found to be less than by using the improved method just described.

The mercury surface, when set by the ordinary dimple method, is higher relative to the pointer than when set by noting the apparent coincidence of the end of the pointer and its image. The improved dimple method gives a setting between those given by the ordinary dimple method and the method making use of the apparent coincidence of the end of the pointer and its image. In ordinary barometry the differences in settings by the various methods are generally negligible, but in very precise work they should be considered.

The improved method should be especially valuable where it can be applied to reading both ends of a mercury column; for when used in this way the constant errors of the settings cancel, thus allowing the great sensibility of the method to be realized.

THE VISCOSITY OF PORCELAINS.

Technologic Paper by A. V. Bleininger and Paul Teetor.

THE vitrification of porcelain in the pottery kiln is made possible by lowered viscosity or softening and surface tension which contracts the mass, thus eliminating the pore space. Since no numerical values are available with reference to the degree of softening of porcelain bodies, a series of mixtures were prepared and their viscosity determined at a number of temperatures, between 1160° and 1310° C. The deformation under tensile strain was used as a measure of viscosity. The previously-fired test pieces of suitable shape were suspended from fire-clay grids, and clay weights corresponding to a load of five pounds per square inch attached. After each successive firing to a higher temperature the elongation due to the tensile load was accurately measured. By inspecting the numerical values with reference to composition, it is found that complete vitrification is not possible with less than 19 per cent. of feldspar. Excess of feldspar is undesirable owing to the lowered viscosity brought about by it. The higher the kaolin content, the less marked does the effect of feldspar become. A sharp line of demarcation appears between the bodies containing less than 45 per cent. clay and those of higher clay content. The

former possess a very much higher temperature coefficient of viscosity decrease and hence are more subject to deformation. A lower clay content than 45 per cent. is hence undesirable and may explain the difficulties experienced with bodies of the Seger porcelain type. The strength of porcelain bodies under tensile stress, at the kiln temperatures considered, has been found to be quite low, approaching five pounds per square inch quite closely with maximum elongation, and is but a small fraction of the tensile strength at ordinary temperatures. As to the permissible numerical elongation value under a load of five pounds per square inch, no exact deductions can be made, but it probably lies between five and six per cent.

This method of studying bodies is capable of producing valuable results, and might, with advantage, be applied to clays and other mixtures.

THE ACCURACY OF THE FORMULAS FOR THE RATIO, REGULATION, AND PHASE ANGLE OF TRANSFORMERS.

Paper by P. G. Agnew and F. B. Silsbee.

A DETAILED investigation of all the approximations involved in the derivation of the following formulas for ratio, regulation, and phase angle shows that they are as accurate as are required by the precision with which the quantities involved may be experimentally determined:

N = ratio of turns, primary to secondary.

E_1, E_2 = primary and secondary terminal voltages.

$R = R_1 + N^2 R_2$ = equivalent total resistance referred to the primary.

$X = X_1 + N^2 X_2$ = equivalent total reactance referred to the primary.

I, I_0 = load current and exciting current referred to the primary.

$\cos \theta$ = power factor of load.

$\cos \gamma$ = power factor of exciting current.

When $\pm$ signs occur the upper sign should be used for lagging and the lower sign for leading current. A positive phase angle means the reversed secondary leads the primary.