May 29, 1951 G. WALTERS 2,555,260

FRICTION DISK

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Fig. 1.

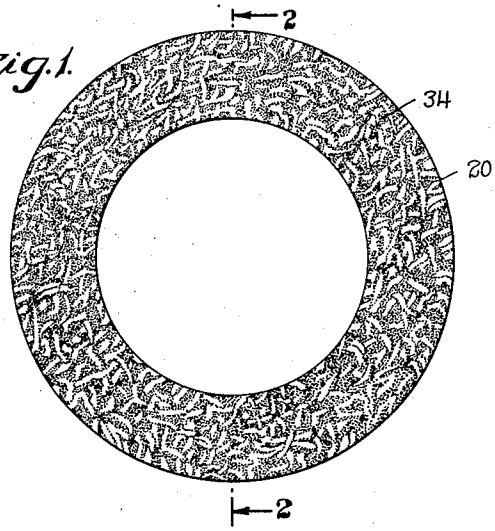


Fig. 2.

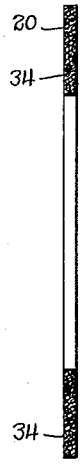


Fig. 3.

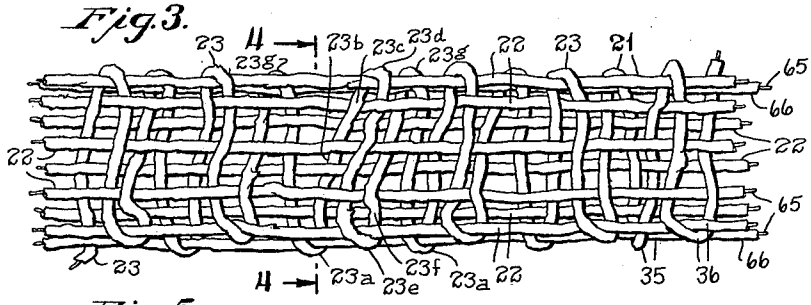


Fig. 4.

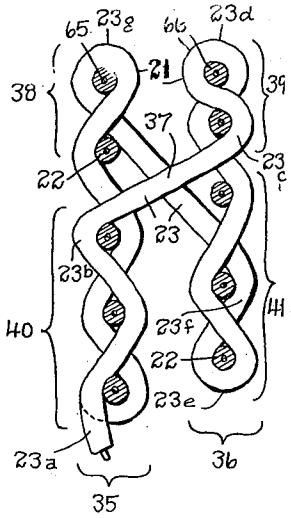


Fig. 5.

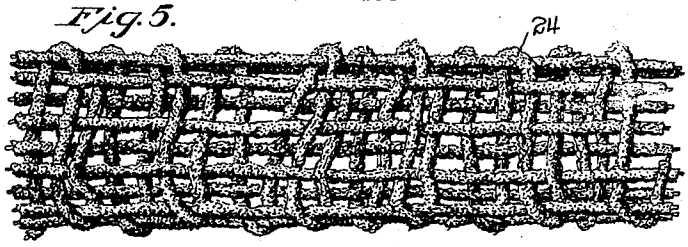
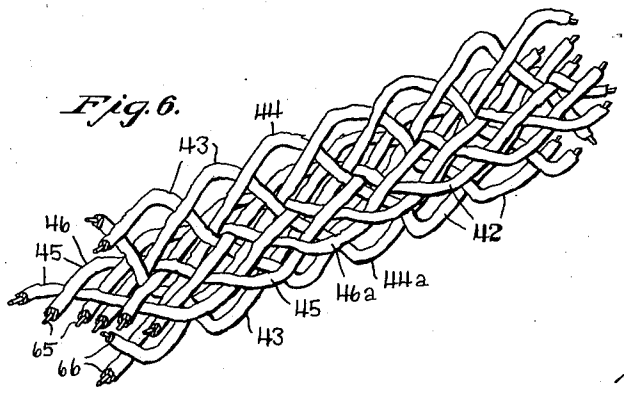


Fig. 6.



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Fig. 7.

