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Cement:
Inorganic fillers

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METHOD OF MANUFACTURING PRESSURE-
PROOF INSULATING BODIES ESPECIALLY
FOR ELECTROLYTIC CELLS

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8 Claims. (Cl. 18—47.5)

This invention relates to a method of manufacturing pressure-proof insulating bodies especially for electrolytic cells. In applicant's divisional application Serial No. 10,589, filed March 11, 1935, claims are made to insulating bodies of the nature produced by this method.

The discovery of an insulating construction-material suitable for electrolyzers, especially in connection with the decomposition of water under low or high pressure, has given rise to comparatively great difficulties owing to the great and extensive requirements demanded from such construction-material for these purposes. Insulating materials such as glass, fibre, and vulcanite, hitherto employed, can at once be eliminated as not possessing any permanent resisting power to the concentrated electrolytes with their subsequently arising active gases used in these electrolyzers. The use of such non-permanent materials not only leads to the destruction of vital construction elements but also, by the resulting reaction products, the electrolyte will be made impure, thereby having a detrimental effect on the efficiency of the apparatus.

In the category "varnish" various materials have been discovered, having the power of resistance and constancy which have in every respect proved efficient in withstanding concentrated electrolytes and their active gases. Foremost in consideration are cellulose-ether-compositions, such as benzyl- and ethyl-cellulose, discovered during the last few years.

It has also proved expedient to mix such varnishes with inorganic filling material such as asbestos, powdered asbestos, powdered slate etc.

On the other hand, these materials prove noticeably defective, particularly under high temperature and high pressure, for they have the tendency, under high temperature, of growing soft.

In utilizing these materials, especially for electrolytic cells, as a result of the softening under high temperature, there arises the risk of a deformation under the pressure-load. This deformation is, in the case of construction parts which have channels or must maintain a certain distance from each other, particularly detrimental because, owing to the yielding of the material in the direction of the pressure, e. g. in the case of filter-press-electrolyzers by movement towards the securing spindles, the distances between the electrodes may be decreased to such an extent as to interfere with the regular passing of the gas-electrolyte-mixture. The yielding of the material results in its bulging, which will disadvan-

tageously increase the diameter of the cell-body and, what is even of greater danger, will decrease the cross-section of the channels hollowed in the frames, even narrowing them to such an extent as to make impossible an unimpeded passing off of the gas-electrolyte-mixture so that the gas will thus accumulate in the cell-spaces, thus resulting in the destruction of the cells.

The problem set by the inventor consists in discovering a medium for overcoming the softening of such materials under high temperature. This is to be effected by admixing stiffening agents with the construction materials or their component parts while still in a plastic state, such stiffening agents possessing the peculiarity of not losing their stiffness even under a rising temperature.

Consequently, the method for manufacturing pressure-proof insulating bodies especially for electrolytic cells, of materials or their component parts softening under heat, consists in adding setting or stiffening substances to the construction material in its plastic state. This quality of allowing the material to set, and the subsequent consolidation of the admixed stiffening substance, result in achieving the desired effect, for such setting substances e. g. cement etc. possess the peculiarity of not afterward losing their consolidation effected by the setting process, not even under considerably increased temperature. In addition, the setting process leads furthermore to the valuable complementary phenomenon that each setting substance expands by the chemical processes taking place, thus allowing the moulds to be well filled out during the moulding process, resulting in a perfect form.

The setting stiffening medium forms within the finished constructional part a porous skeleton, the pores of which are uniformly impregnated with the other construction substances. Even under high temperatures, the finished porous skeleton offers a satisfactory resistance to the compressive force acting upon it, and prevents the yielding and bulging of the construction material, whilst the construction material proper, filling the pores of the skeleton, adds to the construction piece itself the necessary properties, namely, insulating effectiveness, density etc.

Cements, added to the construction material proper or the component parts of the construction material, have to be chiefly considered as stiffening agents whereby, in the case of utilizing cellulose-ether compositions, the quantity of water necessary for the setting process has to be added simultaneously with the cement.

A mixture consisting of 4 parts of varnish solution, one part of asbestos fibre, one part of Roman cement, and 2 to 3 parts of water has proved advantageous.

The varnish solution can, for example, be made by dissolving one part benzyl-cellulose in 10 parts benzene or in a benzene xylolite mixture 1:1. In place of benzyl-cellulose also ethyl-cellulose or some other cellulose varnish can be used.

Now, 4 parts of thus obtained varnish solution are mixed with one part well-loosened asbestos fibre and thoroughly compounded. Thereupon, one part Roman cement, first mixed with 2 to 3 parts of water, is added to 5 parts of this pulpy mass, and the whole is thoroughly intermixed. By this means a kneadable, doughy mass results which is easily mouldable. The required weight of this mass is, for example, now placed in a well-moistened wooden mould and left to dry for some time to allow the solution-agent to escape. The final stability and shape is obtained by gradual firm pressing and drying of the mass in steel moulds. Care has to be taken that the cement has not entirely been allowed to set prior to the final pressing process as, otherwise, the inner structure is liable to be demolished.

In place of an immediate shaping of the form it is of advantage to spread out the plastic doughy mass in thin layers and thus allowing the solution-agent or solvent to evaporate. Prior to the layer being entirely dried out, it is completely torn apart into small pieces by a shredding machine and placed in a heated pressing mould which can be made of steel. The mass is pressed under high power, resulting in a solid moulded article.

This additional process has the advantage of shortening the working process on account of the easily evaporable solution escaping fairly quickly from the thin mass, whilst it takes longer for it to rise from the interior of the body to the surface and to evaporate therefrom. In the latter case, the solution-agent generally carries some cellulose with it, which causes the disadvantage of the inner layers becoming impoverished in cellulose.

