UNITED STATES PATENT OFFICE.

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PROCESS OF MAKING FRICTION FACINGS.

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To all whom it may concern:

Be it known that I, FREDERICK C. STANLEY, a citizen of the United States, residing in the city of Bridgeport, county of Fairfield, and State of Connecticut, have invented certain new and useful Improvements in Processes of Making Friction Facings, of which the following is a specification.

This invention relates to improvements in process of making friction facings and refers more particularly to a clutch facing or brake lining adapted for use in motor vehicles.

The invention is directed to a novel process of making a friction facing from felted unwoven asbestos fibre saturated with a binder.

The object of the invention is to provide a process by which the friction facing has a maximum tensile strength and hardness so that it can withstand the shocks to which these facings are subjected in a motor car and also will have sufficient resistance to abrasion; while at the same time it has the proper co-efficient of friction. It is also necessary that the binder in these facings must be unaffected by oil or water in use, which object is accomplished by the present invention without in any way detracting from the other characteristics.

The process may be carried out as follows: asbestos fibre preferably the short or low grade fibre is first ground in a suitable grinding machine or cutter. The ground material is then put into a beater mixed with the water or other solution and beaten into a pulp. The pulp is then delivered to a paper making machine as for example a wet board machine and formed into sheets or boards of suitable width and thickness. This forms an unwoven felted sheet.

As a feature of the invention, there is mixed with the pulp in the beater an oxidizing agent, as for example red oxide of lead. In using red lead as an oxidizing agent, the amount employed is approximately 1.6 per cent by the weight of the asbestos fibre although this can be varied according to the characteristics of the product desired. This oxidizing agent facilitates or hastens the cure of the binder and adds to the strength of the product and also converts the binder into a form insoluble by oil or water. It also tends to produce a uniform curing throughout the mass during the curing operation hereinafter described. It is to be noted that this reagent is put into the pulp before the formation of the sheet and not during the saturating and curing steps of the process.

After the sheets or boards have been formed as described, they are subjected to hydraulic pressure in suitable presses and are then hung up to dry in a drying room of sufficient temperature to remove the water. The sheet is then calendered to the desired thickness and the friction facings are then cut out of the sheet. The sheets are subjected to sufficient pressure in the calender to obtain as much tensile strength in the dry sheet as is feasible. The friction facings whether clutch rings or brake linings are now ready for saturation. The saturating tank is filled with a binder. This binder may consist of 94 per cent of linseed oil, 6 per cent of gilsonite in solution in the oil the mixture being thinned with gasoline to about 33° Baumé gravity. The friction facings are then immersed while suspended on suitable rods in this binder solution for a period of half an hour. The friction facings are then removed and put in a closed steam oven and maintained at a temperature of about 200° F. to drive off the gasoline which gasoline may be recovered and saved. This steam treatment is preferably continued from two to three hours. The friction facings are then removed to a closed baking oven where they are subjected to a temperature of about 250° F., for a period of twelve hours. The facings are then taken out of the oven and immersed in another saturating tank containing a solution of 66 per cent of linseed oil and 33 per cent of gasoline, the gravity of the solution being about 33° Baumé. This second immersion takes place for from two to three minutes. In both of the saturating steps double boiled linseed oil is preferable. The friction facings are then put into a second closed baking oven and maintained at a temperature of 300° F. for twenty-four hours. The heat in both of the baking ovens is preferably dry heat. The friction facings are then removed from the second oven and sand papered to micrometer size and to get a smooth finish to the facing. The facings are now ready for use.

I have given above an illustration in which the process is actually carried out in commercial operation. It is to be understood that the temperature and length of

treatment are subject to reasonable variations depending on the flexibility and strength required in the finished product. Also oils other than linseed oil may perhaps in certain cases be used and other asphalts substituted for gilsonite.

During the baking operation, the linseed oil, due to the presence of the air in the oven and also to the oxidizing agent in the sheet, is oxidized to produce a tough hard binder. The solubility of the linseed oil in gasoline before the baking treatments is practically 100% while after the baking treatments it is very materially reduced, and in fact, the baking operation may be so carried out as to make the oil practically insoluble in gasoline. It is to be noted that by means of the double saturation and double baking, a more efficient curing of the binder is obtained and the sheet can be impregnated with larger quantities of binder. This adds greatly to the tensile strength and hardness of the finished product. In order that the tensile strength of the friction facings made in this manner may be more clearly understood, I submit the following, giving actual tests made on such friction facings:

Thickness of sheet before calendering in inches.	Thickness of sheet after calendering in inches.	Average tensile strength of finished facing in pounds per sq. in.	Average hardness of finished facing by Brinnell test.
.150	.123	4614	23.4
.145	.123	4282	17.2
.140	.123	4028	16.6
.135	.123	3966	15.3

The strength and hardness of the product made by this process is far in exess, in fact from 1000 to 2000 lbs., upwards in tensile strength, over that heretofore obtained from any unwoven saturated friction facing and is even stronger than a woven sheet. The hardness also is proportionately increased over the friction facings heretofore made. It is to be noted that in the baking operation, the reaction develops autogenous heat or in other words exo-thermic and care must be taken to prevent the material from becoming so highly heated as to catch fire. This exo-thermic reaction results in the fact that the oxidation is of such a character as to generate heat in addition to that externally applied. This exo-thermic reaction of oxidation is well known in other arts as for example in the manufacture of air blown asphalt from petroleum residuum.

