

Aug. 9, 1927.

1,638,012

A. C. HOOF

BLANK FOR GEARS AND METHOD OF MAKING THE SAME

Filed April 11, 1924

2 Sheets-Sheet 1

Fig. 1.

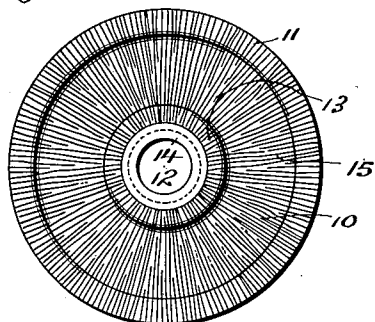


Fig. 2.

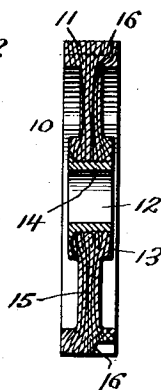


Fig. 3.

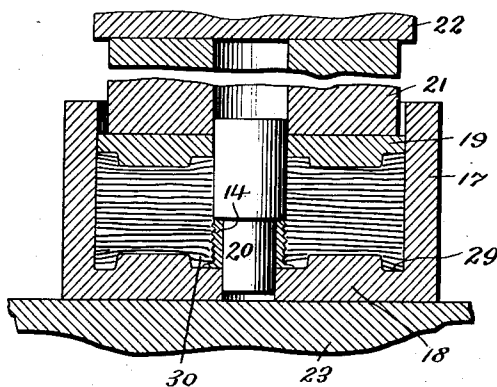


Fig. 8.

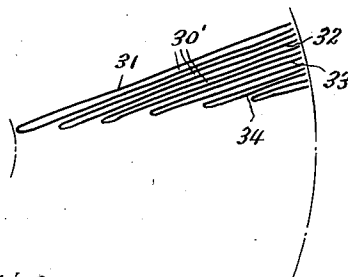


Fig. 4.

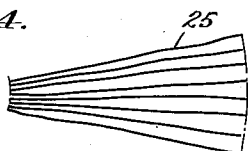


Fig. 5.

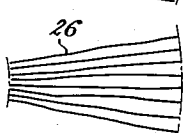


Fig. 6.

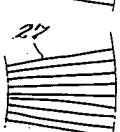


Fig. 7.



Fig. 9.

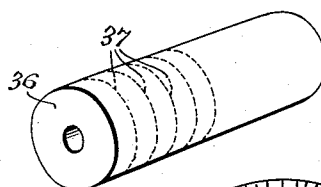
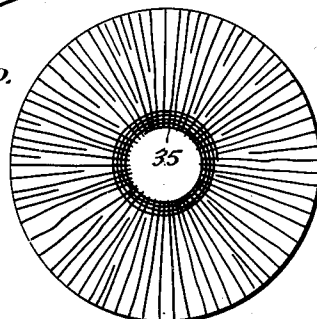


Fig. 10.



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2 Sheets-Sheet 2

Fig. 11.

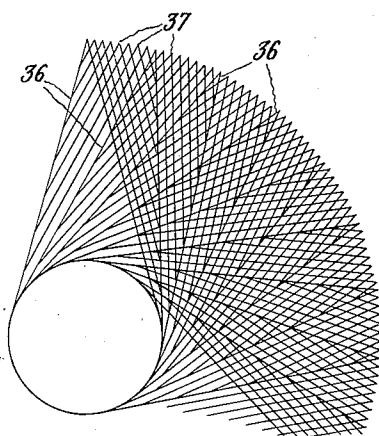


Fig. 12.

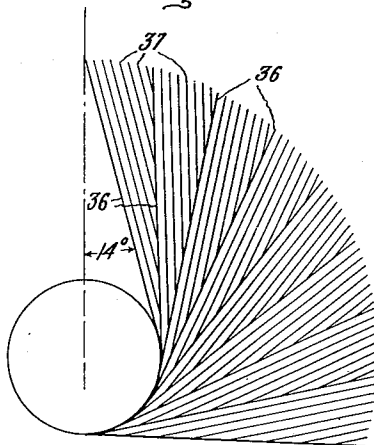


Fig. 13.

