Oct. 15, 1940. V. W. MEHNERT 2,217,915

CIRCULAR KNITTED WEB AND METHOD FOR ITS MANUFACTURE

Filed Nov. 30, 1937 2 Sheets-Sheet 1

Fig.1

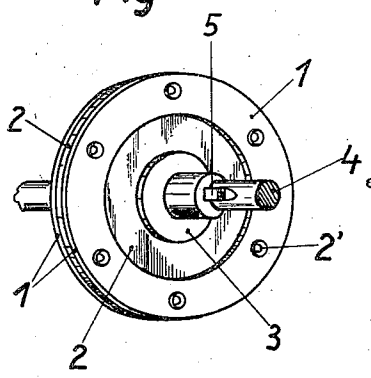


Fig.2

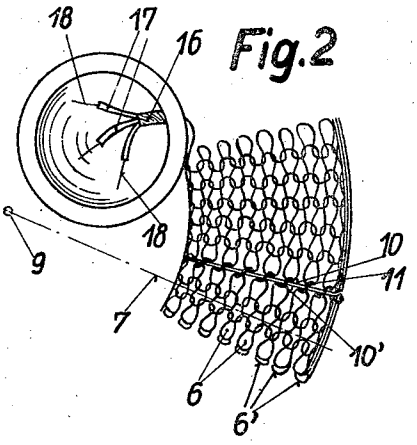


Fig.5

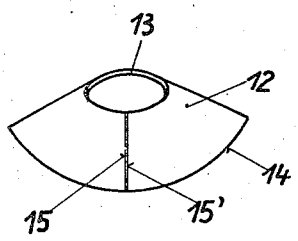


Fig.6

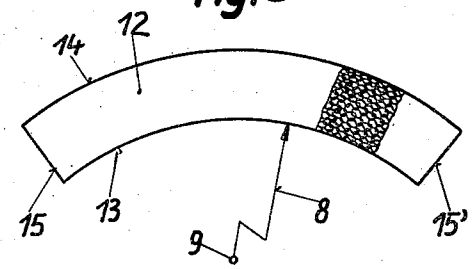
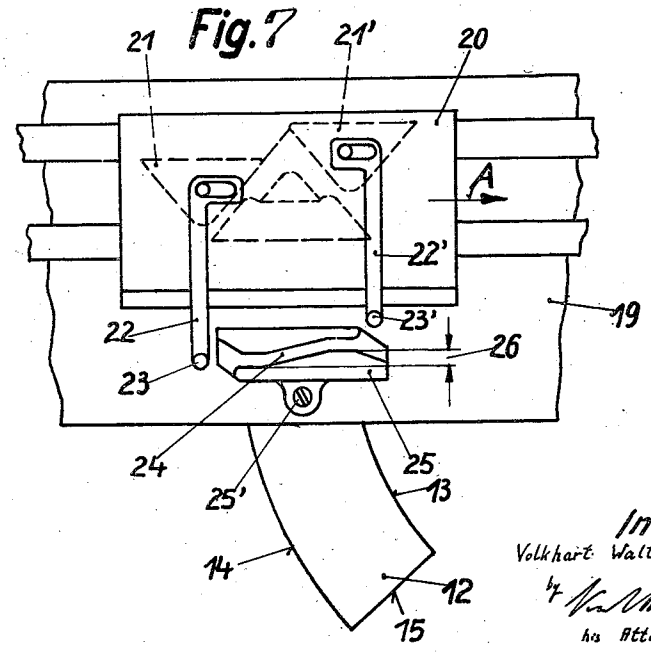