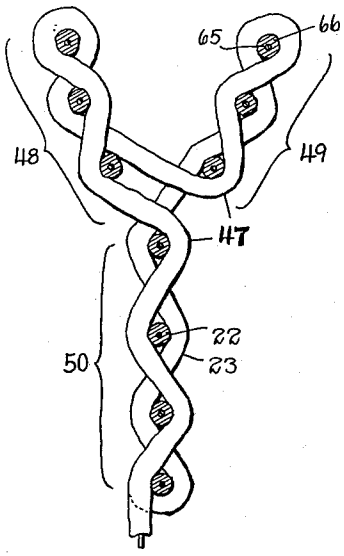


Fig. 8.

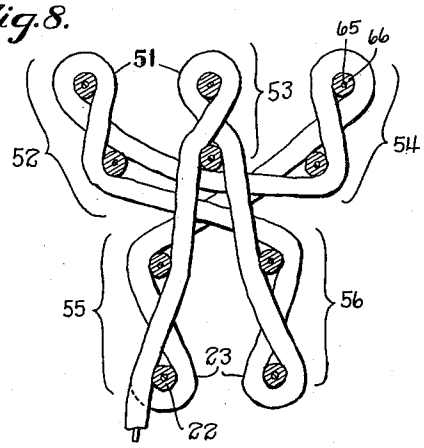


Fig. 9.

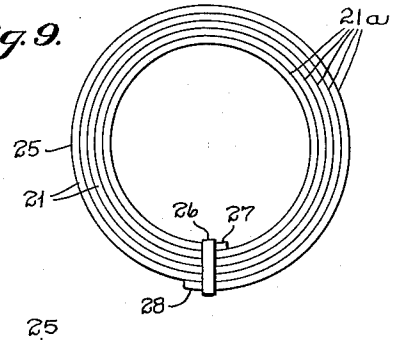


Fig. 10.

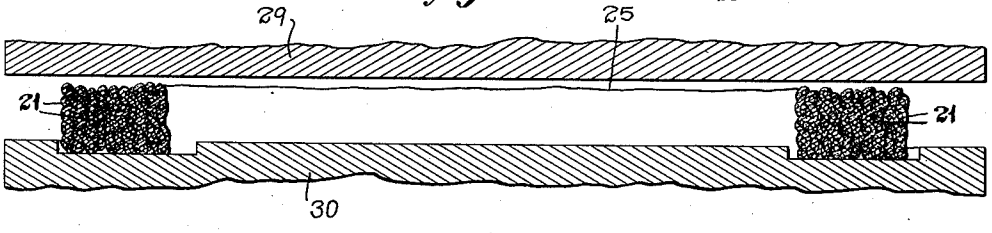
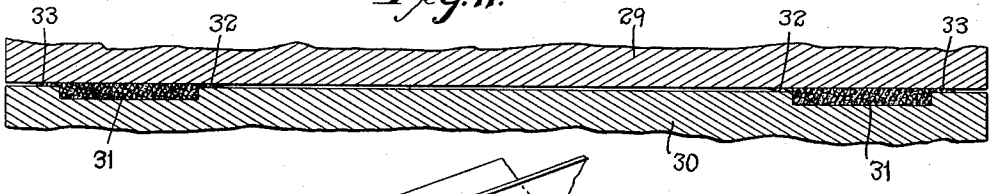


Fig. 11.



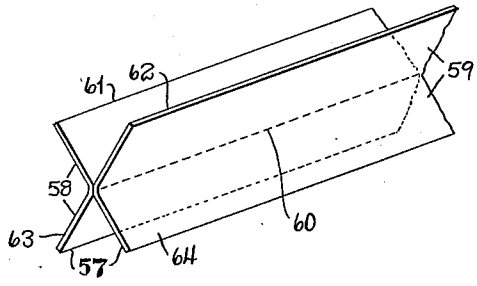


Fig. 12.

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UNITED STATES PATENT OFFICE

2,555,260

FRICTION DISK

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Application June 21, 1949, Serial No. 100,506

6 Claims. (Cl. 28—80)

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This invention relates to improvements in friction-disks or -facings, and more particularly to friction-disks for use in connection with clutches.

