Oct. 9, 1928. 1,686,903

F. J. EISENHARDT

BRAKE LINING

Original Filed Sept. 11, 1926

FIG. 1.

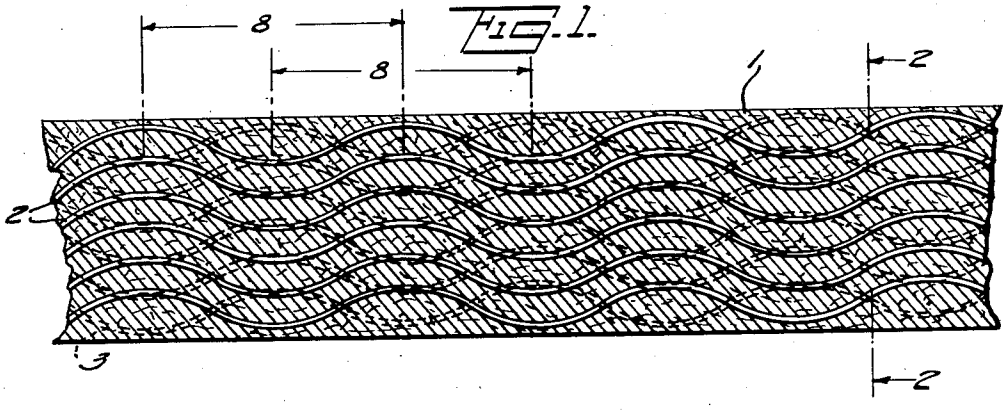


FIG. 2.

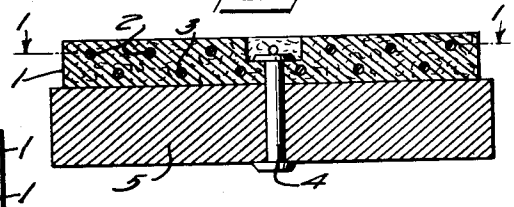


FIG. 3.

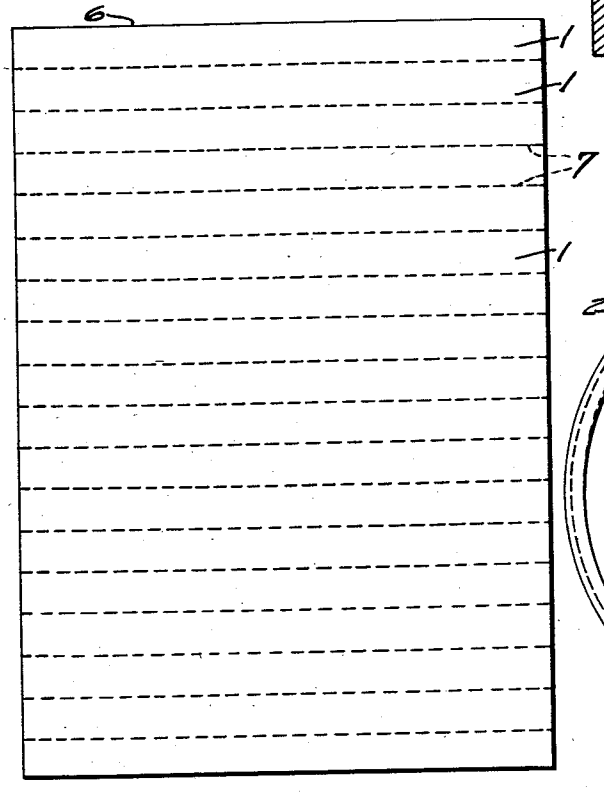
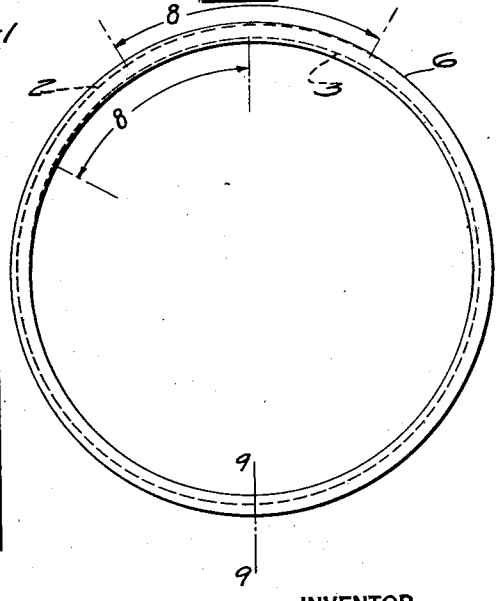


FIG. 4.



