Dec. 24, 1935. F. L. HESS 2,025,052

ARTICLE OF MANUFACTURE AND METHOD OF MAKING THE SAME

Filed Dec. 10, 1932

Fig. 1.

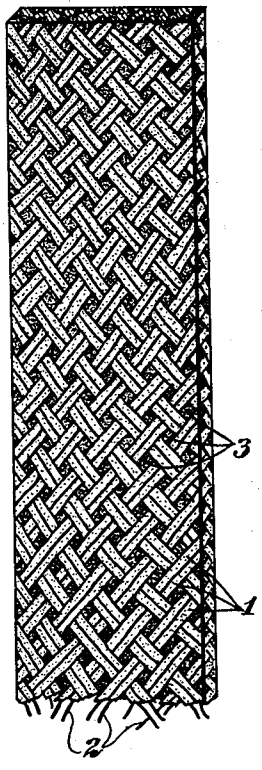


Fig. 2.

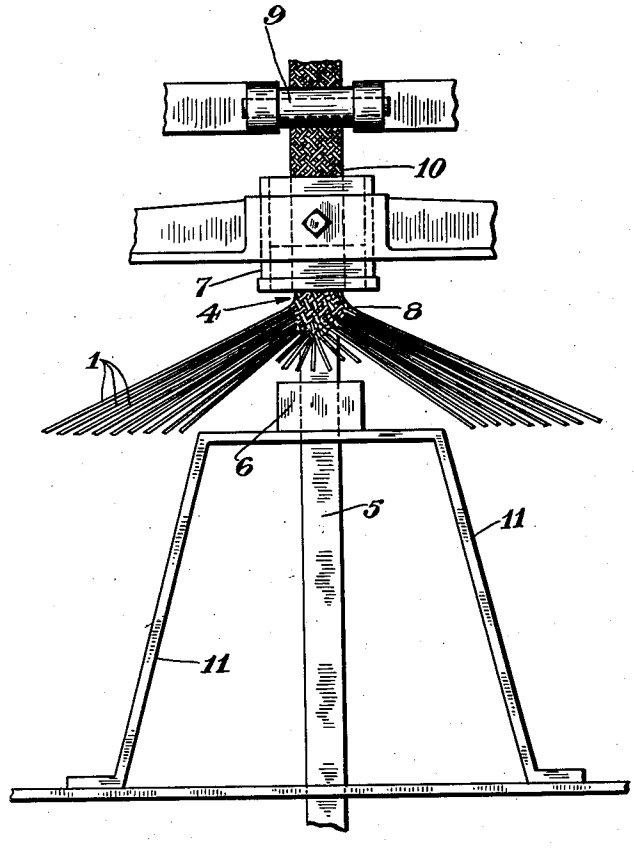
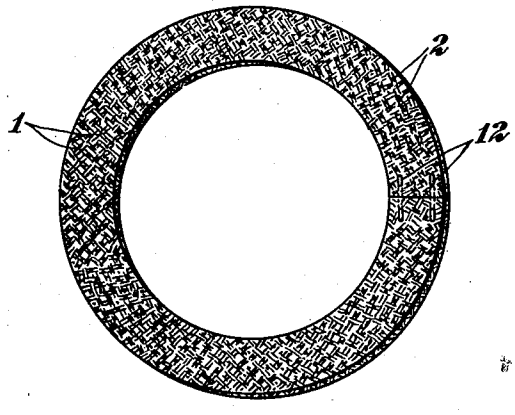


Fig. 3.



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ARTICLE OF MANUFACTURE AND METHOD OF MAKING THE SAME

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6 Claims. (Cl. 28—1)

This invention relates to an article of manufacture, particularly a friction material, and to the method of making the same.

