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PROCESS OF MAKING FRICTION FACINGS

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This invention relates to the manufacture of brake linings, clutch facings and similar friction facings.

Facings of this character usually consist of a body member or element made of woven or felted asbestos fibre, the fibre being united by a binder of some kind. Drying oils and high melting point asphalts are largely used as binders. According to the usual method of manufacture the facing blanks are soaked in the binder which first is dissolved or thinned by benzol, naphtha, or some other solvent in order to make it penetrate the body of the blank more readily. It has been found impossible, however, to produce a uniform impregnation of a friction facing blank in this manner even when the blank is subjected to preliminary heating and vacuum treatments and the best impregnating methods are followed. The difficulty appears to be that the asbestos fibre is an exceptionally good filter and it strains out the more viscous constituents of the impregnating liquids.

This condition has long been recognized and various expedients have been adopted to produce a more uniform and thorough impregnation. Among these expedients may be mentioned particularly those of making the facing blanks more porous so that they will absorb the impregnating liquid more readily, and subjecting the facings to double impregnating and baking processes.

The present invention is especially concerned with the problem presented by these conditions in the felted or unwoven type of friction facings. It aims to devise a thoroughly practical solution for this problem, and in addition to provide a process for incorporating binders in solid form in friction facings of this type.

It is a further object of this invention to improve both the composition of friction facings and the methods of making them with a view to eliminating the squealing or squeaking which is very likely to occur when a brake or clutch is being applied or is "taking hold," and which is extremely annoying.

The nature of the invention will be readily understood from the following description of a preferred method of procedure, and the novel features will be particularly pointed out in the appended claims.

According to a typical process embodying this invention a quantity of asbestos fibre in a more or less crude condition is introduced into a beater of the type commonly used in processes of manufacturing paper. The asbestos is beaten until the fibre is thoroughly opened up and has become quite fluffy, the asbestos being suspended in water or any other suitable liquid. If a drying oil is to be used as a binder it is preferable to add an oxidizing agent to the fibre, and such an agent may be placed in the beater at this stage of the process. Red lead, manganese oxide or the common dryers used with drying oils are satisfactory for this purpose. After a brief period of further beating or agitating the drying oil is added to the mass in the beater. Preferably an emulsion of a drying oil such as linseed oil, china wood oil, or the like is used, the emulsion being made by any of the well known methods. Assuming that a thousand pounds of asbestos fibre is originally introduced into the beater, about four hundred pounds of a 60% drying oil emulsion is suitable and approximately twenty-five pounds of red lead of similar dryer.

For a time after the emulsion is added the roll of the beater may be left in an elevated position where it acts simply as an agitator and later lowered to its usual position. The asbestos fibre tends to settle to the bottom of the beater after the introduction of the oil emulsion and the mass therefore should be stirred with paddles for a considerable length of time, say half an hour, in order to lift the fibre and agitate the entire body of stock. Gradually the fibre takes up the oil and rises to the surface of the water.

If a pulverized binder or filler is to be added to the fibre it can be introduced at practically any stage of the beating operation. I consider it preferable, although not at all necessary, to introduce such pulverized solids after the fibre has become thoroughly wetted or coated with the drying oil or other liquid binder used. If gilsonite or other high melting point asphalts are to be incorporated in the facing as binders, they may be added at

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this stage of the process. For a batch of asbestos fibre of the weight above mentioned I prefer to add about one hundred and thirty-five pounds of pulverized gilsonite to the mass in the beater and to continue the agitation or beating so that the pulverized material will adhere to the fibre. Such adhesion appears to be facilitated very materially by the fact that the fibre is already more or less saturated with the oil. The greater part of the red lead or other oxidizing agent used has previously become attached to the fibre.

In order to fix these pulverized solids more firmly to the fibre, a sufficient quantity of a solution of alum or equivalent material is added to the beater mixture at this point to give the entire mass an acid reaction. For the batch above mentioned about one hundred pounds of alum is dissolved in a barrel of water and added to the mixture, the beating being continued to mix the solution thoroughly with the other materials in the beater.

The fibre so prepared may now be used in making a friction facing blank according to any suitable process. I prefer to make this fibre into a sheet or board and then to cut the facing blanks out of the sheet material so produced. For this purpose the fibre is drawn from the beater to a stuff chest and is then run to a board machine or paper making machine of the cylinder type where a laminated board is built up in the usual manner. The addition of the alum to the beater bath prevents the separation of the gilsonite, red lead, or other pulverized materials from the fibre which otherwise would occur. No substantial separation actually takes place, however, when the alum is used and the alum also seems to harden the fibre.