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UNITED STATES PATENT OFFICE.

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BRAKE LINING.

Application filed September 11, 1926, Serial No. 134,832. Renewed February 17, 1928.

This application is, in part, a continuation of my application Serial No. 715,715, filed May 24, 1924. The invention relates generally to the production of a sheet or strip of composite material which may have its greatest tensile strength along one dimension of the sheet or strip, usually lengthwise thereof. More specifically the invention is mainly designed to produce a friction lining or covering for a machine element which is subjected to pressure and friction from another element moving always in one direction with reference to said first mentioned element, usually longitudinally thereof, as is the case with brake linings and clutch facings for motor cars, although a plurality of such sheets may be so superposed and pressed together as to form a thicker sheet or body which shall have substantially the same strength in all directions and be useful for many other purposes. A most useful embodiment of the invention may consist of a dense, tough, slightly resilient, body made from a generally plastic material as a base, such as a composition containing india rubber, and having a plurality of continuous reenforcing members such as wires, thread, yarn or the like; embedded and extending in a generally common direction therein, said reenforcing members being preferably arranged at varying inclinations one to another, or in sinuous curves or waves to a greater or less extent. By varying the constituents of the rubber compound and the amount of fibre or wire added thereto, and the extent of vulcanization, sheets of varying degrees of softness and flexibility can also be produced. The continuous reenforcing members both give great tensile strength to the structure in the general direction of their length and afford good holding means for the rivets or other devices by which the material is fastened to any given support.

The best form of apparatus, at present known to me, embodying my invention and indicating the method of constructing the same, is illustrated in the accompanying sheet of drawings, in which:

Fig. 1 is a longitudinal horizontal section of a completed strip taken on line 1—1 of Fig. 2, the curvature of the wires being exaggerated for clearer illustration.

Fig. 2 is a cross section of a completed strip taken on line 2—2 of Fig. 1, and also showing a supporting base in cross section.

Fig. 3 shows on a smaller scale an original sheet of the material from which strips such as shown in Figs. 1 and 2 may be cut, and

Fig. 4 is an end view (on a different scale) of an annular band from which the sheet shown in Fig. 3 is produced by slitting said band lengthwise of the cylinder, the continuous reenforcing members being shown diagrammatically in dotted lines.

In the following detail description the reenforcing members have been designated as wire, however the same may be thread, yarn or the like.

Throughout the drawings like reference characters indicate like parts. 1 is a strip or tape-like mass of a composition having a rubber base, or of other suitable composition. 2, 2, are continuous, similarly inclined or sinuously curved wires embedded in the mass 1 and all lying in the same plane, as shown in Fig. 2, and extending lengthwise of said strip as shown in Fig. 1. As this Fig. 1 is a section on a plane passing through the centers of wires 2, 2, the latter are shown in full lines therein. 3, 3, form another group of differently inclined or similarly curved wires also embedded in the mass 1, but all located in a plane sunk further from the upper surface of the strip, as shown in Fig. 2. Consequently they are shown in dotted lines in Fig. 1. The planes in which the different groups of wire lie are all substantially parallel one to another. Usually, in practice, the curves of these wires are much flatter or more gradual than those shown in Fig. 1. Each wave length may extend over a length of several feet so that it will not be complete in any of the strip sections cut off for actual use, but I have made the drawings somewhat diagrammatic for the sake of clearness.

While the wave-like curves of the wires 2, 2, and 3, 3, are all substantially uniform in wave-length and amplitude, and all these

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wires so curved which lie in any one plane, as 2, 2, are parallel one to another, I prefer to have the wave-lengths, such as 8, 8, of different groups, staggered so that the crest of the wave of any wire of set 2, 2, will come opposite or nearly opposite the hollow of the wave of a wire in an adjacent set 3, 3. If the wave heights are sufficient the wires of adjacent sets will then more or less overlap, or, at any rate, be out of register one with another to some extent. This distributes the wires quite extensively throughout any one cross section of strip 1, (as generally indicated in Fig. 2) and avoids any transverse weakening effect which might occur if the corresponding wires in the various groups 2, 2, 3, 3, and so forth, were superposed directly one over the other at each such cross section.