The invention comprises the novel features hereinafter described or claimed, and, especially, a friction element, adapted for use as automotive brake lining or clutch facing, including a friction binder compound and reenforced asbestos yarn or the like fabricated into a unit disposed around the binder compound, then pressed firmly thereinto, to form an impregnated product, and maintained in selected shape by hardening of the binder. The invention comprises also the making of the improved product by a method which includes forming a shaped mass of binder compound, braiding or otherwise fabricating yarn therearound, pressing to force the binder into intimate association with the yarn, as an impregnating material therefor, and hardening the binder.

The invention is illustrated in the drawing in which:

Fig. 1 shows a perspective view of the product that is the embodiment of the invention preferred at this time, with certain parts broken away for clearness of illustration;

Fig. 2 shows a view of the product in the stage of being fabricated and, diagrammatically, the initial steps in the fabrication; and

Fig. 3 shows a perspective view of the product shaped into clutch facing.

There are shown strands of yarn 1 provided, suitably, with inner reenforcing wires 2 and a binder compound 3. The article shown as Fig. 1 may be produced by braiding the tube 4 around a shaped mass, say a strip of binder compound 5 passed to the braiding point through a guide 6, drawing the tube and enclosed binder through a forming die 7, to shape the product roughly into a band, and then pressing the tube and enclosed binder to form a band of desired dimensions, in such manner that the binder compound, supplied initially in the form of the strip, is caused to impregnate into the various interstices between the yarn in the braided fabric.

The yarn used is preferably asbestos, reenforced with small wires or other reenforcement that is conventional in asbestos yarn. Furthermore, the asbestos yarn may contain a certain proportion of other fibers, as, for example, one part by weight of cotton or wool spun with four parts of asbestos. If heat-resistance or other unique properties of asbestos are not desired, the yarn may consist of jute, flax, or the like.

The binder compound may be one comprising reenforcing fibers and a binder composition commonly used in friction materials. Thus, there may be used a friction binder compound comprising wire-reenforced asbestos yarn in short lengths, rubber and conventional vulcanizing oxidation, pigment, and filler materials. Also, there may be used a resinous phenol-aldehyde condensation product, a drying oil adapted to be hardened, as by polymerization and/or oxidation, as, for example, China-wood or linseed oil. Or, there may be used incompletely polymerized chloroprene of the empirical formula $CH_2:CCl.CH:CH_2$, of consistency, as used, resembling that of raw rubber and adapted to be hardened, that is, toughened by further polymerization.

Or, the binder compound may comprise a strip of woven asbestos fabric and a binder composition impregnated thereinto and coated heavily thereon.

In general, the binder is preferably one that is semiplastic or thermoplastic, as used initially, and adapted to be hardened and made resilient after it is impregnated into the fibrous material. When the binder is a rubber compound the hardening takes the form of vulcanization. A drying oil, if used, is hardened by being subjected to an elevated temperature, in an oxidizing atmosphere; a phenol-aldehyde resin, of the type of bakelite, is hardened at an elevated temperature; and chloroprene is hardened by being subjected to an elevated temperature, say to a temperature of approximately 300° F. for a period of time that may be about 40 minutes. The binder may be applied in the condition of being softened by a volatile solvent, which, if used, is evaporated before the binder is hardened or as part of the hardening process.

The invention will be illustrated by a specific product comprising reenforced asbestos yarn and rubber binder compound and the method of making such a product.

There is first made a rubber composition of type used in friction materials. It may have the following, typical composition:

	Parts by weight
Reclaimed rubber	10
Raw rubber	15
Sulphur	9
Litharge	7
Carbon black	10
Barium sulphate filler	38
Lead dust	7
Non-volatile, oily, rubber softener (50% resin and 50% heavy mineral oil)	2
China-wood oil	2
Total	100

Of the above rubber composition, 8 parts by weight are thoroughly mixed on rubber mixing rolls with 8 parts by weight of a macerated product resulting from cutting scrap reenforced asbestos cloth or yarn into small units, pieces or short lengths, respectively. The mixture is then incorporated into the remaining 92 parts of rub-

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ber composition, to give a semi-plastic mixture, in conventional rubber mixing equipment, and then is formed into sheets, as by being sheeted between socalled sheeter rolls which are conventional in the rubber industry. The sheet thus formed is cut into strips of width which adapts the strips to be inserted into a tube fabricated as will be described hereinafter.