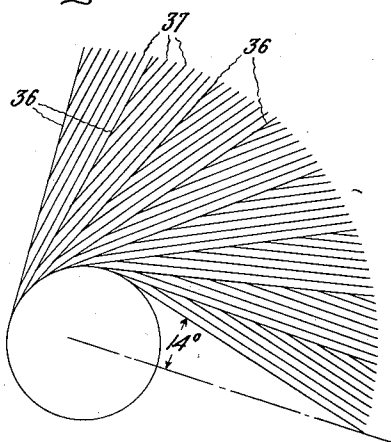
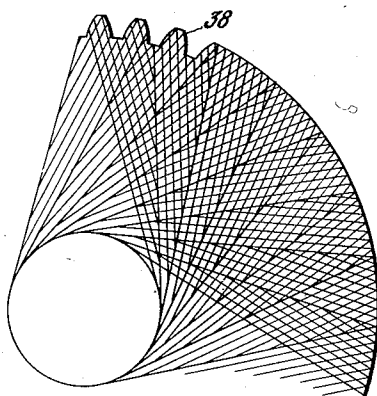


Fig. 14.



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UNITED STATES PATENT OFFICE.

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BLANK FOR GEARS AND METHOD OF MAKING THE SAME.

Application filed April 11, 1924. Serial No. 705,742.

The present invention relates to gears of the type composed of spinnable textile material and a binder, the latter serving to hold the fibers of the material in compression.

5 Heretofore in the manufacture of these gears the textile material employed has been in the form of sheets of woven cloth or fabric of square or rectangular shape, from which were cut disks, rings or segmental pieces. 10 Under such conditions there is bound to be a substantial wastage of expensive material.

I have invented or discovered a way of making gears of the above specified type out of binder-treated cord by which I not only 15 eliminate the trimmings but also one complete operation heretofore used in the process of converting textile fibers into gear blanks, i. e., the weaving operation. By my invention I am able to improve the product 20 by making it stronger and at the same time appreciably decreasing the cost thereof; also, to avoid certain of the difficulties now found in the manufacture of blanks from woven material. I am also able, due to the use of 25 cord, to construct a blank of any desired shape and size, or thickness of rim or web or hub.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto. 30

In the accompanying drawings, which are illustrative of my invention, Fig. 1 is a side view of a gear blank; Fig. 2 is a cross section of the same; Fig. 3 is a vertical section of a fixture or mold used in making gear blanks; Figs. 4 to 7 are diagrams indicating the general arrangement of the cords used in making blanks; Fig. 8 shows a slightly modified way of distributing the cords; Fig. 9 is a perspective view of a roll made in accordance with my invention from which gear blanks may be sawed; Fig. 10 shows a means for varying the thickness of the blank in the region of the hub, and Figs. 11, 12, 13 and 14 are diagrams illustrating the crossing of the individual cords whereby additional strength of the blank and teeth is obtained. 45

50 In carrying out my invention I utilize cord made of spinnable textile fibers such as cotton, for example, which may be treated with bakelite or other suitable binder, according

to well known methods, and afterwards cut into short lengths, assembled in a fixture and subjected to heat and pressure to consolidate the material and cause the binder to harden and hold the material in compression. The size and kind of cord employed may be widely varied and, for that reason, I do not limit myself in this particular. In general, it may be stated that the cord should not be so small in cross section as to interfere with the proper treatment with the binder or the subsequent handling thereof, nor be so large as to require an undue amount of binder to fill the intervening spaces between cords in the finished blank, it being remembered that in a gear of this kind it is the textile fibers and not the binder which impart the strength thereto and also the quiet running properties. Hard twisted cord of the character used in the manufacture of cord tires for automobiles may be used for this purpose. 55

10 indicates a gear blank having a thickened rim 11 and a central shaft opening 12. The blank may have a thickened hub as indicated at 13 or it may be omitted. Where such a hub is provided it will usually have a metal sleeve or bushing 14. From Fig. 2 it will be observed that the web 15 is relatively thin, the purpose of which is to permit the rim to yield slightly in an axial direction, when the teeth 16 which are spirally cut are subjected to undue pressure. Since the amount of cord required in a blank progressively increases from the hub to the rim, due to the difference of diameter, and since the arrangement of the cord in the gear teeth is important, special distribution thereof is necessary. The cord is first cut into pieces of long, short and intermediate lengths and these are then so stacked that as the distance from the axis increases, so do the number of pieces. I have used the terms long, short and intermediate lengths for convenience of description but it is to be understood that a different number of lengths may be employed. To provide for the thickened hub and rim additional short pieces of cord are provided and located in these regions. To attain the best results, the cords long, short and of intermediate lengths should be so evenly and uniformly spread or distributed, taking into account the contour of the blank, that the density per unit area is approxi- 60 65 70 75 80 85 90 95 100 105

mately the same at every point. One thing in particular I desire to point out is that the general trend of all of the cords, especially those in the rim where the teeth are to be cut, is radial, with the result of obtaining stronger teeth and better tooth action.