Whilst it is possible for the body to be produced in two stages of pressing according to the second process, 8 to 10 stages of pressing are required with the first process.

I claim:

1. The method of manufacturing an insulating body capable of resisting the combined effects of heat and pressure without substantial deformation so that it is adapted for an electrolytic cell, which comprises mixing an inorganic fibrous filling agent, a thermoplastic insulating material comprising a varnish solution containing a material of the group consisting of benzyl and ethyl cellulose in a volatile solvent therefor, and a water hardening cement in the presence of water, pressing the mixture and effecting a partial drying and elimination of the solvent, and finally pressing the composition into the final form of the body prior to the setting of the cement, and then permitting the cement to set and locally unite the particles of the fibrous filling agent for forming within the thermoplastic material a rigid skeleton, the pores of which are uniformly filled and closed by the thermoplastic material.

2. The method of manufacturing an insulating body capable of resisting the combined effects of heat and pressure without substantial deformation so that it is adapted for an electrolytic cell,

which comprises mixing an inorganic fibrous filling agent, a thermoplastic insulating material comprising a varnish solution containing a material of the group consisting of benzyl and ethyl cellulose in a volatile solvent therefor, and a water hardening cement in the presence of water, preforming the mixture in a porous mold and finally pressing the composition into the final form of the body prior to the setting of the cement, and then permitting the cement to set and locally unite the particles of the fibrous filling agent for forming within the thermoplastic material a rigid skeleton, the pores of which are uniformly filled and closed by the thermoplastic material.

3. The method of manufacturing an insulating body capable of resisting the combined effects of heat and pressure without substantial deformation so that it is adapted for an electrolytic cell, which comprises mixing an inorganic fibrous filling agent, a thermoplastic insulating material comprising a varnish solution containing a material of the group consisting of benzyl and ethyl cellulose in a volatile solvent therefor, and a water hardening cement in the presence of water, effecting a partial drying and elimination of the solvent prior to the final formation of the body, and finally pressing the composition into the final form of the body prior to the setting of the cement, and then permitting the cement to set and locally unite the particles of the fibrous filling agent for forming within the thermoplastic material a rigid skeleton, the pores of which are uniformly filled and closed by the thermoplastic material.

4. The method of manufacturing an insulating body capable of resisting the combined effects of heat and pressure without substantial deformation so that it is adapted for an electrolytic cell, which comprises mixing an inorganic fibrous filling agent, a thermoplastic insulating material comprising a varnish solution containing a material of the group consisting of benzyl and ethyl cellulose in a volatile solvent therefor, and a water hardening cement in the presence of water, molding the mixture by pressure and effecting the elimination of the solvent of the varnish solution in stages which bring the body to final form prior to the setting of the cement and then permitting the cement to set and locally unite the particles of the fibrous filling agent for forming within the thermoplastic material a rigid skeleton, the pores of which are uniformly filled and closed by the thermoplastic material.

5. The method of manufacturing an insulating body capable of resisting the combined effects of heat and pressure without substantial deformation so that it is adapted for an electrolytic cell, which comprises mixing an inorganic fibrous filling agent, a thermoplastic insulating material comprising a varnish solution containing a material of the group consisting of benzyl and ethyl cellulose in a volatile solvent therefor, and a water-hardening cement in the presence of water, spreading the mixture in thin layers for preliminary evaporation, disintegrating the layers, molding the disintegrated material by pressure and heat prior to the setting of the cement, and then permitting the cement to set and unite the particles of the fibrous filling agent for forming within the thermoplastic material a rigid skeleton, the pores of which are uniformly filled and closed by the thermoplastic material.

6. The method of manufacturing an insulating body capable of resisting the combined effects of

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heat and pressure without substantial deformation so that it is adapted for an electrolytic cell, which comprises forming the body by mixing one part of asbestos fiber, four parts of insulating varnish solution including a material of the group consisting of benzyl and ethyl cellulose in a volatile solvent therefor, one part of Roman cement and two to three parts of water, effecting a partial drying and elimination of the solvent prior to the final formation of the body, and finally pressing the composition into the final form of the body prior to the setting of the cement, and then permitting the cement to set and locally unite the particles of the fibrous filling agent for forming within the cellulose ether a rigid skeleton, the pores of which are uniformly filled and closed by the cellulose ether.

7. The method of manufacturing an insulating body capable of resisting the combined effects of heat and pressure without substantial deformation so that it is adapted for an electrolytic cell, which comprises forming the body by mixing an inorganic fibrous filling agent, an insulating varnish solution containing benzyl-cellulose in a volatile solvent therefor, and a water-hardening cement in the presence of water, effecting a partial drying and elimination of the solvent prior

to the final formation of the body, and finally pressing the composition into the final form of the body prior to the setting of the cement, and then permitting the cement to set and locally unite the particles of the fibrous filling agent for forming within the benzyl-cellulose a rigid skeleton, the pores of which are uniformly filled and closed by the benzyl-cellulose.

8. The method of manufacturing an insulating body capable of resisting the combined effects of heat and pressure without substantial deformation so that it is adapted for an electrolytic cell, which comprises forming the body by mixing an inorganic fibrous filling agent, an insulating varnish solution containing ethyl-cellulose in a volatile solvent therefor, and a water-hardening cement in the presence of water, effecting a partial drying and elimination of the solvent prior to the final formation of the body, and finally pressing the composition into the final form of the body prior to the setting of the cement, and then permitting the cement to set and locally unite the particles of the fibrous filling agent for forming within the ethyl-cellulose a rigid skeleton, the pores of which are uniformly filled and closed by the ethyl-cellulose.

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