Fig.7



Inventor:
Volkhart Walter MEHNERT
by
his Attorney

Oct. 15, 1940. V. W. MEHNERT 2,217,915

CIRCULAR KNITTED WEB AND METHOD FOR ITS MANUFACTURE

Filed Nov. 30, 1937 2 Sheets-Sheet 2

Fig. 8

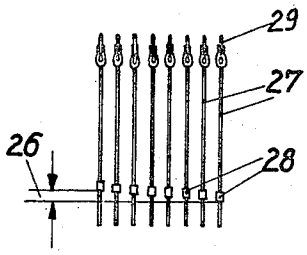


Fig. 9

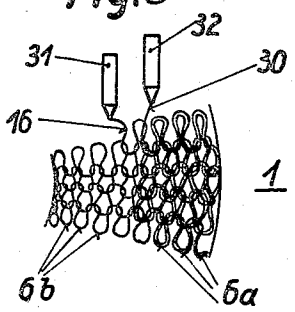


Fig. 10

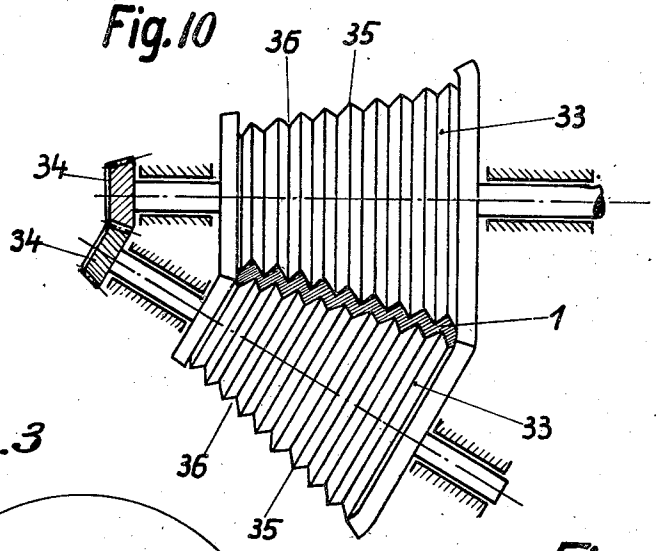


Fig. 3

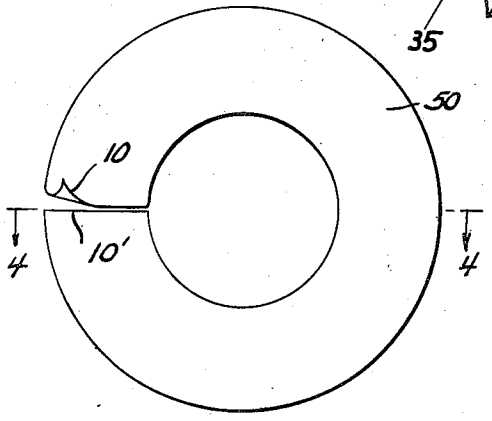


Fig. 4



Inventor:
Volkhart Walter MEHNERT
by Kirschstein
his Attorney

Patented Oct. 15, 1940 2,217,915

UNITED STATES PATENT OFFICE

2,217,915

CIRCULAR KNITTED WEB AND METHOD FOR ITS MANUFACTURE

Volkhart Walter Mehnert, Siegmar-Schonau, Germany, assignor to the firm Elite-Diamant-werke Aktiengesellschaft, Siegmar-Schonau, Germany, a company of Germany

Application November 30, 1937, Serial No. 177,369
In Germany December 1, 1936

9 Claims. (Cl. 28—1)

The invention relates to a circular knitted web as is intended in particular for use as lining or cover material for friction couplings, e. g. in automobiles. In that connection it is important that the knitted web be elastic and porous in order to receive the saturating or impregnating material, e. g. resin, artificial resin or similar products known as brake coverings or linings and that the fibrous material withstands the abrasive effect of the frictional stress without becoming frayed or unravelled.

In order to comply with these conditions in the best manner possible, keeping at the same time the consumption of asbestos yarn or threads comparatively low, the invention provides the knitting of the ring as a flat strip or band of circular shape. In it the meshes or stitches are to be produced in radial rows so that their loops are directed at right angles to the radius, i. e. tangentially, and, in order to obtain a uniform circular shape, each outer mesh of a row is larger than the adjacent one situated more towards the centre of the same row.