One object of this invention is to provide an improved friction-disk having maximum wear-resistance, and therefore greater length of life.

Another object of this invention is to provide an improved friction-disk in which the friction-face will have less variation of its friction-coefficient in use.

With the above and other objects in view, as will appear to those skilled in the art from the present disclosure, this invention includes all features in the said disclosure which are novel over the prior art.

In the description and claims, the various parts and steps are identified by specific terms for convenience, but they are intended to be as generic in their application as the prior art will permit.

In the accompanying drawings forming part of the present disclosure, in which certain ways of carrying out the invention are shown for illustrative purposes:

Fig. 1 is a face view of a clutch-friction disk made in accordance with this invention;

Fig. 2 is a sectional view on line 2—2 of Fig. 1;

Fig. 3 is a side view of a portion of a woven web used for making a clutch-friction disk in accordance with this invention;

Fig. 4 is an enlarged transverse sectional view on line 4—4 of Fig. 3 with the two web-sections of the web shown as spaced for clearness;

Fig. 5 is a view similar to Fig. 3, after the web of Fig. 3 has been impregnated with friction-material;

Fig. 6 is a perspective view of a modified form of web made by braiding instead of by weaving;

Fig. 7 is a view similar to Fig. 4, of a modified web having three branches instead of the four branches of Fig. 4;

Fig. 8 is a view similar to Fig. 4 of a modified web having five branches instead of four;

Fig. 9 is a side elevation of a biscuit formed by winding the impregnated web of Fig. 5 into coiled or spiral form prior to subjecting the biscuit to heat and pressure;

Fig. 10 is a central vertical sectional view through a pair of heated dies and a biscuit just prior to the dies being forced together;

Fig. 11 is a view similar to Fig. 10 after the dies have been forced together, the dies being heated to convert the biscuit into a compressed heat-hardened unitary friction-disk; and

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Fig. 12 is a modified form of web construction in which two single flat webs are sewed together to form an X-type of web somewhat similar to the X-type web illustrated in Fig. 4.

Referring to Figs. 1 to 5 and 9 to 11 showing the particular form of the invention chosen for illustration therein, the friction-facing 20 is made by first loosely weaving an open readily-impregnated web or web-member 21 of warp strands 22 and a weft strand 23, then passing the web 21 through a tank containing heat-hardenable bonding friction-material 24. No particular bonding friction-material is any part of the present invention, and any suitable bonding friction-material may be used, such, for example, as bonding friction-material containing a phenol-formaldehyde type of resin, as is well known to those skilled in the art. The bonding material initially is in the form of a heavy liquid which impregnates and clings to the web, which then is dried, and is then wound in coiled or spiral form to form a ring-shaped biscuit 25 (Fig. 9) with the convolutions or web-portions 21*a* of the web-member 21 extending in side-by-side relation with one another, and with a band 26 secured around the biscuit in the region of the ends 27 and 28 of the web 21, so the biscuit can be readily handled and placed between the heated die-members 29 and 30 (Fig. 10), which thereupon are forced toward one another as in Fig. 11 to produce the rough-pressed heat-hardened unitary friction-disk 31 which usually contains inner and outer annular flash-portions 32 and 33. After the flash-portions are trimmed off and the front and rear faces of the rough-pressed friction-disk 31 are ground, the finished disk appears as the finished disk 20 in Figs. 1 and 2, having a friction-face portion 34.

