

# UNITED STATES PATENT OFFICE.

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FLEXIBLE VULCANIZED-FIBER BOARD AND PROCESS FOR MAKING THE SAME.

966,101.

Specification of Letters Patent.

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No Drawing.

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*To all whom it may concern:*

Be it known that I, GEORGE KELLY, a citizen of the United States, residing at Hinsdale, in the county of Dupage and State of Illinois, have invented a new and useful Flexible Vulcanized-Fiber Board and Process for Making the Same, of which the following is a specification.

This invention relates to a process for treating what is commercially known as vulcanized fiber board, whereby the latter is rendered soft and flexible for increasing the usefulness and adaptability of the article.

Vulcanized fiber board is made of cotton, flax or paper fiber chemically dissolved and solidified under great pressure. The resulting product is hard and inflexible and of strong and close-grained formation resembling somewhat ordinary horn. Owing to its inflexibility, its field of usefulness is greatly limited so that, in practice, its use is confined to the electrical art as an insulator. The product is unattacked by ordinary solvents, such as alcohol, ammonia, turpentine and the like, although it has the property of absorbing water and hence is useless even as an insulator in damp places.

The primary object of the present invention is to treat this vulcanized fiber board, as now found on the market, so as to render the same permanently soft and flexible. The vulcanized fiber, after being treated by the method presently to be described, can be used for upholstering material, chair seats, valises, power transmission belts, straps and the like, and is intended to take the place of leather and equivalent materials now used in the various manufactures and arts.

By extended experiment, I have found that vulcanized fiber board cannot be rendered soft by applying oils, grease or other softening agents either by immersion or coating the fiber therewith under atmospheric or high hydraulic pressure, although treated in this manner for weeks, as the softening agent is unable to permeate the interstices between the fibers of the material, with the result that the vulcanized board is just as hard at the end of the period of treatment as at the beginning. By immersing the board in water, the fibers become softened but the board does not remain permanently soft and returns to its original condition

of hardness and inflexibility as soon as the water evaporates. I have found, however, that the fiber can be rendered permanently soft by means of certain softening agents which are conducted into the vulcanized board by means of a suitable vehicle; that is to say, by using water as a vehicle, a softening agent such as glycerin can be conducted into the board to soften the fiber thereof, the glycerin being retained while the water evaporates or is otherwise removed. By treating the board with pure glycerin, no perceptible effect as to the diminution in hardness of the board results, but by diluting the glycerin with the vehicle or conducting agent, the glycerin can freely enter the board and remain therein as the softener. In relatively thin material, one treatment will be found sufficient to impart permanent flexibility thereto, but in thicker sheets, the process is carried on in stages, beginning with a water and glycerin solution of minimum density and increasing the density for the successive stages. After each stage, the board is removed from the bath or solution so that the water can be artificially or naturally extracted and thus leave the glycerin remaining. The partially treated sheet is immersed in a stronger solution and the water thereof conducts the glycerin into the fibers. In this manner, it is possible to impregnate the board with any desired quantity of glycerin in a much shorter time than would be required in a single stage with a solution of maximum density.

Although glycerin has been found to be useful to accomplish the foregoing results, it is to be understood that the process can be carried out with efficient results by the use of soap solutions, emulsions and the like, with or without commercial glycerin added.

Experience has shown that a non-drying oleaginous substance is the best to use to insure permanent results.

In order to illustrate the process more clearly, let it be assumed that a piece of vulcanized fiber board of one eighth inch thickness is to be treated. A solution of glycerin and water is prepared, varying from five to ten Baumé, and the fiber board is then immersed in the solution during a period varying from one to twenty-four days. Af-