I claim as my invention:

1. A process of making a friction facing, consisting in mixing asbestos pulp with an oxidizing agent, forming the pulp into felted unwoven sheets, drying and calendering the sheets, cutting out the friction facings, impregnating the facing with a binder containing a drying oil, and a bitumen, baking the facing, subjecting the facing to a second saturation in a similar drying oil and subjecting the facing to a second baking.

2. A process of making a friction facing, consisting in mixing asbestos pulp with an oxidizing agent, forming the pulp into felted unwoven sheets, drying and calendering the sheets, cutting out the friction facings, impregnating the facing with a binder containing a drying oil and a bitumen, baking the facing at a temperature of 250° F. more or less, subjecting the facing to a second saturation in a drying oil and subjecting the facing to a second baking at a temperature of 300° F. more or less.

3. A process of making a friction facing, consisting in forming a felted unwoven sheet, the major portion of which consists of asbestos fibre, forming friction facings of the desired configuration from said sheet and subjecting them to a plurality of independent saturations and subjecting the facings to a separate baking operation after each saturation.

4. A process of making a friction facing, consisting in forming an unwoven sheet, the major portion of which consists of asbestos fibre, cutting friction facings out of said sheet, subjecting the facings to a plurality of saturations, and baking the friction facing after each saturation at a temperature sufficiently high to oxidize the drying oil and produce a maximum tensile strength in the facing and subjecting the drying oil to the action of an oxidizing agent.

5. A process of making a friction facing, consisting in forming an unwoven sheet, the major portion of which consists of asbestos fibre, forming the friction facings from said sheet, subjecting the facings to a plurality of saturations in a binder containing a drying oil, in separately baking the friction facing after each saturation at a temperature sufficient to oxidize the drying oil and produce a maximum tensile strength of not less than 3000 lbs., to the square inch.

6. A process of making friction facings, consisting in forming a facing of desired size and configuration, subjecting the facing to a plurality of saturations, in subjecting the friction facing to a separate baking treatment after each saturation, and continuing the baking until the binder has become substantially insoluble in a mineral oil such as gasoline.

7. A process of making friction facings, consisting in forming a facing of desired size and configuration, subjecting the facing to a plurality of saturations in a drying oil, baking the facing after each saturation and continuing the baking until the binder has become substantially insoluble in a mineral oil.

8. A process of making a friction facing

consisting in forming a facing, the friction surface of which consists essentially of asbestos fibre, saturating the facing with a waterproof binder and then baking the saturated facing in the presence of an oxidizing agent contained in the facing, the baking or curing operation being carried out under such a regulated temperature as to produce an exo-thermic reaction and oxidation of the binder.

9. A process of making a friction facing consisting in forming a facing, the friction surface of which consists essentially of asbestos fibre, saturating the facing with a waterproof binder and then baking the saturated facing in the presence of an oxidizing agent contained in the facing, the baking or curing operation being carried out under such a regulated temperature as to produce an exo-thermic reaction and oxidation of the binder.

10. A process of making a friction facing consisting in forming a facing having a substantially incombustible wearing surface and subjecting it to saturation in an oxidizable binder and then baking it in the presence of an oxidizing agent contained in the body of the facing.

11. The process of making a friction facing, consisting in forming an unwoven felted friction facing containing at the time of the felting operation an oxidizing agent of a nongaseous form, saturating the facing with a hydrocarbon binder, and in then subjecting the facing to heat at an elevated temperature.

12. The process of making a friction facing consisting of unwoven fibrous material, comprising incorporating with the unwoven material an oxidizing agent, in forming the unwoven material with the oxidizing agent into a sheet, in saturating the sheet with an oxidizable binder, and in then heating the saturated sheet.

13. The process of making a friction facing composed of unwoven fibrous material having an oxidizing agent incorporated therein, comprising saturating the facing with an oxidizable binder, and in then subjecting the facing to a heat treatment.

14. The process of making a friction facing consisting in forming an unwoven felted friction facing, containing an oxidizing agent in a nongaseous form, in saturating the facing with an oxidizable binder, and in then subjecting the facing to a heat treatment.

15. The process of making clutch facings consisting in forming an unwoven felted facing blank having a substantially incombustible wearing surface, subjecting the blank to saturation in an oxidizable binder, and in then subjecting it to heat at an elevated temperature, and at a step during the process before treating the blank with the oxidizable binder incorporating into the material an oxidizing agent of nongaseous form.

16. The process of making a friction facing composed of asbestos fiber, which consists in subjecting the facing to independent saturations in binders containing different relative quantities of binder constituents forming the binder, and in subjecting the facing to a heat-treatment after each saturation.

17. The process of making friction facings consisting of asbestos pulp formed into unwoven sheets, in cutting friction facings from the sheet, impregnating the facings with a binder containing a drying oil and bitumen, in then subjecting the facing to the presence of heat, in again saturating the facing with a drying oil and bitumen in relative quantities different from the quantities composing the first mentioned bath, and in then again drying the facing.

18. The process of making friction facings comprising grinding asbestos fiber into a pulp, in saturating the pulp with water and a nongaseous oxidizing agent, in forming the pulp into sheets, in cutting facings from the sheets, in immersing the facings in a bath of oxidizable binding material, and in then subjecting the facings to a heat treatment.

19. The process of making a friction facing composed of fibrous material, which consists in saturating the facing in a composite binding material, in heating the facing, in subjecting the facing after a heat treatment to a saturation in a second composite binding material containing different relative quantities of the binder constituents than said first mentioned composite binding material, and in heating the facing after its second bath.

20. The process of making friction facings composed of fibrous material, which comprises subjecting the facing to independent saturations in binders containing different relative quantities of binder constituents forming the binder, each bath containing an oil, and in heating the facing after each bath.

FREDERICK C. STANLEY.