March 21, 1939. I. J. NOVAK 2,150,937

CLUTCH FACING

Filed Feb. 24, 1936

Fig. 1.

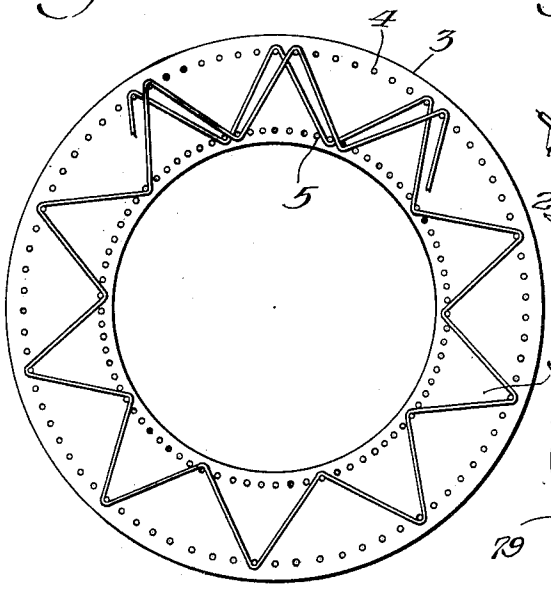


Fig. 2.

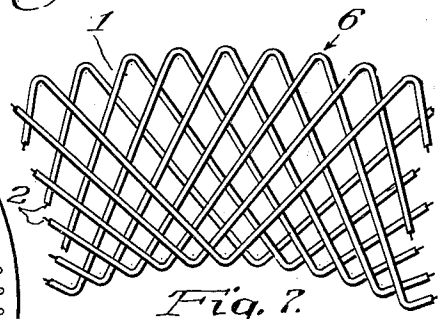


Fig. 7.

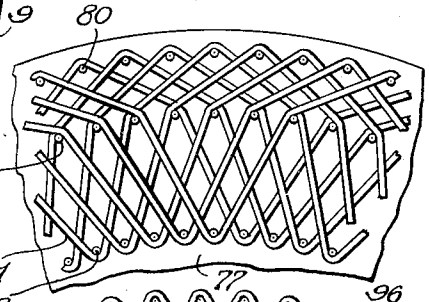
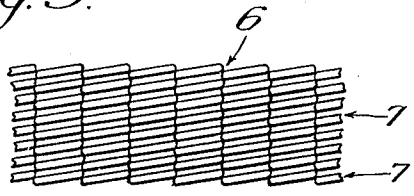


Fig. 3.



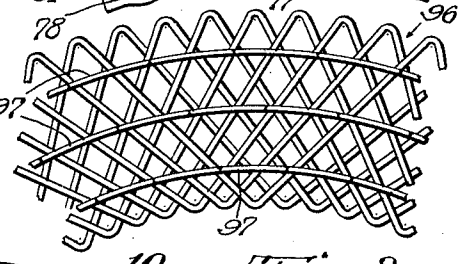


Fig. 8.

Fig. 5.

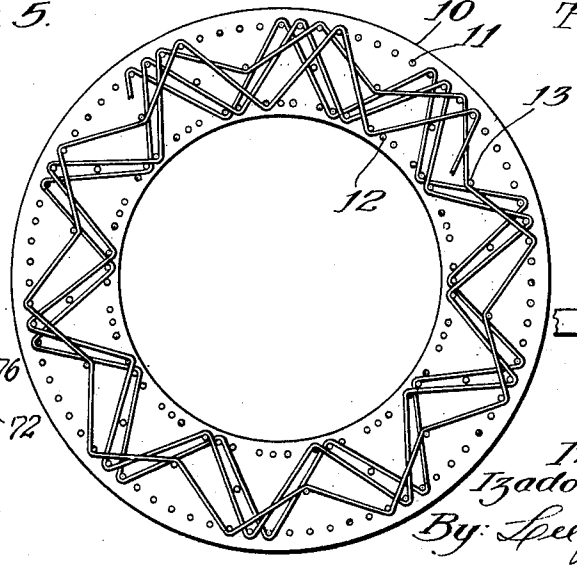


Fig. 6.

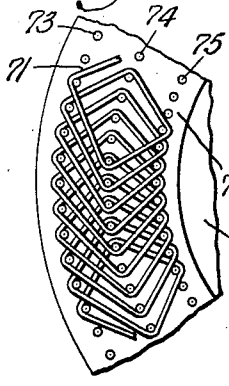
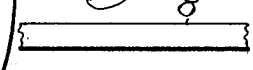


Fig. 4



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CLUTCH FACING

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Application February 24, 1936, Serial No. 65,363

3 Claims. (Cl. 192—107)

This invention relates to improvements in annular friction facings of the endless type and a method of manufacturing the same, and refers specifically to a friction facing which is possessed of extremely high strength and resistance to centrifugal forces which tend to cause bursting, and a relatively simple and economical method of making such facings.

The utility, objects and advantages of my invention will be apparent from the accompanying drawing and following detailed description.

In the drawing, Fig. 1 is a face view of a winding form suitable for carrying out my invention, a constituent layer of a friction facing being wound thereon.