Another advantage resulting from this arrangement of wires is that they then tend to enmesh any rivets 4, or other fastening means mounted in the supporting base 5, and passing through strip 1.

The preferred process of manufacturing a brake or friction lining, such as above described, is as follows: A composition of any suitable materials having a rubber or similar heat hardened binding base, with or without a mineral filler or short bits of fibre or wire mixed therewith to serve as a mechanical binder, is made up in a mixer of the Charles Ross or other similar type, and a thin sheet of this originally plastic material is then spirally wound up on itself on a revolving hot drum to form a built-up annular sheet 6, shown in Fig. 4. For this purpose I may use the well-known form of machine having a heated drum and a cooperating cold roll, commonly employed in making sheets from any rubber composition which is deposited as a plastic mass in the bight of said drum and roll, and initially vulcanizing the same. As this annular sheet is being formed by winding one convolution of the spiral upon another a plurality of fine wires (preferably of copper or brass) evenly spaced apart laterally are fed into the material and wound up with it. As the blanket of material accumulating on the drum becomes thicker the portions of wire being drawn into the mass are progressively embedded therein, each successive convolution of the wire spirals so produced lying slightly further and further from the axis of the annulus, as shown diagrammatically in dotted lines in Fig. 4, where the inner convolution of a wire spiral is formed by portions 3, 3, of the wire and an outer convolution by portions 2, 2. When the annular sheet has reached the desired thickness (which may require fifty, or more or less, revolutions of the drum, forming a corresonding number of convolutions of embedded wire) the sheet so formed with wires embedded therein is cut along a line parallel to the axis of the roll, as indicated at 9, 9, and the blanket-like mass is taken off the roll and flattened out as shown in Fig. 3. When this is cut up into strips, as indicated by dotted lines 7, 7, in said Fig. 3, a plurality of strips 1 are formed.

If during the winding in of these wires the guides through which they are delivered are moved gradually back and forth, lengthwise of the roll, the wire will be embedded in the mass in sinuous curves, as shown diagrammatically in Fig. 1, and if this motion is so timed that the equal wave-lengths 8, 8, of all the wires are not divisors of, nor divisible by, the circumference of the annular sheet, the wave crests and depressions of any two successive convolutions of the spirals of wire will not register one with another but will be staggered more or less as indicated diagrammatically at 8, 8, in Fig. 4, producing the relative arrangement of wires generally indicated in Fig. 1. Often the back and forth movement of the wire guides is so slow, relatively, to the circumferential speed of the heated drum, that each wave length of wire thereby produced will extend nearly around the drum or sometimes more than once around it, but the relative distribution of the different convolutions of wire will be the same in principle as is illustrated in Fig. 1 on a very much shorter wave length, for greater clearness and facility of explanation.

As an example of one usable mixture (although other mixtures of heat hardened binders may serve much better for certain special purposes) I may take 75 parts by weight of asbestos fibre, or other fibre (with or without short bits of wire intermixed), 25 parts by weight of a mixture of rubber and zinc oxide in equal proportions, by weight, and the proper amount of sulphur and any suitable vulcanizing accelerator. On treating this according to the above described process, including vulcanization, there will result a fairly dense, tough, elastic body, having a hardness and durability and a coefficient of friction on steel which are considerably higher than in the average woven asbestos brake lining. Such product is resistant to oil and has a low water absorption rate,—in short it is a material possessing all the desirable qualities of a brake lining.

In some forms of the product, such as gaskets, the extent of vulcanization may be reduced and of course the proportions and nature of the constituents may be varied to produce different degrees of hardness, flexibility and other qualities. For rigid brake blocks a composition of a rubber base and a proportion of filling materials and method of treatment would be adopted which would produce hardness, while for brake bands that must be bent around drums the constituents and treatment would be such as would produce flexibility.

While I prefer to use fine, flexible metallic wire in the manner above described, continuous strands of any organic or inorganic material may be substituted for them.

Having described my invention, I claim.

