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UNITED STATES PATENT OFFICE.

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CLUTCH FACING AND PROCESS OF MAKING SAME.

No Drawing. Application filed June 4, 1921. Serial No. 475,147.

To all whom it may concern:

Be it known that I, SUMNER SIMPSON, a citizen of the United States, residing at Bridgeport, county of Fairfield, State of Connecticut, have invented an Improvement in Clutch Facings and Processes of Making Same, of which the following is a specification.

This application is a continuation in part of application Serial Number 221,002, filed March 7, 1918.

The invention relates generally to processes of producing clutch facings, with more particular reference to the various types of automobile clutches. It is well known that there are two highly important qualities which, on account of the nature of the work they are called upon to perform, should be possessed by clutch facings in general, first, they should have a uniformly high coefficient of friction, and second, they should be exceedingly tough in order to withstand the excessive wearing strains of use. Particularly in the case of automobile clutches, the replacing of the clutch rings is a laborious and expensive operation, and every effort has been made to produce these rings from material having a requisitely high and uniform coefficient of friction and adapted to withstand the strains of use for the longest possible period of time.

It will be apparent, moreover, that in addition to the two essential qualities mentioned aboye, in view of the heat which is produced by the friction, clutch rings or facings sould be constructed of material capable of being brought to high temperatures without undergoing either physical or chemical change, and on this acount asbestos has been generally employed as the base for clutch-ring material, for asbestos is not only well known to be capable of withstanding high temperatures without chemical or physical change, but it also possesses the requisitely high coefficient of friction, and good wearing qualities.

In the mining of asbestos, the mine run includes relatively long fibers, known as crude asbestos, the only part of the run that can be used for spinning, and relatively short fibers, known as fiber-asbestos, which cannot be spun. The crude asbestos is shipped to the spinning mill, where it is crushed, opened, carded, roved and spun, and then twisted around a metallic core, usually small-gauge brass or copper wire. This yarn is then woven into tape of the desired width and thickness, from which rings of the desired inside and outside diameter are formed. The rings are then chemically treated and baked at the proper temperature to make them coherent, tough, relatively hard, and possessed of the desired coefficient of friction.

With respect to this old process, it will be noted, first, that only a certain selective part of the mined asbestos can be employed—that is to say, the crude or long-fiber asbestos—and, second, that the spinning of these long fibers into filaments, the twisting of these filaments around the metallic core to form reinforced metallic yarn, the weaving of this yarn into fabric, the forming of the fabric into rings of the proper dimensions, and the treating and baking of these rings, constitutes an elaborate, complex and necessarily expensive process, the product of which, moreover, is not entirely satisfactory. That the product is defective is due to two principal causes; first, because in forming, treating and pressing rings of woven fabric it is impossible to produce rings which will hold correct inside and outside diameters and uniform thickness, and, second, because woven fabric, however treated, is always subject to a tendency to ravel, particularly after having been subjected to wear for an uncertain length of time.

The present invention has in view a process of producing asbestos-base clutch rings, in which carding, roving, spinning, twisting and weaving of the raw material is entirely dispensed with; furthermore, a process in which the short-fiber asbestos of the mine run may be utilized, and furthermore, a process by which may be produced integral asbestos-base rings of a homogenous character, not only of uniform dimensions and contour, but of a character to retain the original size, contour, homogeneity and other qualities throughout long-continued use thereof.

One of the characteristic features of the present invention relates to the percentage of binder incorporated in the finished ring. I have discovered that the precentage of binder very materially affects the ten-

sible strength and Brinnell hardness of the ring and has an important bearing on the commercial value thereof. For example, the use of from 10% to 20% is highly desirable. It is to be understood, however, that some variation from the above percentages may be allowed in certain cases, either somewhat below 10% or somewhat above 20%. I am here now talking about the use of a drying oil, as for example, such well known drying oils as linseed oil.

Among other analogous ways of carrying out my improved process, I may take the short-fiber asbestos stock from the mines, mix the same by any approved process of saturation with the proper proportion of a suitable liquid binder or binding compound, mold the same under compression to the desired form and size and then remove the facings from the molds and thoroughly dry the same either in the air, or by passing them through a suitable oven. In this manner, not only am I enabled to utilize what is known as low-grade asbestos fiber, but to produce clutch rings which experiments have demonstrated will wear longer, give much better results and be more efficient in every way than the woven endless or joined rings or facings. Furthermore, by molding under compression, a ring or facing from a homogeneous mass of plastic material, the process is carried on without the excessive waste of material which cannot be avoided under present methods of forming these rings from woven tape. Furthermore, it will be apparent that in mixing the materials to produce the plastic mass from which the rings are molded, I am enabled to insure saturation of the asbestos fiber with the binding material to a much more nearly perfect degree than is possible in the attempted saturation of rings formed from woven tape.