Reenforced asbestos yarn is fabricated loosely into a tube comprising intercrossed strands, say into a braided tube in which the strands of yarn are braided in pairs and which tube contains relatively large interstices between the intercrossed strands permitting impregnation by the friction compound as described below. The tube is braided on a braider, which is conventional in the braiding of tubular packing, with bobbins, say 32 in number, providing each two parallel strands of yarn. The braider is no part of the present invention and, therefore, is not illustrated. The yarns are drawn around the strip of binder compound, as illustrated in Fig. 2, to form a braided tube that is approximately a flat ellipse in cross section.

I pass the strip of binder compound through a hollow form or guide **6**, near and just in advance of the braiding point **8**, to maintain the position and shape of the strip at the time the various strands of yarn are interbraided around the strip. This guide is supported suitably on rods **11**. Beyond the braiding point, the tube and the strip disposed therewithin are advanced, as by being wound upon a conventional reel (not shown). In being so advanced they may be drawn through the preliminary shaping or forming die **7**, to form an irregular band **10**, and then between squeezing rollers **9**.

Preferably, the strip of binder compound, before being passed through the hollow form, and having the tube braided around it, is provided with a film of rubber cement over its surface. This may be done by passing the strip, on its way to the hollow form, through a viscous solution of rubber, comprising, suitably, rubber compound, of the type contained in the strip, and a volatile solvent therefor. This cement coating softens the strip and facilitates the subsequent impregnation of the enclosing braided fabric. It will be noted, from Fig. 2, that the strip of binder compound is of width approximately equal to the inside width of the tube.

The braided tube and the strip of binder compound disposed therewithin, is then subjected to treatment to compress and flatten the tube and compound into a dense, rectangular band, cause the binder to be impregnated into the interstices in the fabric of the tube, size the band to the exact width and thickness desired, and vulcanize the rubber therein.

If desired, a coating of binder compound, say in the form of cement containing volatile solvent, may be applied to the outside of the tube shortly before the whole is compressed. After the cement is applied, the volatile solvent therein is allowed to evaporate before the pressing is undertaken. The pressing operation may then be made by passing the tube, with its enclosed strip of binder compound, through calender rolls. These calender rolls exert a strong flattening and compressing action, and cause the binder compound to be squeezed through the fabric, on either face of the band, and into the interstices therewithin. Further, the compression may be made so severe as to cause the fabric in the face portion and the fabric in the back portion of the band to come approximately or almost into contact with each other. The calenders are of the type used in shaping bands of brake lining or the like and contain not only rolls that establish the thickness but also an edge roll and oppositely disposed base plate that establish the width; the calendering trues up all surfaces and corners of the band.

In this manner the additional binder or friction compound, initially applied thus over the exterior surfaces of the yarn and the unitary mass of compound initially disposed within the tube, are made integral with each other and then are hardened in situ.

The flattening of the tube represents one example of shaping the tube around the mass of friction compound disposed therewithin; shaping to other forms than a flat band is intended to be included within the meaning of the term "flattening", so long as the tube is shaped and strongly compressed against the friction compound and the compound thus caused to impregnate the wall of the tube.

After being calendered, the resulting band is subjected to a process to harden the binder. Thus, the rubber therein is vulcanized, suitably in a steam-heated pressure die, which maintains or augments the condition of compression and densification produced during the calendering.

To make a clutch facing, the product made as described but before vulcanization may be bent edgewise into a disc, provided with brass staples **12** holding the two ends of the shaped strip in abutment, shaped more exactly and further compressed in a pressure die, then vulcanized, either under pressure or without pressure, and then ground on the faces, to make the faces uniform and improve the frictional characteristics.

