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PROCESS FOR THE PRODUCTION OF MASSES AND SHAPED PIECES POSSESSING HIGH ELECTRIC, CHEMICAL, MECHANICAL AND THERMIC STRENGTH

Herbert Witzenmann, Munich, 13, Germany; vested in the Alien Property Custodian

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This invention relates to a process for the production of masses and shaped bodies possessing high electric, chemical, mechanical and thermic strength. According to this process masses of the following composition are obtained by smelting:

	Per cent
SiO_2	30–80
MnO	4–54
MgO	0–35
Al_2O_3	0–30
CaO and/or SrO and/or BaO	0–30
WO_3	0–3
$Ca_3(PO_4)_2$	0–5

By suitably proportioning the constituents of the gob and by certain additions, which will be hereinafter explained, the masses and shaped pieces which are obtained can be influenced in different directions, according to the properties which are especially desired in each instance.

At the preparation of a dielectric of high electric insulating property, two properties have to be observed especially.

1. The mass must contain only a small percentage of alkali compounds, especially alkali oxides, or it must be free from alkali. Alkali compounds and alkali oxides affect the electric conductivity and the disruptive strength as well as the surface resistance of the masses in question in a manner which is the more unfavorable the stronger they are present in the same. Their expansion coefficients are further comparatively high, whereby in turn the constancy against change of temperature of the corresponding masses is unfavorably influenced. A high content in alkali reduces the mechanical and chemical strength of the corresponding masses.

2. At the preparation of the dielectric it is advisable to strive for the highest possible homogenity of the same. As in inhomogenous media the chief drop in voltage occurs on the constituent with the smallest dielectric constant, the drop in voltage predominates in the constituent having a low dielectric constant when the dielectric constant is high in the other constituent, especially in the air film or air bubble. Consequently glow discharge occurs here easily, which might lead to heating of the insulator and to heat disruption, and also to the releasing of voltages of the workpiece which might still exist.

The two required properties, low content in alkali and high homogenity, are, however, in a certain opposition. The alkalis as excellent flux enable in glasses the purification of the same and therefore their homogenisation, in porcelains the production of a scarf as tight as possible at normal temperatures. The same result can be obtained in masses free from alkali, if at all, only at temperatures which in practice can no longer be applied owing to the extraordinarily high cost of the products. The introduction of B_2O_3 in silicates makes it possible to do justice to both requirements (the almost complete exclusion of the alkalis and the obtention of homogenous workpieces). There are, however, serious objections against the employment of B_2O_3. If used in percentages above 5% B_2O_3 increases the lixiviation capability of the glasses. It is further known, that boron silicates of high electric and thermic strength owing to their high content in silicon are rendered much expensive not only by the comparatively high price of the boric acid but also by the technological difficulties of their preparation. Glasses of this kind melt only at high temperatures. The melting can take place only in crucibles or vats of the expensive materials capable of withstanding this stress. The difficulties which occur at the shaping and cooling are not less great. Finally, alkali compounds can practically not be completely dispensed with also in glasses of this kind.

The present invention overcomes these difficulties. It enables, which up to the present has never been the case, the preparation of masses free from alkali and boric acid at melting temperatures which approximately correspond to that of the window glass. In connection herewith it has to be pointed out that the corresponding masses can be easily worked. The modification capability of the manganese silicate is further one of its excellent properties and owing to this capability several special properties may be imparted to the same by additions of different kinds. Consequently, if desired, small quantities of alkalis or boric acid may be added to the mass. If it is desired to prepare, instead of the easily meltable mass, a difficultly meltable mass with the corresponding special properties of this modified form, it is also possible to develop masses with especially high content in silicon and alumina in the range according to the formula, said masses melting only at a temperature of over 1450°.

Before the melting the raw materials disintegrated very finely are mixed in a suitable manner, for instance in an Alsing cylinder. The mixture is molten in suitable containers at temperatures between 1250° and 1450° (with the exception of the higher melting special forms mentioned above). Single constituents of the mixture may also be first kept back and gradually added during the melting of the other constituents.

The components of the above mentioned gob

	Per cent
SiO_2	30–80
MnO	4–54
MgO	0–35
Al_2O_3	0–30
CaO and/or SrO and/or BaO	0–30
WO_3	0–3
$Ca_3(PO_4)_2$	0–5

may also be introduced wholly or partly in other form. The silicon (SiO_2) may be wholly or partly replaced by SiC, the manganese oxide (MnO) by MnO_2, Mn_2O_3, Mn_3O_4, $MnCO_3$, $MnCl_2$, $MnHPO_4$ or MnS, the magnesium oxide (MgO) by $Mg(AlO_2)_2$, $MgNH_4AsO_4$, $MgBr_2$, $MgCO_3$, $MgCl_2$, MgF_2, $Mg(OH)_2$, $Mg(NO_3)_2$, $Mg_2P_2O_7$, Mg_2SiO_4, $MgSiO_3$ or $MgSO_4$ the argillaceous earth (Al_2O_3) by Al_4C_3, $AlCl_3$, AlF_3, AlN, $Al(OH)_3$, $AlPO_4$, $Al_2(SO_4)_3$, Al_2S_3, the calcium oxide (CaO) by $CaBr_2$, CaC_2, $CaCO_3$, $CaCl_2$, $CaCN_2$, CaF_2, CaJ_2, $Ca(MnO_4)_2$, $Ca(NO_3)_2$, $Ca(PO_3)_2$, $CaSiO_3$, or $CaWO_4$. Further the calcium oxide or the calcium containing additions may be replaced wholly or partly by the corresponding strontium- and barium compounds. Barium is known as flux. In some gobs with high content in manganese the constituent in barium must, however, not be high, as otherwise the mass will become inhomogenous and porous. Strontium is in many instances better suited to replace the barium wholly or partly, preferably in form of strontium carbonate, strontium chloride or strontium sulphate.

To the mass known coloring substances may be added also. By addition of titanium compounds the dielectric constant can also be increased.

By addition of circonium compounds together with alumina especially the strength against hydrolytic influences and against alkalis is increased.

To the molten mass reducing agents such as tartar, tartaric acid, urea, sugar, charcoal and others, and purifying agents such as antimony, antimony sulfide, arsenic compounds and others may be added.

The masses are cooled at suitable temperatures adapted to the composition and stressing.

HERBERT WITZENMANN.