

Cl. 18

# ALIEN PROPERTY CUSTODIAN

## METHOD OF ADDITIONALLY HARDENING NATURAL OR ARTIFICIAL SUBSTANCES OF A PARTICULAR STRUCTURE HAVING LINEAR CHAIN MOLECULES

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This invention relates to a method of additionally hardening natural or artificial substances of a particular structure having linear chain molecules, polymerized according to the method disclosed in the copending application Serial No. 202,011, filed April 14, 1938.

The above copending application relates to a method of hardening polymerized natural or artificial substances consisting in homogeneously mixing these substances with an interpolymerizable mixture of at least two components capable of being polymerized, at least one of said components containing two groups capable of being polymerized and then in interpolymerizing the total mixture. This method lends itself particularly to substances of a structure having linear chain molecules and permits among other things the hardening of polyisobutylene. As an example of interpolymerizable mixtures of substances styrene+divinylbenzol is mentioned in the above copending application. The method according to the above copending application may be called a pseudo-vulcanization.

The invention consists in a method of additionally hardening natural or artificial substances treated according to the method as disclosed in the above copending application. This may be accomplished by subjecting these substances to a subsequent heat treatment. In this case by the expression "heat treatment", such treatments are to be understood as are generally employed for the normal vulcanization; i. e., for instance, the substances are subjected to steam at a temperature of 130 degrees centigrade; however, no vulcanizing agents are employed. The method according to the invention is particularly employed for polyisobutylene treated according to the method disclosed in the above copending application.

The products produced according to the invention have not only a particularly high degree of hardness but they present the great advantage in that they may be softened at individual or all points thereof by a mechanical operation and then rehardened by a further heat treatment. The mechanical operation may, for instance, consist in a kneading or rolling operation. Consequently, waste material may be utilized again when producing other products. To attain the desired hardness it is, as a rule, sufficient to heat-treat the products, for instance, for half an hour at a temperature of 130 degrees centigrade. Of course, in this case the hardening period besides being dependent upon the temperature depends

also upon the thickness of the products to be hardened. It is preferable to carry out the method according to the invention in steam free of oxygen or in a protective gaseous atmosphere. The substances treated according to the invention have a low thermal conductivity. It is, therefore, preferable to quench the substances hardened, in cold water or in a cold current of air or in any other similar manner in order to avoid too long cooling periods.

The method according to the invention may also be carried out in the manner that materials treated according to the invention are mixed with pure starting materials; i. e., such starting materials which have not yet been hitherto treated according to the method of the above copending application. For instance, a substance, pseudo-vulcanized according to the invention and containing polyisobutylene, may be mixed with pure polyisobutylene. If the same degree of hardness is to be attained in this mixture as in the portion of the pseudo-vulcanized substance contained therein, a corresponding quantity of the interpolymerizable substance, i. e., for instance, of the styrene+divinylbenzol mixture, computed in accordance with the quantity of polyisobutylene is added thereto, considerable periods being then necessary to additionally harden the total mixture.

The above essential feature of the invention can be contributed to the fact that the particles of the interpolymerizable substance, i. e., for instance, of the styrene+divinylbenzol polymer, added according to the method disclosed in the above copending application conglomerate in a network-like manner owing to the heat treatment so as to form considerable complexes. This network is again destroyed by the mechanical operation.

The invention may, for instance, be employed in all such cases where products must be temporarily in a deformable state and temporarily in a less or non deformable state as the case may be. If therefore conduits for electric conductors, made of artificial substances are to be laid, the conduits may be first hardened according to the invention so that they are rigid or solid and do not sag when laid and the conduits are deformed to the desired degree by a simple mechanical operation at the points where there should be bends, curved tube portions etc.

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