Feb. 22, 1938. J. N. LONGLEY 2,108,988

FRICTION MATERIAL AND METHOD OF FORMING SAME

Filed Nov. 3, 1934

Fig. 1.

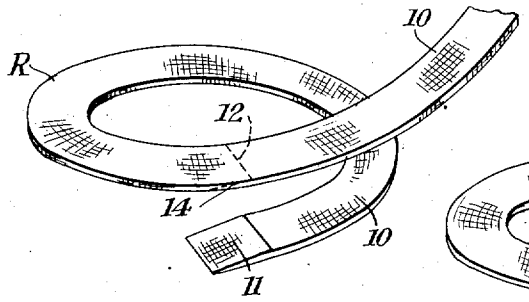


Fig. 2.

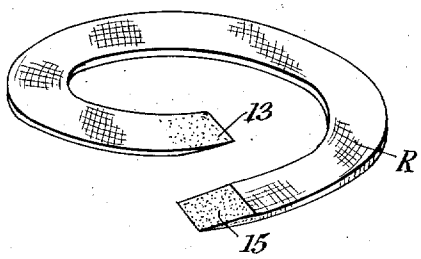


Fig. 3.

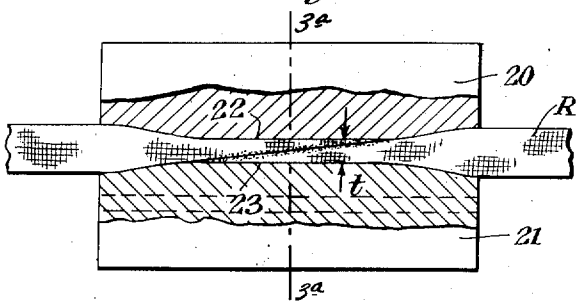


Fig. 4.

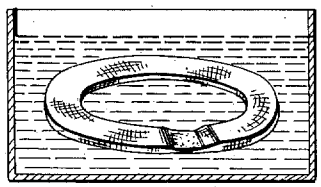
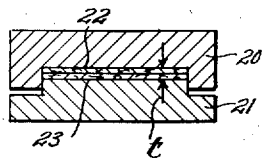


Fig. 3a



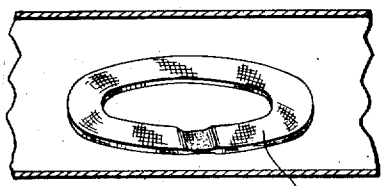


Fig. 5

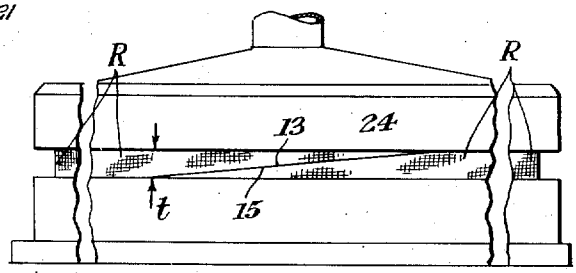


Fig. 6.

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BY

Edwards, Brown & Pohl

ATTORNEYS

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UNITED STATES PATENT OFFICE

2,108,988

FRICTION MATERIAL AND METHOD OF FORMING SAME

James N. Longley, Chinley, England, assignor to Ferodo and Asbestos Inc., Ambler, Pa., a corporation of New York

Application November 3, 1934, Serial No. 751,321

2 Claims. (Cl. 192—107)

This invention relates to friction rings for brakes, clutches and the like and particularly to such rings made of woven webbing formed from strip to circular form and joined at the ends to complete the circle.

The object of the invention is to provide a friction ring of woven material which will be simple in manufacture and durable in use, and giving a very even and efficient action over the entire area of frictional contact.

A further object of the invention is to provide a method of formation of the friction ring which will use continuous strip stock and convert it into ring form inexpensively and with substantially no wastage.

In the accompanying drawing illustrating the invention—

Fig. 1 is a perspective view of one form of continuous strip material as it is shaped for cutting into ring form,

Fig. 2 is a similar view of the cut ring,

Fig. 3 is a diagrammatic view in elevation illustrating the formation of the joints between the ends completing the ring,

Fig. 3*a* is a sectional view on the line 3*a*—3*a* of Fig. 3.

Figs. 4 and 5 are diagrammatic views illustrating subsequent steps of impregnation and curing, and

Fig. 6 is an elevational view illustrating the final pressing step producing the completed ring.

In the specific example of the invention illustrated in the drawing asbestos woven webbing 10, preferably but not necessarily woven spirally, is fitted into a steel or cast iron channel reproducing exactly the shape and circumferential dimensions of the required finished face. The butt end of the spiral as received from the loom or from the radiusing device is, of course, a plain square ended section, and this is cut to waste with a sharp knife or other suitable instrument along a sloping scarf-line for about 1'' in length as shown at 11 in Fig. 1. When fitted into the metal annulus, the point where the spiral band passes the thick end of the scarf cut is marked as shown at 12 in Fig. 1, and the material so marked is removed from the die and another sloping scarf cut 13 is made as shown in Fig. 2. Thus the length of the material required for making the finished disk is determined and cut, and the balance of the spiral coil 10 has a wedge-shaped end 14 (Fig. 1) ready cut to place in the annulus for the production of the next ring. It will thus be seen that there is no waste except at the beginning of each coil.