The material so made has desirable features in addition to those that have been indicated already. It contains a high proportion of rubber, that is, more than can be impregnated conveniently into the ordinary, tightly woven fabric. This relatively high proportion of rubber decreases the porosity of the product and minimizes the penetration thereinto of water, dirt, and other undesirable materials during exposure of the product. Although the product is of multiply thickness of fabric, there is as large a proportion of binder compound in the central as in the outer portions. In fact, the proportion of binder compound in the central portion is usually larger than in the outer portions, in contrast to the condition which ordinarily prevails when the impregnated material is forced into a woven or braided fabric from the outside. This high proportion of binder in the central portion and the fact that the fabric in the face portion and the fabric in the back portion are continuous with each other and integrally united at the two edge portions of the article minimize the tendency of the product to separate into laminæ when used under severe conditions as brake lining or clutch facing in automobiles and the like.

The binder compound may be made without asbestos incorporated therein. The fibrous material in the binder compound, if used, may have the same composition as the yarn **1**.

The details that have been given are for the purpose of illustration, not for restriction, and many variations therefrom may be made without departing from the spirit and scope of the invention.

What I claim is:

1. In making an article adapted for use as friction material, the method which comprises braid-

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ing reenforced asbestos yarns into a loosely fabricated tube, disposing within the tube a single shaped mass of semiplastic friction binder compound adapted to be hardened, applying a coating of friction compound to the outside of the band, pressing the tube and binder compound into a flat band, and thus uniting the said semiplastic binder and coating and then hardening the binder in situ.

2. In making an article adapted for use as friction material, the method which comprises forming reenforced asbestos yarns into a loosely fabricated tube of intercrossed strands of yarn, forming a strip of rubber binder compound adapted to be inserted into the said tube, treating the exterior of the said strip with rubber cement, to form a viscous liquid film thereover, disposing the thus treated strip within the said tube as the tube is formed, pressing the tube to flatten and form it into a band and force the rubber binder compound therewithin into the interstices in the said fabricated yarn, and then vulcanizing the rubber in situ.

3. In making an article adapted for use as friction material for automobiles and the like, the method which comprises providing a single strip of friction compound, integrally fabricating therearound a tube of intercrossed strands of yarn, applying additional friction compound to the exterior surfaces of the said yarn, flattening the tube and strongly compressing it to cause the friction compound to impregnate the wall of the tube and to cause the said additional friction compound and the compound of the said strip to become integral, and then subjecting the article to treatment to harden the compound in situ.

4. A friction material, adapted for use as brake lining and clutch facing for automobiles and the like, comprising an integrally fabricated tube of intercrossed strands of yarn, a unitary mass of friction compound disposed within the tube, the said tube being in the condition of having been flattened around the mass of friction compound and pressed strongly thereagainst and the friction compound being thoroughly impregnated into the tube and securing together the face and back portions thereof, and additional friction compound applied over the exterior of the said strands and impregnated thereinto, the said additional friction compound and friction compound in the said unitary mass being integrally united and hardened in situ.

5. A friction material, adapted for use as brake lining and clutch facing for automobiles and the like, comprising a unitary mass of friction compound, strands of yarn loosely braided thereabout to form a tube, and additional friction compound applied over the exterior of the said strands, the product being in the condition of having been strongly compressed, to flatten the tube and bring the face and back portions approximately into contact with each other and to cause integral union between the friction compound of the said unitary mass and the additional compound applied originally over the exterior of the strands, and the friction compound having been hardened in situ.

6. A friction material, adapted for use as brake lining and clutch facing for automobiles and the like, comprising a unitary mass of friction compound, strands of yarn woven therearound to form a tube, and additional friction compound applied over the exterior of the said strands, the product being in the condition of having been strongly compressed, to flatten the tube and bring the face and back portions approximately into contact with each other and to cause integral union between the friction compound of the said unitary mass and the additional compound applied originally over the exterior of the strands, and the friction compound having been hardened in situ.

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