The circular band fashioned in this manner is joined together at its ends, e. g. by sewing up. All according as to whether the band had the full length of a circular ring or only the length of a segment of a circular ring there results after the joining together either a flat circular ring or the surface of a truncated cone. In order to obtain plane and uniform circular rings the relative size of the loops shall be in direct proportion to the distance of the mesh from the centre of the circular ring.

A further object of the invention consists in the method for manufacturing the said knitted web on a flat knitting machine.

The method is characterized in that the loops, during the knitting of each row of meshes, are increased in one direction of knitting and correspondingly decreased in the other direction of knitting. For the purpose of accomplishing this mode of operation every following needle in the row of meshes is drawn back farther than the preceding needle by the amount of the intended increase of the size of the loops.

This method can be attained in a flat knitting machine where the drawing back part of the cam box causing the formation of the loops is provided with a device which, during the stroke of the carriage, displaces that part in the direction of the stroke of the needle. The same result can, however, be achieved in a machine with a fixed drawing back part if the drawing back length of the needles working side by side differs by the amount of the size of the loops, e. g. by a different distance between the heel and the head of each individual needle.

Since the loops of that kind of knitting according to the invention are larger at the outer rim of the circular ring than the inner loops, they are, consequently knitted more loosely than the inner ones. This by itself complies with the conditions for the transmission of the twisting or turning moment through the coupling covering, as the lever arm of the forces to be transmitted is longer towards the periphery than towards the centre. Yet it may be of advantage to render closer the outer stitches of the knitted web. This may be accomplished in that way that the outer loops are knitted with yet an additional thinner thread.

The uniform thickness of the knitted material across the whole width can be achieved in this manner that the band is conducted through a pair of rollers in which the knitted material is pressed and made closer.

After the pressing, or even immediately before it, the knitted material may be saturated or impregnated with resins, artificial resins, e. g. condensation products of phenol formaldehyde, or other substances known as brake material. After the impregnation the ring may also be smoothed by grinding.

A particularly suitable kind of closely knitted fabric which will not fray even under great stress through frictional forces, is the so-called "interlock-knitted fabric." It is understood that the term "interlock-knitted fabric" used in the specification and claims has reference to a fabric in which the loop courses of a plurality of layers arranged upon each other are formed by a continuous thread, the loops in each course being arranged alternately among said layers and being disposed alternately with respect to each other in each layer, so that the layers are integrated or interlocked.

The drawings show various embodiments of the invention and represent in

Fig. 1 a perspective view of a coupling flange with the cover ring according to the invention,

Fig. 2 a fragmentary sectional view of a knitted cover ring,

Fig. 3 a top plan view of a knitted strip of fabric having the form of a full plane circular ring, the adjacent ends of said strip being not yet connected with each other,

Fig. 4 a cross-sectional view of the strip of fabric taken on line 4—4 of Fig. 3,

Fig. 5 a cover ring in the shape of a truncated cone,

Fig. 6 a top plan view of a knitted strip of fabric of the length of a segment of a circular ring, by means of which the truncated cone according to Fig. 5 is formed,

Fig. 7 a top view of a part of a kniting machine with the cam box by means of which the ring is manufactured,

Fig. 8 another arrangement of the knitting needles in a machine for manufacturing the ring,

Fig. 9 a modified embodiment of the ring with reinforced rim part while being manufactured,

Fig. 10 a roller device for compressing the ring.

A coupling flange according to Fig. 1 consists of the knitted rings 1 saturated with resins, these rings being fastened in any desired way on a metal disc 2, e. g. by means of hollow rivets 2'. The disc sits with its hub 3 on the driving or driven shaft 4 and is non-rotatably connected with the latter by means of the wedge 5.