It will be clear that the board prepared in this manner has drying oil distributed substantially uniformly through it, and if gilsonite or some other pulverized binder or filler is used, such material also is distributed very uniformly throughout the entire structure of the board. The production of a board in this manner, however, permits a very accurate control of the entire manufacturing process, and results in a far more uniform and homogeneous product than can be produced by any other method of which I have been able to learn.

The further operations performed on the board so produced will depend very largely upon the nature of the final product to be made. In making brake linings and clutch facings the board usually is pressed under heavy pressure to squeeze out the surplus water and then preferably is allowed to rest or "season" for at least two or three weeks. Exactly what occurs in this seasoning process is not entirely clear, but probably a slow oxidation of the drying oil takes place. In any event, the seasoning step does appear to result in a superior product. The board next is calendered, the friction facings are died out to shape, and in the case of brake linings or shoes the blanks produced by the cutting or dieing out operation are next bent to the desired curvature. This obviously is not necessary in making clutch rings.

The facing blanks so prepared next go through a curing process which substantially changes the condition and characteristics of the binder. They are first dried at a temperature of from approximately 250° to 275° F. for about ten or twelve hours, and if they have been pressed to a curvature the drying operation is performed while the blanks are held in forms which prevent them from becoming misshapen to any great degree. A very thorough oxidation of the drying oil takes place at this time. Additional binder may be added to the blanks at this stage of the process, if desired, by soaking them in a liquid binder. For example, they may be immersed in a solution of, say, sixty parts of china wood or linseed oil dissolved in forty parts of naphtha. If they are placed in this bath immediately after being dried and while they are still warm, they will absorb quite a high percentage of the bath in half or three-quarters of an hour. When liquid binder is thus added to the rings by saturation they are next allowed to drain and are then subjected to an additional drying operation at 150° F., for example, for about twelve hours. Next the facings are pressed in molds under heavy hydraulic pressure to bring them down to approximately the desired thickness and they are then baked for about two hours at a considerably higher temperature than any to which they formerly have been subjected, a temperature of 375° being suitable. This baking operation is performed even when the saturating step is omitted, but for most products this step is desirable.

The facings now may be finished in any desired way, usually by drilling and counterboring them to receive the rivets by which they are to be fastened to the brake bands or metal clutch rings, and by surface grinding to size them accurately. In some cases these facings are redipped and baked a second time in order to give them an exceptionally hard shell, but this is rarely advisable.

The process above described produces friction facings which are exceptionally homogeneous in structure, due chiefly to the fact that the binder is distributed very uniformly throughout the entire body of the facing. This is accomplished by wetting the fibre thoroughly with oxidizing oil while it is in the beater and by attaching the pulverized binder, if one is used, to the fibre at this time. As above stated, the pulverized binder usually consists of a high melting point asphalt, and while it is attached to the fibre in a solid condition, this binder later is melted

in the drying and baking of the facings and soaks into the fibre at this time. A far more uniform impregnation of the facing both with drying oils and also with gilsonite or other solid binders, such as resins, is obtained by this process than can be produced by any of the prior methods of which I am aware. Furthermore, these materials are used economically which is important from a manufacturing standpoint, especially when expensive granular or pulverized binders are used.

In making certain friction facings, particularly brake linings, a part or all of the gilsonite or other high melting point asphalt is omitted, and in place of it a corresponding quantity of graphite is added to the beater, preferably at the point in the process at which the gilsonite was added. The pulverized graphite of commerce, such as Dickson's or Acheson's, may be used. This material will adhere readily to the fibre, particularly after it has become more or less saturated with oil in the beater, and it is firmly attached to the fibre when the bath is made slightly acid. The remaining steps of the process are carried out substantially as described above.

This addition of graphite and its distribution uniformly throughout the facing is particularly desirable in making brake linings where the graphite has the effect of modifying the coefficient of friction, and is especially valuable in preventing the squealing of the brakes which is so annoying. So far as I am aware, graphite has not been successfully introduced heretofore in friction facings of this type.

While a typical method of procedure has been above described, it will be understood that this disclosure has been made rather by way of illustration than limitation, and that considerable variation may be made in the procedure without departing from the spirit or scope of the invention. For example, the body forming material has been referred to as asbestos fibre, but it may be desirable for special purposes to add to the asbestos other materials, such as paper stock, although a predominating percentage of asbestos fibre is always used.

