blanks from textile material cords which are arranged side by side, are united by a relatively fragile carrier and are coated with a binder which comprises cutting the material into relatively short strips of different lengths with the cords extending lengthwise, stacking the strips in layers to form an annular body with the longer strips forming the web and a part of the rim and the shorter strips cooperating with the longer strips to form the rim, the cords extending outwardly from the axis of the stack and crossing one another at angles to planes radial to said axis, subjecting the stack to heat and pressure to compress the cords and cause the binder to harden and retain the cords in their compressed state.

5. The method of forming gear blanks from binder-treated textile material cords which are united to form strips with the cords extending parallel which comprises assembling said strips layer by layer into an annular stack, said cords extending outwardly from the axis, the cords in one strip crossing those in adjacent layers at acute angles in the peripheral region, subjecting the stack to heat and pressure to compress the cords and cause the binder to harden and retain the cords in their compressed state.

6. The method of forming gear blanks from binder-treated textile material cords which are united by a fragile carrier to form relatively narrow ribbons in which the cords extend parallel which comprises cutting the ribbon into relatively long and short strips, assembling the strips layer by layer into an

annular stack, with the shorter cords located in the region of the periphery, said cords in one layer crossing those in adjacent layers at acute angles, subjecting the stack to heat and pressure to compress the cords and cause the binder to harden and retain the cords in their compressed state.

7. A blank for gears comprising strips of varying lengths made of textile material cord in which the cords in each strip are bound together and extend parallel to each other, said strips being arranged in layers with the cords in each strip extending outwardly from the axis, the shorter cords being in the region of the rim, the cords in adjacent layers crossing each other at acute angles, and a binder which holds the cords in a compressed state.

8. A blank for gears comprising strips of textile material arranged in layers, each strip comprising a plurality of cords which are bound together and arranged side by side, certain of said strips being longer than the others and forming the web and a part of the rim, the shorter strips forming the remainder of the rim, the strips being so arranged that the cords in one layer cross the cords in the adjacent layers at acute angles both in the web and rim, and means which hold the cords in a compressed state.

9. A blank for gears comprising relatively narrow strips of textile material arranged in layers, each strip comprising a plurality of relatively large-diameter cords arranged in parallel and a carrier for uniting them, the cords in said strips having a radial trend, those in one layer crossing those in adjacent layers at acute angles in the peripheral region, and a binder which holds the cords in a compressed state.

In witness whereof, I have hereunto set my hand, this 13th day of September, 1924.

FREDRIC S. GODFREY.