1. As a new article of manufacture, a body of dense, tough, material, having embedded therein, and extending approximately parallel to the surface thereof, a plurality of continuous wires each slightly curved in wavelike form, and arranged in a plurality of groups, the constituent wires of each of said groups lying in a separate plane, and all said planes being parallel one to another and sunk at different depths from the surface of the strip.

2. A structure such as defined in claim 1 in which the wires in any one of said planes are substantially parallel one to another.

3. A structure such as defined in claim 1 in which the wires in any one of said planes are substantially parallel one to another, but the wires in any one plane are out of parallelism with those in any adjacent plane.

4. A structure such as defined in claim 1 in which, all the wires in any one of said planes are substantially parallel one to another, but the wires in any one plane are out of parallelism with those in any adjacent plane and slightly overlap the wires in certain other planes, at a plurality of points.

5. As a new article of manufacture, a strip of initially plastic composition comprising a rubber compound as a base, having a plurality of continuous wires arranged in wavelike, reversed curves extending longitudinally thereof and embedded therein.

6. As a new article of manufacture a strip of initially plastic composition comprising a rubber compound as a base, having a plurality of continuous wires arranged in wavelike, reversed curves extending longitudinally thereof and embedded therein at different depths from the surface of the strip.

7. As a new article of manufacture a strip of initially plastic composition comprising a rubber compound as a base, having a plurality of continuous wires arranged in wavelike, reversed curves extending longitudinally thereof and embedded therein, said wires being arranged in a plurality of groups and these various groups being submerged at different depths in the strip.

8. As a new article of manufacture, a strip of initially plastic composition comprising a rubber compound as a base, suitable for brake linings and the like, having a plurality of continuous, slightly curved wires extending longitudinally thereof and embedded therein, said wires being arranged in a plurality of groups and these various groups being submerged at different depths in the strip, the wires in each group being substantially parallel one to another but inclined to the wires of adjacent groups and being staggered in cross sectional location with reference to those of the adjacent groups.

9. A brake member for automotive apparatus and the like comprising, in combination, a supporting base, a strip of molded material having a plurality of continuous wires embedded in, and extending longitudinally throughout said strip, and fastening devices anchored in said base, passing through said strip and wires.

10. A brake member for automotive apparatus and the like comprising, in combination, a supporting base, a strip of molded material having a plurality of continuous, slightly curved wires embedded and variously distributed as to cross sectional location in, and extending generally longitudinally throughout, said strip, and fastening devices anchored in said base, passing through said strip and enmeshed by said wires.

11. As a new article of manufacture, a strip of initially plastic composition comprising a rubber compound as a base mixed with short fibres as a mechanical binder, having a plurality of continuous wires arranged in wavelike, reversed curves extending longitudinally thereof and embedded therein.

12. A friction resisting material of the class described having a dense, tough body with asbestos fibre incorporated therein, a plurality of wave-like curved reenforcing members embedded in the body, the curves of all the members lying substantially in planes parallel to the upper surface of the body.

13. A friction resisting material of the class described comprising dense, tough, flexible material having asbestos fibre and short lengths of wire embedded therein, a plurality of long reenforcing members embedded therein at different depths, said members being in the form of a series of curves, with all the curves lying substantiallv in planes parallel to the upper and lower surfaces of the body.

14. In a friction resisting material of the class described having a body of tough, flexible material, a plurality of wavelike curved reenforcing members embedded in the material, the members being arranged in groups at different depths, the curves of the members of each group lying in substantially parallel planes.

15. A new article of manufacture comprising vulcanized rubber as a body, having short lengths of asbestos and wire incorporated therewith, a plurality of sinuously curved reenforcing members embedded therein, the curves of all the members lying in planes parallel to the upper and lower surfaces of the body.

16. In a friction resisting material of the class described having a body of tough flexible material, a plurality of long reenforcing members embedded therein in groups at different depths, said members having wavelike curves

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therein lying substantially in planes parallel to the upper and lower surfaces of the body, the curves in one group overlying the curves in other groups.

17. A friction resisting material of the class described comprising a body of tough, plastic material having asbestos incorporated therein, a plurality of wave-like curved long reenforcing members embedded therein, the members being arranged in groups with all the parts of adjacent curves in the respective groups lying at substantially the same depth.

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