Preferably, the above mentioned knitted ring 1 is made of a so-called "interlock-knitted fabric" as diagrammatically shown in Fig. 2. In this embodiment the interlock-knitted fabric has two layers arranged upon each other. The upper layer has the loops 6, the lower layer has the loops 6'. The loop courses of both layers are formed by the same continuous thread, which, one back and forth movement of the thread between the outer and inner circumferences of the ring taken in consideration, at first forms a first loop in the lower layer, then forms a first loop in the upper layer out of line with said loop of the lower layer, then forms a second loop in the lower layer spaced from the first loop of the lower layer, then forms a second loop in the upper layer spaced from the first loop of the upper layer, etc., whereupon, during the return movement of the thread from the inner circumference to the outer circumference of the ring, the thread forms alternate loops in the same alternate manner in the layers, said alternate loops being positioned in the spaces between the loops formed during the first mentioned movement of the thread from the outer circumference to the inner circumference of the ring. Thus, the two layers of the knitted fabric are interlocked with each other. The loop courses 7 of both layers extend in radial direction. The length of the loops of each loop course gradually increases from the inner selvage of the fabric to the outer selvage thereof, and the length of every loop is in direct proportion to the distance of the loop from the centre 9 of the circular fabric. Of course, any other type of weft-knitted fabric having loops formed of a continuous thread may be used for the manufacture of my new clutch lining instead of the above described interlock-knitted fabric.

As best shown in Figs. 3 and 4 the curved strip 50 of knitted fabric used for the manufacture of a ring-like clutch lining has such a length, that it forms a plane circular ring when its ends 10 and 10' are placed adjacent to each other. When the ends 10 and 10' of the plane circular strip are brought together, they are connected with each other by a seam 11 as shown in Fig. 2. Then the ring-like clutch lining thus obtained may be impregnated with a binding agent, if desired.

If it is desired to produce a lining of the form of a frusto-conical member as shown in Fig. 5, a strip 12 of a curved knitted fabric is used, which has only the length of a segment of a circular ring as shown in Fig. 6. The ends 15 and 15' of the strip 12 are brought together and are connected with each other by a seam or the like. The upper edge 13 of the frusto-conical member has a smaller diameter than the lower edge 14. The shape of the frusto-conical member depends on the length of the strip 12 in proportion to the radius 8.

As may be gathered from Fig. 2, the knitted web consists of a thread 16, preferably of asbestos, which is twisted of several individual threads 17. Each one of the individual threads 17 may possess a metal core 18, e. g. of brass wire.

For the manufacture of the band on the flat knitting machine the arrangement of Fig. 7 is put into practice. The carriage 20 is laterally displaceable on the needle bed 19. The cams 21 and 21' of the cam box are guided with their feet 23 and 23', by way of a system of rods 22 and 22', in a curved groove or path 24, which is situated at the needle bed 19 and is formed by the sliding cams 25. During the movement of the carriage 20 in the direction of the arrow A the foot 23, together with the cam 21, is displaced upwards, at right angles to the direction of the carriage stroke, by the distance 26 corresponding to the inclination of the incline 24. In accordance with this the loops of each row of meshes being produced one after the other, are reduced. In one direction of the carriage, i. e. in the direction opposite to that of the arrow A, the size of the loops is correspondingly increased by the cam 21' lagging during this stroke, this cam being controlled by means of the guiding rod 22' and foot 23'. The cams 21 and 21' are reversed or changed in the usual manner with each change of direction of the carriage. The sliding cam 25 can be pivoted around the axis 25' whereby the slope of the incline 24 is altered. Hereby it is rendered possible to vary the difference in the size of the loops within the individual rows of meshes as compared with the difference of another preceding row of meshes and, simultaneously, the distance 26 which corresponds to the increase of size of the loops.