The web-member 21 illustrated in Figs. 3 and 4 may for convenience be said to comprise two web-sections 35 and 36 interconnected to one another at 37 by the weft 23. The upper web-branches 38 and 39 respectively form the upper portions of web-sections 35 and 36, and extend upwardly in Fig. 4 from the interconnecting weft-portions at location 37 to form one face of the friction-disk 20, which may, for example, be the friction-face portion 34 of the friction-disk. And the other branches 40 and 41 respectively form downwardly-extending branches of the web-sections 35 and 36. Each of the reference characters 21 and 21*a* relates to the entire cross section of the web-member 21, whereas reference characters 35, 36, 38, 39, 40 and 41 relate to sub-portions of the entire cross section of the

web-member. The web-member 21 is woven by the weft 23 passing from the location 23a at the bottom left of Fig. 4, upwardly and being interwoven with warps 22 to about the middle of the left web-section 35 at 23b where it crosses over at 37 to the right web-section 36 at 23c, and then is interwoven with warps 22 to the top 23d of the right web-section 36 to thus complete one weft-pick, then weft 23 is interwoven with warps 22 all the way down to 23e at the bottom of the right web-section 36 to complete the second weft-pick, then weft 23 is interwoven with warps 22 about halfway up to 23f of the right web-section 36 and then crosses over at 37 to the left web-section 35 and to near the top 23g thereof to complete the third pick, and then is woven with warps 22 down to the bottom 23a of the left web-section 35, whereupon it is ready to start weaving the next repeat cycle of four picks. Actually, the two web-sections 35 and 36 are close together, but Fig. 4 has been drawn in enlarged exaggerated form with the interconnecting portions of the weft 23 shown longer at the interconnecting or cross-over region 37, for clearness of illustration. If the upper two branches are spread away from one another and the lower two branches are spread away from one another in the actual web as made, the cross-sectional appearance of the web is of X-form.

The modified form of web 42 illustrated in Fig. 6, instead of being woven as in the case of web 21 just described, is illustrated as made by braiding, and by this braided construction, a web-member of X-shape in cross section is produced having one braided section 43 which has two branches 44, 44a lying in one plane, and inter-braided through another braided section 45 which has two branches 46 and 46a lying in another plane. The web-member 42 would be used similar to the web-member 21 previously described by impregnating it with heat-hardenable bonding friction-material and forming it into a flattened web and coiling it into a biscuit similar to that illustrated in Fig. 9 and pressing it to form a friction-disk with two of the branches extending side-by-side in a direction to form the friction-face portion 34, in a similar manner to that previously described.

In the modified form of the invention illustrated in Fig. 7, the web-member 47 has two branches 48 and 49 which extend in the same general direction in which they will ultimately form the friction-face portion of the friction-disk, and the other branch 50 extends in the opposite direction toward the rear face of the friction-disk.

In the modified form of the invention illustrated in Fig. 8, the web-member 51 is woven to have three branches 52, 53 and 54 extending in the same general direction to form the friction-face portion of the friction-disk, and with two other branches 55 and 56 extending toward the rear face of the friction-disk.

Instead of forming the web-member of a single woven or braided or otherwise interlaced member, the web-member 57 schematically shown in Fig. 12 may be formed of two independently-woven or braided or otherwise interlaced flat sections or webs 58 and 59 which are stitched together along a line indicated at 60 so that when the branches 61 and 62 are spread apart, and the oppositely-extending branches 63 and 64 are spread apart, a composite web-member is formed of general X-shape in cross section in appearance.

While all of the strands illustrated in the drawings have a wire center or core 65 with a surrounding covering of asbestos material 66, for some friction uses wire could be entirely eliminated from use. Or, wire, for example, could be employed only in the weft, or in the weft and only in the warps which are to form the friction-face portion of the finished friction-disk. But, ordinarily, it is advantageous to employ wire-cored asbestos strands to form all of the strands of the web used in making friction-disks according to the present invention.

Fig. 4 is considerably schematic, and the interconnecting weft-strand portions 37 are longer than is actually the case, whereas the two web-sections 35 and 36 are actually close together, and also the weft strands or picks in the finished pressed form will be more nearly vertical than would appear from Fig. 4.