Fig. 2 is a fragmentary face view of a completely wound facing before the same is compressed.

Fig. 3 is a fragmentary edge view of the facing shown in Fig. 2.

Fig. 4 is a fragmentary edge view of a finished facing after compression and cure.

Fig. 5 is a view similar to Fig. 1 illustrating a slightly modified method of winding the facing.

Fig. 6 is a fragmentary top plan view of a partially completed modified form of facing.

Fig. 7 is a fragmentary top plan view of a partially completed modified form of facing.

Fig. 8 is a fragmentary top plan view of a facing which has been stitched.

The product of my invention comprises an annular friction facing, particularly adaptable for use as an automobile clutch facing, which is composed essentially of asbestos yarn 1, with or without a metal wire core 2, wound in the form of continuous superimposed waves of predetermined amplitude and wave length.

To describe the method of winding said facing, reference will now be made to Fig. 1 of the drawing wherein the reference numeral 3 indicates a flat annular ring or disc which constitutes the form upon which the friction facing is wound. The ring 3 carries a plurality of pins or pegs arranged in two concentric circles, pins 4 comprising the pins of the outer circle and pins 5 comprising the pins of the inner circle. The number of pins 4 is equal to the number of pins 5, the pins 4 and 5 being individually in radial alignment.

In winding the facing, the yarn 1 is alternately looped around pins 4 and pins 5 in the form of a wave which repeats itself around the circumference of the form, the pins 4 comprising the nodes of the waves and the pins 5 comprising the anti-nodes. This travel of the wave around the circumference of the form will hereinafter be referred to as a cycle, and in order that succeeding cycles are not in phase, the wave length, measured in terms of pins on either arc, is selected with respect to the total number of pins 4 or 5, so that the waves of the succeeding cycle will either lead or lag the waves of the preceding cycle, preferably by the spacing of one pin from the next adjacent pin upon the same circle. In this manner a progressive or retrogressive wave winding will be obtained which falls into phase after a number of cycles equal to the number of pins constituting a wave length, assuming a progression or retrogression of one pin per cycle.

It can readily be seen that in this manner an endless annular body 6 may be built up comprising relatively loosely meshed asbestos yarn. The thickness of the body will depend upon the number of cycles wound and the number of times the waves are brought into phase, each repetition of bringing the waves in phase, in the case of one pin progression or retrogression, adds a layer 7 to the body 6.

The asbestos yarn 1 is treated, prior to winding, with a conventional binder for friction facings including phenol resins, drying oils, asphalt, rubber and in general any of the well known oxidizable oils or hardenable saturants or combinations thereof used in friction facings. After the body 6 is formed it may be pressed in a hot mold to set the binder, cured and sanded to desired thickness as indicated by the finished facing shown at 8 in Fig. 4. It is desirable that the binder be of such a nature that when the body 6 is compressed in a mold the whole mass will cohere and be capable of easy removal and handling for further hardening of the binder if necessary.

The waves must be so laid upon the form that the body 6 will be sufficiently dense to form after compression a relatively dense body of desired strength. The density of the body 6, in turn, can be controlled by selecting the proper number of pins 4 and 5 upon which the yarn is wound and also by properly relating the wave length, in terms of pins, to the total number of pins on each of the circles.

The radial and circumferential or circular strength of the finished facing may be controlled by varying the included angle 9 of the waves, which angle may vary from 30° to 150°. It can readily be seen that by decreasing the included angle 9 or decreasing the wave length with respect to the mean diameter of the facing, the radial strength of the resulting facing will be increased and by increasing the angle 9 the cir-

cumferential or circular strength will be increased, inasmuch as the yarn in the first case is laid lengthwise more closely adjacent the radius and, in the latter case, is laid more closely adjacent the circumference of the facing. It can also be seen that the outer and inner edges of the body 6 comprise the nodes and anti-nodes of the wave winding and, hence, loose ends will not protrude from either edge of the body 6 or finished facing 8.

It is to be understood that other manners of winding the yarn may be suggested herein to those skilled in the art and, hence, I do not wish to be limited to the precise embodiment chosen for the illustration of my invention. My invention broadly contemplates the winding of asbestos yarn in wave form in a more or less continuous manner upon an annular form, the waves being so spaced that when the mass of laid yarn is compressed the result is a relatively dense, filled-in structure.

Referring particularly to Fig. 5, a slightly modified manner of carrying out my invention is illustrated, in which 10 is an annular ring or disc which carries upon its face a plurality of pins 11, 12 and 13 arranged in three concentric circles, being the pins of respectively the outer, inner and intermediate circles. In this case the number of pins 11 is equal to the sum of the pins 12 and 13, the arrangement being such that a predetermined number of uniformly spaced pins are removed from the inner circle and that a like number comprise the intermediate circle and are uniformly spaced from each other. In the embodiment illustrated in Fig. 5, every fourth pin 12 is removed from the inner circle and appears as a pin 13 in the intermediate circle.

In winding the yarn upon the form 10 the same procedure is followed as described in conjunction with form 3. However, when the cycle arrives wherein the yarn is to be looped over the removed pins 12, said yarn is instead looped around the corresponding pin 13. In this manner a cycle of waves of amplitude less than full width are formed.