In Fig. 3, 17 indicates the cylindrical vertical wall of a fixture or mold and 18 the bottom thereof, the upper surface of which is shaped to conform to one of the sides of the gear blank. The top member 19 is vertically movable and its under surface is shaped to conform to the other side of the gear blank. Rising from the bottom of the fixture is a stud 20 over which is fitted the metallic hub or sleeve of the blank. 21 indicates a follower which rests on the upper side of the top member 19. Above the follower is the upper platen 22 of a hydraulic press and the fixture as a whole is seated on the lower platen 23 of the press. The parts are so arranged as to prevent relative rocking movement one on the other to the end that the finished blank will have the proper thickness at every point and the side faces of the rim will be exactly parallel to each other. By making the side faces parallel and the proper distance apart machine work thereon is avoided and the advantage of the glasslike surface due to the binder is retained.

Owing to the multiplicity of cords used in the construction of a blank, it is difficult to illustrate the exact arrangement in any one figure. In Fig. 4 is shown diagrammatically a group of radially-extending cords 25 which have been previously treated with bakelite or other binder. They should be spaced as nearly uniform as is feasible in the fixture and extend from the inner surface of the fixture to the outer surface of the hub sleeve. In the outwardly diverging spaces between these cords are groups of similar but shorter cords as indicated at 26 in Fig. 5. In the diverging spaces between cords 26 are similar but shorter groups of cords 27 and inserted between the cords 27 are other cords 28 of Fig. 7. Short cords may also be employed to increase the size of the blank in the hub region. The treatment of the cord with binder has the effect of stiffening it to a certain extent, and while the pieces are by no means rigid they are sufficiently straight and stiff so that they may be freely handled and distributed at will.

In stacking the cords in the fixture if the sides of the blank are to have insets as shown, I first distribute several layers of the shortest cords 28 at the bottom thereof as indicated at 29 in Fig. 3, and also a number of short cords at 30 if the blank is to have a thickened hub as well as rim. The next thing is to build up the remainder of the body which is done by stacking successive layers or groups of cords corresponding

to 25, 26 and 27 and 28 until the desired number have been stacked, after which are added additional short cords such as 28 to form the other side of the rim and of the thickened hub.

After the stack is assembled and the fixture closed, it and its contents are first subjected to heat to soften the binder and then to a moderate pressure and later to a higher and final pressure which for a blank six and a quarter inches in diameter may be of the order of 2000 lbs. per square inch of face and also to a sufficiently high temperature to cure the binder or cause it to set or harden and hold the cord in compression. While the pressure is being applied the cords being unwoven are free to move or flow within the fixture from one position to another. In other words, if there is too great a number of cords at one spot or region and too few at another, there will be a gradual movement of the cords from the region of the high pressure to that of the low. As a result, the unit density of the product will be uniform and the rim the same width at all points, thereby avoiding the necessity of dressing the sides of the rim before cutting the teeth. Due to the shifting of the cords when subjected to pressure, the layers as such are not distinctly noticeable in the finished blank when viewed edgewise.

In Fig. 8 is illustrated a modified way of assembling the cord. In this case, the cord is cut and formed into hairpin loops 30' of varying lengths. With this arrangement, the same general plan of assembly is followed as with the construction previously described. 31 indicates a loop the length of which is equal to the distance between the metal hub or the bore of the blank if it has no such hub and the inner wall of the fixture. The loop 32 is of similar construction but is somewhat shorter because it occupies a position in the blank nearer to its periphery. 33 and 34 indicate loops which are still shorter and are arranged to fill in the diverging spaces between other loops.

In the event of its being necessary or desirable to increase the thickness of the web from that illustrated to make it less flexible or for any other reason, or to thicken the hub or both, it may be done in a very simple manner. As illustrated in Fig. 10, a binder treated cord is spirally wound to form a flat coil 35. The coil may be made in one or several layers depending upon the additional thickness required in the hub or in the web. It will generally be desirable to make these coils flat and of lesser diameter than the rim but they may be of other shapes depending upon where they are to be employed. When used to enlarge the hub region around the metal sleeve they may be thickest at the center and taper from one or both sides to or toward their periphery. The

coils may be located on one or both sides of the web of the blank or it or they may be located at some intermediate point in the web between the sides thereof. In other words, one or more coils may be interspersed with the radially extending cords.

In order that gear cutters may be in a position to quickly supply gears without maintaining a large stock of blanks on hand, I may make my improved product in the form of relatively long cylindrical bodies such as is shown in Fig. 9. These bodies may be sawed as indicated by the dotted lines 37 to form disks from which gears may be cut. Such disks will not have the thin webs unless additional machine work is done thereon but for many purposes gears with thin webs are not required. By keeping on hand a few cylindrical bodies of various diameters, a gear cutter will be able to supply gears suitable for a great variety of purposes on short order.