Having thus described my invention, what I desire to claim as new is:

1. A friction facing comprising a shaped body of unwoven felted asbestos fibre and a binder distributed substantially uniformly throughout said body and cured by heat, said facing also having a pulverized lubricating filler distributed substantially uniformly throughout the body portion thereof.

2. A friction facing comprising a shaped body of unwoven felted asbestos fibre united by a heat resisting binder distributed substantially uniformly throughout the facing, said facing also including a substantial percentage of powdered graphite distributed throughout the body thereof.

3. That improvement in processes of making friction facings, which consists in beating asbestos fibre in a liquid medium, causing a pulverized solid material to adhere to said fibre while it is suspended in said medium, making a friction facing blank from the fibre so treated, at some stage of the process associating a binder with the fibre of said blank, and subsequently curing said binder.

4. That improvement in processes of making friction facings which consists in beating asbestos fibre in a liquid medium until it is thoroughly opened, wetting said fibre thoroughly with a binder while the fibre is suspended in said medium, making a friction facing blank from said fibre, and subsequently curing said binder with heat.

5. That improvement in processes of making friction facings which consists in beating asbestos fibre in a liquid medium until it is thoroughly opened, wetting said fibre thoroughly with a drying oil while the fibre is suspended in said medium, making a friction facing blank from the fibre so prepared, and subsequently oxidizing said oil.

6. That improvement in processes of making friction facings which consists in beating asbestos fibre in a liquid medium until it is thoroughly opened, wetting said fibre thoroughly with a drying oil while the fibre is suspended in said medium, making a laminated board from the fibre so prepared, cutting friction facing blanks from said board, and subsequently oxidizing said drying oil.

7. That improvement in processes of making friction facings, which consists in beating asbestos fibre in a liquid medium until the fibre is thoroughly opened, causing a pulverized binder to adhere to said fibre while the fibre is suspended in said liquid, making a friction facing blank from said fibre, and subsequently heating said blank sufficiently to melt said binder.

8. That improvement in processes of making friction facings, which consists in beating asbestos fibre in a liquid medium until the fibre is thoroughly opened, causing a pulverized binder to adhere to said fibre while the fibre is suspended in said liquid, making a friction facing blank from said fibre, adding a liquid binder to said facing by saturation, and later heating the blank so treated sufficiently to melt said pulverized binder and to cure said liquid binder.

9. That improvement in processes of making friction facings, which consists in beating asbestos fibre in a liquid medium until the fibre is thoroughly opened, causing a pulverized binder to adhere to said fibre while the fibre is suspended in said liquid, making a friction facing blank from said fibre, at some stage in the process wetting substantially all of the fibre of said blank with a dry-

ing oil, and subsequently oxidizing said oil and melting said pulverized binder.

10. That improvement in processes of making friction facings which consists in beating asbestos fibre in a liquid medium until it is thoroughly opened, causing powdered graphite to attach itself to the fibre while the fibre is suspended in said medium, making a friction facing blank from the fibre so prepared, at some stage in the process wetting substantially all of the asbestos fibre of said facing with a liquid binder, and subsequently curing said binder with heat.

11. That improvement in processes of making friction facings which consists in beating asbestos fibre in a liquid medium until it is thoroughly opened, causing said fibre to absorb a drying oil while the fibre is suspended in said medium, attaching powdered graphite to said suspended fibre, making a friction facing blank from the fibre so prepared, and subsequently oxidizing said oil.

12. That improvement in processes of making friction facings which consists in beating asbestos fibre in a liquid medium until it is thoroughly opened, causing said fibre to absorb a drying oil while the fibre is suspended in said medium, attaching powdered graphite to said suspended fibre, making a laminated board from the fibre so prepared, cutting friction facing blanks from said board, and subsequently oxidizing said drying oil.

13. That improvement in processes of making friction facings which consists in beating asbestos fibre in a liquid medium until it is thoroughly opened, causing said fibre to absorb a drying oil while the fibre is suspended in said medium, attaching a pulverized solid material to said suspended fibre, making a laminated board from the fibre so prepared, cutting friction facing blanks out of said board, drying the blanks, immersing the dry blanks in a liquid binder, and subsequently baking the blanks so treated at a high temperature.

14. That improvement in processes of making friction facings which consists in beating asbestos fibre in a liquid medium until it is thoroughly opened, causing said fibre to take up a drying oil while the fibre is suspended in said medium, attaching a pulverized binder to said suspended fibre, forming a laminated board from the fibre so prepared, cutting friction facing blanks out of said board, and subsequently heating said blank sufficiently to melt said powdered binder and to oxidize said drying oil.

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