By having each web-member provided with at least two branches extending in the same general direction to form the friction-face portion 34 of the friction-disk, a single web-member is provided with a larger number of weft picks in the friction-face, with the consequence that there is a larger number of upstanding ends of the weft picks extending transversely to the friction-face of the friction-disk. This results in improved wear-resistance of the friction-face portion of the friction-disk. And where the weft picks carry or have cores or are formed of metallic wire, such, for example, as brass, the larger number of these wires extending transversely to the friction-face of the friction-disk, conduct the heat away from the surface of heat-generation at the friction-face and therefore prevents as high a rise in temperature as would otherwise occur. Also, as the friction-face wears down, the weft-strand ends are worn away in a general transverse direction to their longitudinal length, thereby retaining these larger numbers of weft-pick ends as part of the friction-forming surface, and without their being completely worn away and then reappearing, and then wearing away again. Therefore, this larger number of weft-pick ends, especially where they have metal cores or metal wires otherwise extending along them, gives a more uniform friction-coefficient and a higher amount of metal in the friction-face portion with consequently greatly-increased wear-resistance to the friction-face portion of the friction-disk.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. A friction-disk having a friction-face portion, and mainly formed of a heat-hardenable bonding friction-material-impregnated coiled web-member, with the web-portions of said web-member extending in side-by-side relation with one another as a compressed heat-hardened unitary mass; each said web-portion having strands interlaced together to form the web-portion of branched form in cross section with at least three branches, and with certain of said branches extending widthwise of the web-portion in opposite directions from a location intermediate the width of the web-portion, and with at least two of said branches extending in the same direction widthwise of the web-portion in side-

by-side relation to form said friction-face portion.

2. A friction-disk having a friction-face portion, and mainly formed of a heat-hardenable bonding friction-material-impregnated coiled web-member, with the web-portions of said web-member extending in side-by-side relation with one another as a compressed heat-hardened unitary mass; each said web-portion having strands interlaced together to form the web-portion of branched form in cross section with four branches, and with certain of said branches extending widthwise of the web-portion in opposite directions from a location intermediate the width of the web-portion, and with two of said branches extending in the same direction widthwise of the web-portion in side-by-side relation to form said friction-face portion.

3. A friction-disk having a friction-face portion, and mainly formed of a heat-hardenable bonding friction-material-impregnated coiled web-member, with the web-portions of said web-member extending in side-by-side relation with one another as a compressed heat-hardened unitary mass; each said web-portion having strands woven together to form the web-portion of branched form in cross section with at least three branches, and with certain of said branches extending widthwise of the web-portion in opposite directions from a location intermediate the width of the web-portion, and with at least two of said branches extending in the same direction widthwise of the web-portion in side-by-side relation to form said friction-face portion.

4. A friction-disk having a friction-face portion, and mainly formed of a heat-hardenable bonding friction-material-impregnated coiled web-member, with the web-portions of said web-member extending in side-by-side relation with one another as a compressed heat-hardened unitary mass, each said web-portion having strands woven together to form the web-portion of branched form in cross section with four branches, and with certain of said branches extending widthwise of the web-portion in opposite directions from a location intermediate the width of the web-portion, and with two of said branches extending in the same direction widthwise of the web-portion in side-by-side relation to form said friction-face portion.

5. A friction-disk having a friction-face portion, and mainly formed of a heat-hardenable bonding friction-material-impregnated coiled web-member, with the web-portions of said web-member extending in side-by-side relation with one another as a compressed heat-hardened unitary mass; each said web-portion having strands, a major portion of which have metallic wires extending therealong, interlaced together to form the web-portion of branched form in cross section with at least three branches, and with certain of said branches extending widthwise of the web-portion in opposite directions from a location intermediate the width of the web-portion, and with at least two of said branches extending in the same direction widthwise of the web-portion in side-by-side relation to form said friction-face portion.

6. A friction-disk having a friction-face portion, and mainly formed of a heat-hardenable bonding friction-material-impregnated coiled web-member, with the web-portions of said web-member extending in side-by-side relation with one another as a compressed heat-hardened unitary mass; each said web-portion having strands, a major portion of which have metallic wires extending therealong, interlaced together to form the web-portion of branched form in cross section with four branches, and with certain of said branches extending widthwise of the web-portion in opposite directions from a location intermediate the width of the web-portion, and with two of said branches extending in the same direction widthwise of the web-portion in side-by-side relation to form said friction-face portion.

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