The next step in the formation of the ring is to generously cover and impregnate the surfaces of the two wedge-shaped ends 13, 15 (Fig. 2) with a thick solution of a synthetic resin, preferably of the cresol formaldehyde condensation type and to dry off the solvent, leaving the ends coated and to a degree impregnated with resin still in the fusible stage, generally referred to in the resin trade as stage B.

Now if the whole of the gray ring with the "scarfed" or wedge-shaped ends overlapping is placed in an annular die, the entire ring may be subjected to simultaneous heat and pressure to render the synthetic resin on the joined ends infusible and insoluble. This will strongly and effectively join together the ends and complete the ring, which may go forward to further processing.

This method is not preferred, however, because the unimpregnated part of the ring has been, and unnecessarily, consolidated, leaving less air spaces than are necessary for adequate impregnant absorption. Moreover in the material of this invention the finished impregnated fabric ring should be of maximum density. It, therefore, follows that after impregnation and drying the ring should be compressed to remove those air spaces left by the volatilization of the solvent generally used in the composition of the impregnant. If the whole of the ring has been pressed under heat, in the unimpregnated state, to effect the joint, the unimpregnated ring is left only as thick as the joint. Being rendered infusible, the joint is thus incapable or highly resistant to further thickness reduction under the subsequent attempt at compression, and will thus hold the pressure off the balance of the ring, now impregnated and partly cured and needing compression. Moreover, if a complete annular mold is used it is obvious that every different size of ring will need an accurate absolute die, which involves heavy expenditure on molds.

Accordingly and for these several reasons, I prefer to first form the joint and then treat the ring R as a whole. The die or mold used for the joining instead of being a complete annulus is only a sector of an annulus as shown in Fig. 3. The length of the arc of the sector is approximately that represented by the length of the overlapping scarfed or wedge-shaped ends. The lower die section 21 has a groove the width of the strip and the upper die section 20 has a tongue entering and closely fitting the groove. The surfaces 22 and 23 respectively of the tongue and groove are formed to fit and compress the joint to

the final thickness *t* which the ring R is to have as a finished product, at the same time supplying and holding the heat to fuse the resin and permanently harden it. In this way only the joint receives the pressure in effecting the consolidation of the ends and is accordingly pressed and heated to harden the resin and is reduced to the required finished thickness, leaving the balance of the ring thick and porous and capable of absorbing the necessary amount of impregnant. This also makes it possible to finally compress the impregnated ring R as a whole to thickness *t* to absolute maximum density after curing so that the compressed thickness is substantially that of the original infusible joint.

The annular sectors **20**, **21** of the molded die are gas heated by means of gas burners integral in their structure, the recessed sector **21** being heated from underneath and the top pressure annular sector **20** being heated from above. The temperature of the mold is very high being at least 600° F. In this manner the transition of the condensation product from the set and fusible stage to the infusible is brought about very rapidly—the actual speed depending largely on the mass of the joint to be made, and in normal average sizes the time is about thirty seconds. When the condensation product is polymerized by the heat and pressure it becomes set in form and hardened so as to be infusible, the action being irreversible.

After the formation and hardening of the joint as shown in Fig. 3, the ring as a whole is impregnated throughout its entire porous structure, the impregnant being any desired waterproofing filling and reinforcing compound common in the trade and usually including a vaporizable solvent, which is then driven off by heat during the thickening and curing stage, as shown in Fig. 5.

This leaves the body of the ring somewhat porous and unconsolidated due to the escape of the vaporizable diluent, and the entire ring R is then placed between upper and lower dies **24**, **25** (Fig. 6) and subjected to high compression with or without heat according to the nature of the impregnant to give a maximum density minimizing this porosity, the compression being such as to bring the whole ring to substantially the same thickness throughout the entire circle.

While the invention has been described in connection with the particular process, it is not limited thereto in every detail. For instance, it is in some cases necessary or preferable to perform the operatoin of "scarfed" cutting and joining after the asbestos webbing is impregnated and semi-cured. In such case the formation of the joint will follow the semi-curing, after which the curing will be completed and the ring as a whole compressed to maximum density and even thickness in all parts. For instance, the strip of material will be taken in circular form impregnated and it will then have the solvent volatilized. After this the cement will be applied to the scarfed joint, and this will be hardened and cemented by heat and pressure after which the ring will be cured in its entirety and the process completed as previously described.

I claim:

1. A lining member for brakes, clutches and the like comprising a strip in circular form having overlapping ends joined by a medium hardened under heat and pressure so as to be set and infusible and with the remainder of the strip of substantially the same thickness and density as the said joint and impregnated with a waterproof reinforcing filling of a medium different from that forming said joint.

2. A lining member for brakes, clutches and the like comprising a strip of woven material in circular form having overlapping ends joined by a medium hardened under heat and pressure so as to be set and infusible and with the remainder of the strip of substantially the same thickness and density as the said joint and impregnated with a waterproof reinforcing filling of a medium different from that forming said joint.

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CERTIFICATE OF CORRECTION.

Patent No. 2,108,988. February 22, 1938.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 23, strike out the words "set and" and insert the same before "infusible" in line 24; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 5th day of April, A. D. 1938.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

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