In Figs. 11 to 14 I have illustrated diagrammatically the best embodiment of my invention as regards the distribution of the various cords. In these figures as in the others, the trend or general arrangement of the cords is radial but instead of being truly radial in position the longest cords 36 form an angle of approximately 14° to a radial plane and the shorter cords 37 of each group extend substantially parallel to each other and to the longest cord. As will be seen, the cords 37 get shorter and shorter toward the rim. In assembling, a layer of cords such as shown in Fig. 12 is placed in the fixture and this is followed by a layer of cords such as is shown in Fig. 13 with the result that the cords cross one another at acute angles. By following this procedure layer by layer the cords of one layer will cross those of adjacent layers both above and below as indicated in Fig. 11 and each cord will be bonded to other cords and be securely anchored thereby.

Reference has been made to the 14° relation of the cords. This is due to the fact that side faces of the teeth 38 have substantially this angle. If the angle of the teeth is changed the relation of the cords can profitably be changed to conform. The radial trend of the cords in the teeth, the crossings therein and their anchorage in the rim and web substantially add to the strength of the gear teeth and at the same time permit of a slightly greater degree of flexibility under shock which is highly desirable. The crossing of the cords also strengthens the hub region to the end that the blank may be given a forced fit on its shaft.

By treating the cord with a binder before attempting to assemble or stack the same into a fixture to form a blank the substantial advantage is obtained that the minimum amount of expensive binder is required, an

amount which is less for a blank of given size than where woven material is used. I attribute this to the fact that there are no small pockets or interstices as in woven material where the threads cross which collect and retain the binder. Also to the fact that there is a better distribution of the fibers where independent cords are arranged side by side than where one half of the fibers extend in one direction and the remainder at right angles thereto and are tightly interlocked as in woven fabric.

By using individual cords as distinguished from a woven fabric and arranging them in the manner disclosed I am able to use higher pressure than has heretofore been considered suitable with the result that the product is more dense, which contributes to longer life.

It is evident that the distribution of the short pieces of binder treated cord may be considerably varied from that shown and still be within the scope of my invention. Care should be exercised, however, to arrange the pieces of cord in planes perpendicular to the shaft so as to obtain the necessary strength.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with a particular method and apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that this particular method and apparatus disclosed are only illustrative and that the invention may be carried out with such modifications as come within the scope of the appended claims.

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

1. As an article of manufacture, a blank for gears comprising relatively short pieces of cord made of textile material which are arranged in layers perpendicular to the axis of the blank, and non-flexible means for holding the cord in a highly compressed state to form a rigid structure.

2. As an article of manufacture, a blank for gears comprising textile material cord, said cord being so distributed as to have a radial trend from the axis of the blank outwardly, and non-flexible means for holding the cords in a highly compressed state to form a rigid structure.

3. As an article of manufacture, a blank for gears comprising textile material cord arranged in layers which are perpendicular to the axis of the blank, the cord in each layer being so distributed as to have a radial trend from the axis of the blank outwardly and non-flexible means for holding the cord in a highly compressed state to form a rigid structure.

4. As an article of manufacture, a blank for gears comprising compressed cord made of textile material, said cord being so dis-

tributed layer by layer as to have a radial trend, certain portions of the cord having a greater length than the others, and a non-flexible means for holding the cord in its compressed state to form a rigid structure.

5. As an article of manufacture, a blank for gears comprising a web of compressed cords made of textile material, said cords being so distributed as to have a radial trend, a rim therefor made of compressed textile material, and means for retaining the material in its compressed state.

6. As an article of manufacture, a blank for gears having a web of compressed textile material, a rim therefor comprising radially disposed compressed cord made of textile material, and means for retaining the material in its compressed state.

7. As an article of manufacture, a blank for gears comprising groups of highly compressed cords made of textile material, which have a radial trend, the cords in said groups varying in length, the cords in the shorter groups being situated in the spaces between those of the longer groups, and non-flexible means for holding the cords in their compressed state to form a rigid structure.

8. As an article of manufacture, a blank for gears comprising a group of radially disposed highly compressed cords, other groups of similar but shorter cords arranged to partly fill the spaces between the cords of the first group, another group of similar but still shorter cords arranged to partly fill the spaces between the other groups, and a non-flexible means for holding the cords in their compressed state to form a rigid structure.

9. As an article of manufacture, a blank for gears comprising layers of textile material cord, the members of each layer having a radial trend, the members in one layer crossing those in an adjacent layer, and means for holding the cord in a compressed state.