In place of the mechanism according to Fig. 7 needles may be provided as shown in Fig. 8. The needles 27 operating side by side when knitting the band have differing strokes. The distance between the needle heels 28 and the needle heads 29 differs always by the intended distance 26 in the size of the loops, so that also in this manner the size of the loops increases in one direction and decreases in the other direction.

The parts of the rim in which the loops are worked loosest can be reinforced in the manner illustrated by Fig. 9, in order to obtain a closer knitted web. The loops 6*a*, being situated nearest to the outer circumference, are formed, or reinforced respectively, apart from the thread 16, also by an additional thinner thread 30; the inner loops 6*b* are formed solely by the thread 16. The yarn guide 31 passes the entire width of the band, whereas the yarn guide 32 feeding the additional thread 30, passes only the width of the outer loops 6*a*.

In order to obtain a uniform thickness and good compactness of the ring, the same is conducted through a pair of rollers, either before or after being impregnated. As best shown in Fig. 10, the rollers 33 have a conical form. They can be driven jointly by means of bevel gear wheels 34 and have, at their surface, ring-shaped projections 35 whose distance from the centre outwards is adjusted to the width of the loops 6 in radial direction. This radial width can be the same for the whole surface of the roller, independent of

the increase of the loops from the centre outwards, but it can also change in accordance with the distance from the centre. The rollers 33 are staggered in such a manner that the projections 35 of one roller are opposite to the grooves 36 of the other roller, keeping a space free through which the ring 1 is conducted during the pressing operation.

While in order to comply with the statute, the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features or purposes shown and described.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:

What I claim is:

1. A method of manufacturing clutch linings or the like, comprising the steps of knitting a curved strip of fabric of a length adapted to form a plane circular ring when the ends of the strip are placed adjacent to each other, and connecting the ends of said strip with each other to form a plane circular ring.

2. A method of manufacturing clutch linings or tne like, comprising the steps of knitting a curved flat strip of fabric of a length adapted to form a plane circular ring when the ends of the strip are placed adjacent to each other, compressing said strip, impregnating said strip with a binding agent, and connecting the ends of said flat strip with each other to form a plane circular ring.

3. A method of manufacturing clutch linings or the like, comprising the steps of knitting a weft knitted strip of fabric having loops formed of a continuous thread and having the loop courses substantially at right angles to the longitudinal axis of the strip, alternately gradually increasing the length of the loops from one selvage of the strip to the other selvage thereof and gradually decreasing the length of the loops from the latter selvage to said first mentioned selvage during the knitting of consecutive loop courses for the formation of a strip of curved shape, making the strip of a length adapted to form a plane circular ring when the ends of the strip are placed adjacent to each other, and connecting the ends of said strip with each other to form a plane circular ring.

4. As a new article of manufacture, a weft-knitted fabric forming a plane circular ring having loops formed of a continuous thread and having radially extending loop courses, the length of the loops of each loop course gradually increasing from the inner selvage of the fabric to the outer selvage thereof.

5. A new article of manufacture of the circular weft-knitted fabric as claimed in claim 4, in which the length of every loop is in direct proportion to the distance of the loop from the centre of the circular fabric.

6. As a new article of manufacture, a weft-knitted interlock-fabric forming a plane circular ring having loops formed of a continuous thread and having radially extending loop courses, the length of the loops of each loop course gradually increasing from the inner selvage of the fabric to the outer selvage thereof, the loops being formed of asbestos threads containing at least one thin metal wire, and the frabic being impregnated with a binding agent and being pressed flat.

7. A new article of manufacture as claimed in claim 6, in which the length of every loop of the circular weft-knitted fabric is in direct proportion to the distance of the loop from the centre of the circular fabric.

8. A new article of manufacture as claimed in claim 4, in which the circular ring consists of an interlock knitted fabric.

9. A new article of manufacture as claimed in claim 4, in which the loops are formed of asbestos threads containing at least one thin metal wire.

VOLKHART WALTER MEHNERT.