ter the end of the required period, the board is removed from the solution and the water allowed to evaporate. After the water has thus been removed, a solution of about fifteen Baumé is used for the second stage, and after the fiber is allowed to remain in the second solution a suitable time, it is again taken out and dried by the removal of the water. These steps are repeated with solutions of a successively-increasing density until the proper amount of glycerin has been impregnated in the fiber sheet. The number of stages and the density of the solution will, of course, vary with the gage or thickness of the fiber sheets and according to the required flexibility of the finished product. The same board, if, instead of being treated as thus described, be immersed in a solution of twenty Baumé, the glycerin does not enter the board and it will be as hard when taken out as when it was immersed, but when treated with a weak solution in initial stage and gradually increasing the strength of the solutions, the permanent softening effect is obtainable. Again, if the board is first immersed in pure water, it will become soft, and if then treated with glycerin, it will be found to lack the power of absorbing the glycerin, the pores of the fiber being, of course, filled with water. It will thus be seen that the most advantageous method is to treat the board by solutions in which the water acts as a vehicle for conducting the softening agent into the vulcanized fiber. The water has a two-fold function in that it acts as a temporary softening agent and as a vehicle for carrying the permanent softening agent or glycerin into the fiber, the water being evaporable so that the substantially non-evaporable glycerin remains and a permanent softness or flexibility is imparted to the original hard and inflexible vulcanized fiber. After the final stage, the finished product can be given a coat of glycerin which has the effect of producing a smooth surface on the fiber, but this smooth surface can be obtained by rubbing or burnishing, if desired. The resulting product serves admirably as a substitute for leather and its present known substitutes, and, as it can be made in different thicknesses and colors, the range of usefulness is greatly extended. For instance, the material can be used as a substitute for upholstering cloth or other fabric, or as a substitute for the power transmitting belts now in use. It, therefore, compares favorably with leather belts which are usually made up of relatively small pieces glued or riveted together, or with rubber belts that are made in different plies, according to the thickness required, and besides the soft vulcanized fiber is considerably less expensive than leather or woven fabrics.

Having thus described the invention, what

I claim as new, and desire to secure by Letters Patent, is:—

1. The herein described process of permanently softening vulcanized compressed and hardened fiber board which consists in impregnating the same with a softening agent.

2. The herein described process of permanently softening vulcanized fiber board made of chemically treated fiber and solidified which consists in impregnating the fiber with a solution consisting of a softening agent and vehicle therefor, and finally removing the vehicle from the fiber while the softening agent remains.

3. The herein described process of softening vulcanized fiber after being solidified and hardened into an inflexible board which consists in impregnating the same with a solution containing a permanent softening agent, and an evaporable liquid serving initially as a softener for the fiber and as a vehicle for conducting the softening agent into the latter, and finally removing the said liquid from the fiber while the permanent softening agent remains.

4. The herein described process of softening vulcanized fiber sheet material made by compressing to solidification chemically dissolved fiber which consists in immersing the fiber in a solution of evaporable and non-evaporable liquids whereby the evaporable liquid serves as a vehicle for conducting the other liquid into the fiber, and finally removing the evaporable liquid from the fiber.

5. The herein described process of softening vulcanized fiber sheet material while in an inflexible, hardened and dried condition which consists in treating the fiber in successive stages, each stage consisting in impregnating the fiber with a solution of evaporable and non-evaporable liquids for a predetermined period and thereafter removing the fiber from the solution to permit the evaporable liquid to pass off, the solution in each successive stage being of greater density than the preceding stage.

6. The herein described process of softening hardened vulcanized fiber board which consists in immersing the fiber in a solution of water and glycerin, removing the fiber from the solution, and eliminating the water from the fiber and retaining the glycerin.

7. The herein described process of permanently softening vulcanized previously hardened and solidified fiber in sheet form which consists in immersing the fiber in a relatively weak solution of glycerin and water for a predetermined period, removing the fiber from the solution, and finally extracting the water from the fiber, and repeating the foregoing steps with stronger solutions of different proportions of water and glycerin.



8. A vulcanized fiber sheet or the like impregnated after solidification with a non-drying oleaginous substance to maintain the fiber sheet permanently soft.

5 9. A permanently soft vulcanized fiber sheet or board impregnated after vulcanization with glycerin.

In testimony, that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

GEORGE KELLY.

Witnesses:

W. FRANK RICHIE,

E. C. HALL.