10. As an article of manufacture, a gear blank comprising layers of textile material cord, the members of each layer having radial trend, the members in one layer crossing those in adjacent layers both in the rim of the blank as well as in the body, and means for holding the cord in a compressed state.

11. As an article of manufacture, a gear blank comprising relatively short individual pieces of textile material cord, arranged in layers, said pieces being so disposed about the axis of the blank as to have a radial trend, the pieces in one layer crossing those in an adjacent layer, and means for holding the cords under compression.

12. As an article of manufacture, a blank for gears comprising cords of various lengths made of textile material and arranged in a stack and having a radial trend, the shorter members being located in the

diverging spaces between the longer member, and non-flexible means for holding the cord in a highly compressed state to form a rigid structure.

13. As an article of manufacture, a blank for gears comprising spinnable textile fibers which form the web and rim, a spirally wound coil for thickening a portion of the web which is concentric with the axis of the blank and is also made of spinnable textile fibers, and binder for retaining said fibers in a compressed state.

14. As an article of manufacture, a blank for gears comprising radially disposed textile material cord, compressed textile material cord which is wound to form a coil and is concentric with the axis of the blank, and means for holding the cords under compression.

15. As an article of manufacture, a blank for gears comprising radially extending cords of different lengths, the cords of shorter lengths being situated in the diverging spaces between those of greater length, a coil made of compressed cord which is concentric with the axis of the blank, and means for holding the cords under compression.

16. As an article of manufacture, a blank for gears comprising a web and rim made of textile fibers, a coil made of spirally wound cord also made of textile material and forming a part of the blank and located between the axis thereof and the rim, and means for retaining said fibers in a compressed state.

17. As an article of manufacture, a blank for gears having a web portion comprising spinnable textile material, a rim portion comprising radially disposed textile material cords supported by the web portion, and means for retaining said materials in a compressed state.

18. A gear blank comprising a multiplicity of individual textile material cords of varying lengths which are so assembled that the density per unit area throughout the blank is substantially uniform, and non-flexible means for holding the cords in a highly compressed state to form a rigid structure.

19. A gear blank comprising a multiplicity of individual textile material cords some of which extend from the hub to and form a part of the web and rim, other and shorter cords of which form a part of the rim and are anchored at their inner ends in and form a part of the web, said cords having a radial trend and so assembled that the density per unit area throughout the blank is substantially uniform, and means for holding the cord in a compressed state.

20. As an article of manufacture, a circular blank comprising a web of spinnable textile fibers, a rim which includes cords made of spinnable textile fibers, said cords extending outwardly and being supported by

one another and by the fibers of the web, and a binder for holding the fibers of the web and rim in a compressed state.

21. As an article of manufacture, a circular blank comprising elements made of spinnable textile fibers which form the web, a rim which includes cords made of spinnable textile fibers, said cords having a radial trend and crossing one another in the peripheral region of the blank to add strength thereto, the cords being supported by one another and by the web elements, and means for holding the fibers of the web and rim in a highly compressed state.

22. As an article of manufacture, a circular blank comprising elements made of spinnable textile fibers which form the web, a rim comprising cords which are also made of spinnable textile fibers, said cords having a radial trend and crossing one another in the peripheral region of the blank to add strength thereto, the cords being supported by one another and by the web elements, and a binder with which the fibers of the elements and the cords are coated and which unites the same one to the other and holds the fibers in a highly compressed state.

23. As an article of manufacture, a circular blank comprising elements made of spinnable textile fibers which form the web and extend into the rim to form a part thereof, cords of spinnable textile fibers which have a radial trend, mutually support each other and in turn are supported by the web

elements, and a binder which unites the elements and cords and holds the fibers thereof in a compressed state.

24. As an article of manufacture, a circular blank having a relatively thin web and relatively thick rim and hub comprising elements made of spinnable textile fibers which extend outwardly from the hub region toward the periphery to form the web and also a part of the rim, cords made of spinnable textile fibers which cooperate with the web elements to form the rim, said cords having a radial trend and crossing one another at an acute angle in the peripheral region of the blank, and mutually supporting each other, spinnable textile fibers cooperating with the web to form the hub, and a binder which unites the web elements, cords and hub fibers and holds them in a highly compressed state.

25. As an article of manufacture, a circular blank having web and rim portions, said portions comprising textile fiber cords of varying lengths which have a radial trend, cross one another and are coated with binding material, which latter holds the fibers in a compressed state, the cords of varying length being so arranged that the density of the fibers per unit area is approximately the same at every point.

In witness whereof, I have hereunto set my hand this seventh day of April, 1924.

ADDISON C. HOOF.