Alsimag 196—

A New Ceramic Insulating Material For High - Frequency Purposes

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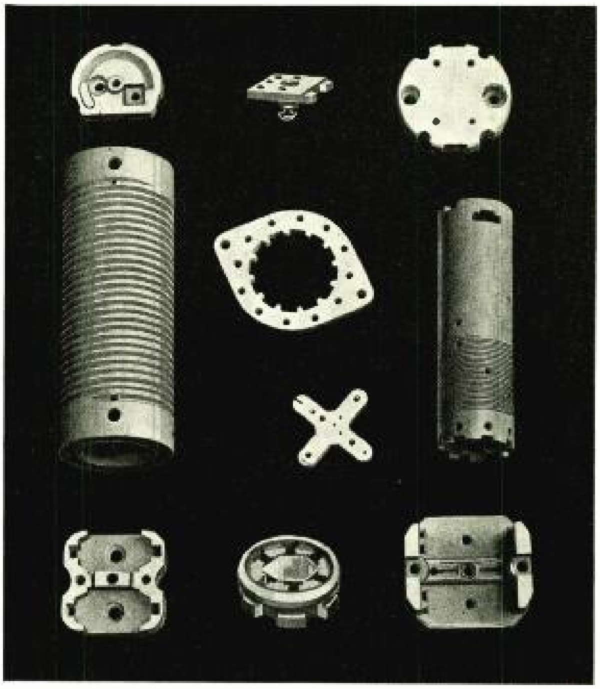

Electrical insulation problems are as important to the electrical engineer as electrical science itself and improvements in electrical insulating materials must be kept in step with the progress in electrical engineering. The desire for increased output of generators and transformers necessitated the development of insulators which worked satisfactorily at elevated temperatures. The power output of electrical machines is, even today, limited to the relatively low temperatures at which organic insulating materials can be used. The story of the progress made in electrical transmission is at the same time the story of the development of the high-tension porcelain insulator. Desired properties for the ideal insulator are: good dielectric strength, high mechanical strength, stability, workability, and last but not least, low cost.

For radio, the problem of insulation becomes involved with another important factor—frequency. For 60 cycles many insulating media work satisfactorily because losses at that frequency are inconsequential. As radio frequencies become higher, dielectric losses become more important. Glass and porcelain, hard paper or bakelite, satisfactory for the original long-wave transmitters, are no longer permissible in the short- and ultra-short-wave field.

QUARTZ INSULATORS

For a long time fused quartz has been regarded as the only ideal material for high-frequency purposes because it combines very low dielectric loss with stability and rigidity. The general application in transmitters and receivers is, however, prohibited because of the high cost of manufacture and also because of the limited possibilities of molding this material into desired shapes. Insulators made out of quartz glass have been used to a certain extent in transmitters for ultra-short waves and gave satisfactory service. However they never could be used in radio sets where mass production together with accuracy of dimensions and low cost are deciding factors.

Fortunately enough the radio engineer has now at his hand an insulating material, or, better, a group of insulating materials, which almost ideally combine the above mentioned properties. These are the insulating materials of the steatite group, widely known under the trade name "Alsimag."

STEATITE ALSIMAG

Under steatite is generally understood a ceramic material which is based on the minerals "Lava," Talc or Soapstone. These minerals are identical in chemical composition, but differ in crystalline structure. Talc has a fibrous structure, the crystals are arranged in one direction and similar to mica, a certain cleavage is noticeable. Soapstone and "Lava" are dense. The crystals are small and form a compact mass. All three minerals are hydrated magnesium silicates of the chemical composition: $3MgO\ 4SiO_2\ 1H_2O$.

For the manufacture of steatite bodies the raw materials are finely pulverized and mixed with certain fluxes. A body prepared in this way is plastic enough so that it can be formed by ceramic methods. Such a "body" owing to its smoothness and plasticity has the further advantage over other ceramic mixtures that it can be pressed in steel dies, in a dry condition, and pieces thus produced are distinguished by great density and uniformity. Dry pressed articles are hard enough when leaving the dies, so that they can go direct into the kiln without pre-drying. The formed articles are fired in ceramic kilns at higher than porcelain temperatures by which process a hard and vitrified product is obtained which consists chiefly of magnesium silicate crystals, mineralogically known as Klinoenstatite crystals, which interlock each other and give the strong and tougher-than-porcelain properties to the body for which it is so well known.

Steatite bodies consisting chiefly of crystals are in a physical sense "one phase" bodies. Uniform crystalline structure not only gives mechanical strength, it also accounts according to newer theories, for two very important properties of the group of steatite bodies: High electrical resistance, even