I have referred to molding the facings as one method of carrying out the invention. Another method consists in forming the fibrous pulp into a sheet on suitable sheet forming mechanism, cutting out the facings of the required shape and size and then saturating them with the drying oil binder above referred to in the percentages given. This oil may then be dried, preferably by submitting it to a baking operation such as previously referred to in connection with the baking of the woven ring. This baking should be continued until the rings have the required tensile strength and hardness to serve their purpose.

I may still further improve the product of my novel process by incorporating in the plastic compound, prior to compression, metal wire, preferably copper or brass wire which may be in the form of rings, or a woven mesh, or short lengths of wire may be indiscriminately dispersed throughout the mass. This metallic reinforcement imparts to the finished rings additional strength, rigidity and toughness.

It is desirable when the asbestos fibers are saturated with the binder before forming the rings that the fibers and the binder be thoroughly commingled or amalgamated through any preferred manner of agitation in a suitable container for such period of time as may be required to insure complete saturation of the asbestos fibers, and that after molding or sheeting the rings or sheets be thoroughly dried and baked, ordinarily in a heated oven.

The proportions of the ingredients to be employed is a matter of individual judgment. The ultimate object is to produce a solid homogeneous body in which the fiber predominates. Therefore, just enough of the binding liquid should be employed to saturate the fiber to an extent which insures substantial solidity and homogeneity under compression. Ordinarily, from 10% to 20% of the binder referred to is used and I am now referring to weight of binder as against the weight of dry ring before saturation. It is to be understood, however, that some modfication of these proportions is permissible, depending on the tensile strength and hardness required and also somewhat on the character of the asbestos fibre used.

In case loose fibre is to be saturated about eighty to ninety parts by weight of fibre are put into a mixer with about ten to twenty parts by weight of the liquid binder. A thinner, such as benzol or gasoline, may be added if desired and the mixture churned till the binder has covered all the asbestos fibres.

In case the asbestos fibre is formed into sheets and cut into pieces of the required shape and size before saturation, the saturation is effected by immersion in a mixture of the liquid binder and the flux and the immersion allowed to continue until the pieces have taken up sufficient saturant to leave about ten to about twenty per cent after subsequent baking.

The quantity of the saturant which is taken up by the asbestos fibre is determined by the gravity of the saturant, its viscosity and the duration of the immersion. For example, I have found that with a mixture of about two parts of the liquid binder with one of the thinner at a temperature from about seventy degrees to about eighty degrees F. depending upon the thinner used, from about ten per cent to about twenty per cent of residual saturant is taken up in one hour. Residual saturant is the quantity of the binding material which remains in the ring after curing.

Uniform density is a matter of prime consideration in the production of these

rings, for if the density varies the effects of wearing will be unevenly distributed and thus tend to shorten the useful life of the product. By saturating and thoroughly intermingling the fibers prior to compression, practically uniform density of the finished product is insured.

It should be noted that in all asbestos yarn as now manufactured, the use of a certain amount of cotton is necessary in order that the asbestos fibers may be "picked up" and carried over the card. The existence of even a comparatively small amount of cotton in clutch-ring material is manifestly objectionable, but its presence therein has been necessitated in the manufacture of rings from woven asbestos. It is highly important that the product of the present process is wholly free from cotton or any equivalent thereof.

Various materials may be used for a binder, but in certain circumstances I have found vegetable drying oils are particularly suitable, since they readily penetrate the fibers, and, upon drying, not only effect the desired cohesion of the asbestos particles, but waterproof and oilproof the product.

The present invention eliminates many expensive operations found in prior processes and removes the necessity for much costly machinery, besides making it possible to use low grade asbestos in the place of the long fiber required for weaving.

Having thus described my invention, I claim:

1. The process of making clutch facings which consists in providing an element composed of unwoven asbestos fibers impregnated with a saturant containing a hardening binder and then curing the element until the required strength and hardness has been secured, the amount of saturant being from about 10% to about 20% of the weight of fibre.

2. The process of making clutch facings which consists in providing an element composed of unwoven asbestos fibers impregnated with a saturant containing a drying oil and then curing the element until the required strength and hardness has been secured, the amount of saturant being from about 10% to about 20% of the weight of fiber.

3. A clutch facing comprising an element formed of unwoven asbestos fibers impregnated with a saturant containing a hardening binder and cured to give the required strength and hardness, the amount of the saturant being from about 10% to about 20% of the weight of fiber.

4. A clutch facing comprising an element formed of unwoven asbestos fibers impregnated with a saturant containing a drying oil and cured to give the required strength and hardness, the amount of the saturant being from about 10% to about 20% of the weight of fiber.

In testimony whereof I affix my signature.

SUMNER SIMPSON.

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