A LINING FOR GLASS POTS¹

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It is the purpose of the present paper to describe a process for manufacturing glass pots which renders them less corrodible by the molten glass and extends their useful life, at the same time improving the quality of the glass produced. This process is particularly applicable to pots used in the melting of heavy lead glass containing potash. It is characteristic of potash-lead glass, that while it is not a very good solvent for clay, nevertheless on account of its density and fluidity at the melting temperature it penetrates the interstices of the pot wall, causing the well known "honeycomb" effect. A further result of such action on the pot wall is that it loosens less soluble portions of the wall, usually consisting of grog particles that float into the glass where they appear as stones and cause much loss of production and rejection of otherwise well made ware.

In the attempt to remedy this condition, that is, to produce a pot resistant to the "honeycomb" action of potash-lead glass, it was readily recognized, in accord with the opinion of Seger and other authorities, that the physical rather than the chemical constitution of the pot wall is of greater importance. Porosity tests made by boiling a weighed piece of pot shell in water, cooling it in water, then wiping off the surplus water and re-weighing, showed that the usual pot wall, except portions that have been greatly overburned, has a porosity, expressed in terms of per cent of water absorbed, averaging 10 per cent. It is thus easy to see how a considerable penetration could be effected by melted glass.

The problem then was to reduce this porosity so as to present an impenetrable wall to the glass. It was considered best not to make the entire pot out of non-porous material for the reason that glass pots are subject to such great variations in temperature,

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and the looser structure of the wall permits expansion and contraction with less danger of fracture. The attempt was made to develop a lining, carried upon a pot wall of the ordinary porous refractory type, which should protect the wall against the attack of the glass.

A refractory clay body having the general character of porcelain is recognized as the least porous that can well be produced. Such a body it was found after some experimentation could be formed from the ordinary glass pot batch by the introduction of feldspar to form a sintering bond between the clay particles producing the phenomenon generally referred to as vitrification. Test pieces made in this way showed less than 1 per cent porosity under the treatment described above. The fragments of such vitrified pieces showed a very small rate of attack by fused sodium carbonate, compared with pot shell.

A choice of suitable composition for the feldspar clay mixture depended entirely upon the temperature at which the pot was to be used. In the first large-scale experiment the mixture of 90 per cent pot batch and 10 per cent feldspar was fixed upon, since this formed a very dense body after burning at 1300° C, yet did not show over burning at that temperature.

The process of applying this lining to the glass pot was simple. The lining mixture, worked up into rolls in the usual manner, was placed along the bottom and sides of the pot, as the latter was built, forming a finger-course about $\frac{1}{2}$ inch thick up to the metal line and diminishing in thickness, leaving off about 8 inches higher. Because of the fact that the lining material did not differ materially in proportions of raw clay and inert material from the composition of the balance of the pot, no difficulty was experienced in drying the pot, and a homogeneous body was obtained at all times.

The results obtained in using such pots have been very good. Experience has shown that it is often necessary to reduce the proportion of feldspar as much as 5 per cent. After firing in the furnace the lining develops a very dense structure and formation of stones is reduced to a minimum. Also, the attack on the pot wall is greatly retarded so that the useful life of the lined pot is from two to three times that of the ordinary pots, in potash-lead

glass. Moreover, although the lining itself may be entirely dissolved from a certain portion, notably the "knuckle" of the pot, it has by that time protected the wall until the latter has reached a stage of vitrification causing it to be very resistant to corrosion. The only difficulty experienced has been in the formation of cracks in the lining, due to the inability of such dense material to withstand the cooling shocks incident to charging with cold batch. These cracks, while not worse than those ordinarily forming in pots, permit the glass to penetrate into the less resistant pot wall and are really the cause of the final failure of the pots.

These lined pots are easier to handle than pots made entirely of porcelain material because, in the first place, the lining matures readily at the ordinary melting temperatures, and second, because of their more porous structure in the raw condition they may be brought up in the pot arch fully as rapidly as ordinary pots.

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