Of course, the arrangement can be such that only one or more waves of diminished amplitude will appear in an otherwise complete cycle of full amplitude waves or as illustrated, the full amplitude waves and the diminished amplitude waves may each have cycles of their own. Similar to the procedure followed with regard to the fabricating of the body 6, the waves in this case may be repeated so that they go into and out of phase a number of times to build up a desired body thickness.

It will be observed that when all of the waves comprising the facing body have an amplitude equal to the radial width of the body, the density of the facing, that is, the amount of yarn adjacent the inner edge of the ring is greater than that adjacent the outer edge thereof. In other words, a facing body having a progressively decreasing density from inner to outer edge is constructed. In some instances such construction is unsuitable for predetermined uses which demand that the area of maximum density be located at a different position or that the density be uniform throughout the entire radial width of the facing. In the latter case the mode of procedure followed in the description of Fig. 5 may be utilized wherein all of the nodes appear at the outer edge of the facing but only a predetermined percentage of anti-nodes appear at the inner edge, the remaining anti-nodes appearing outside the mean diameter of the facing or outside the circle of mean density. Of course, by suitably positioning the pins and suitably proportioning their number in various positions, substantially any local density may be obtained.

It is to be understood that the yarn may be impregnated with substantially any conventional type binder and, if desired, fillers may be incorporated. Moreover, yarns impregnated with the same or different binders may be used to impart, for instance, the same or different frictional characteristics to opposite faces, or the yarns comprising the outer layers may be impregnated with binders which increase the coefficient of friction and the yarn comprising the center layers may be impregnated with binders which, although imparting indifferent frictional characteristics are characterized by imparting great strength to the structure.

Referring particularly to Fig. 6, another modification is illustrated of a facing body of substantially wave form. By "wave" as used in this connection is meant the delineation or definition of a figure which is periodically repeated.

The form 72 is provided with a series of pins 73, 74 and 75 which are disposed in circular arrangement, the pins 73 comprising the outermost circle, the pins 74 comprising the intermediate circle, and the pins 75 comprising the innermost circle. An annular plate 76 provided with a series of apertures corresponding in number and position to the pins 73, 74 and 75, is adapted to be positioned upon the form 72, said pins passing through the apertures.

The asbestos yarn 71 may be looped successively around a pin 73, a pin 74, a pin 75, another pin 74, and the next adjacent pin 73 so as to form a progressively advancing diamond-shaped figure as clearly shown in Fig. 6. One layer of the facing body may be constructed upon the completion of one revolution of the form 72 and said operation may be repeated whereby additional layers may be added until the facing body is built up to the required thickness. When the desired thickness has been built up the facing body comprising a series of helical layers of progressively advancing diamonds may be removed from the form 72.

Referring particularly to Fig. 7, a slightly modified form of wave winding and apparatus for winding the same is illustrated. To wind the facing body in the form shown in Fig. 7 an annular disc 77 carries three concentric circles of pins, pins 78 comprising the inner circle, pins 79 comprising the intermediate circle and pins 80 comprising the outer circle. The yarn 81 is wound in sequence around pin 78, pin 79, pin 80, another pin 79 and another pin 78 thus completing a wave form which may be referred to as a Gothic wave. In winding this wave substantially the same procedure hereinbefore described is followed, that is, each cycle causes the wave to fall out of phase and a predetermined number of cycles causes the wave to "fall in step". Thus a facing body may be built which when compressed has a substantially uniform density throughout its radial width, due to the fact that the wave shape tends to apply proportionately more yarn adjacent the outer periphery than the usual wave forms.

In Fig. 8 a facing body 96 is shown which is similar to the body 6 shown in Fig. 2, the body 96 being stitched, as shown at 97. The stitching operation may be performed simultaneously with the winding operation or, if desired, may follow

the winding operation. In addition, the stitches may travel circumferentially, radially or at substantially any other angle. It is to be understood, of course, that stitching of facing bodies comprising all forms of windings is contemplated. When stitching the body simultaneously with the winding operation, the stitching assists in holding the respective layers together while further winding takes place. Of course, a lock stitch (not shown) may be used to bind the edges of the body which would give the body greater strength and would contribute to ease of handling.

It can readily be seen that in carrying out the process of my invention a facing body may be built up comprising a series of progressing or retrogressing waves or geometric shapes defined by asbestos yarn, the threads of the yarn being sufficiently close to each other to form a relatively dense body which when properly compressed and cured, can be utilized as a friction facing which is a substantially solid body and is provided with no interstices or voids.

I claim as my invention:

1. A friction facing which comprises a compressed and cured annular ring which includes essentially asbestos yarn wound in an angular design which repeats itself throughout a helicoidal path.

2. A clutch facing comprising a bonded asbestos yarn structure formed of a compressed helix, each turn of the helix comprising a plurality of angular portions lying in a plane substantially parallel to the surface of the ring.

3. A bonded clutch facing structure comprising a compressed uniformly distributed mass of yarn in wave form, the included angle of the waves being from 30° to 150° in a plane substantially parallel to the surface of the facing.

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