

DISCUSSION ON "A NEW TYPE OF INSULATOR FOR HIGH-TENSION TRANSMISSION LINES," AND "SOME NEW METHODS IN HIGH-TENSION LINE CONSTRUCTION", AT NIAGARA FALLS, N. Y., JUNE 26, 1907.

J. B. Whitehead: Have any tests been made to determine the potential over these insulators when placed in series? Is the actual distribution 25,000 volts per unit?

Ralph D. Mershon: The more I consider Mr. Hewlett's type of insulator the more attractive it is from many different stand-points, but I should like to know if Mr. Hewlett has constructed any spans using these insulators, with the idea of finding out just what sort of mechanical oscillations or waves, or swinging can be obtained. It seems to me that there is a possible chance of these spans swinging so as to arc to the tower. There does not seem to be any chance to use a discharge gap in connection with a line. Any arc close to the insulator has a good chance to destroy the whole insulator whereas if there were a discharge gap, the arc would rise away from the insulator and it could be saved. It would be extremely difficult to install a line using such insulators and more difficult to repair it.

Ralph W. Pope: This appears to be one of the cases where there is a decided improvement in insulators, with some objections due to manufacturing, which may be eliminated as we go along. It is likely that in the course of time, with greater experience with the insulator, these difficulties may be overcome. Is it not the case with most improvements, that in practice the shortcomings are eventually overcome?

Ralph D. Mershon: For about three years past we have been conducting some high-voltage measurements in Niagara Falls, under all the various conditions we could think of that would approach actual practice. We took a lot of actual loss measurements on insulators of different sizes, dry and wet. I thought that if we assumed a certain thickness of the films on the petticoats of the insulators, and calculated on that assumption the resistance from the neck of the insulator to the pin, perhaps we could get some relationship between the loss over insulators of various sizes. It would not work out. Some of the smaller insulators had less loss than the big insulators. I think that the petticoats become charged and act as a condenser plate with reference to the pin, and the closer they are to the pin the more effectively the condenser acts to increase the loss and make them flash over. We measured the loss from the neck of an insulator to the pin, with a wooden pin and a metal pin. The wooden pin, if dry, gives fine insulation, and at first thought one would think the loss would be lower with the wooden pin than with the iron pin; but it was a great deal higher. This surprised me. I thought it over and finally reached a probable solution, and this solution has been confirmed by another experiment. The way I explained the higher loss is this: the insu-

lator is taking a certain charging current; the pin has a straight ohmic resistance; and the voltage taken by it is in quadrature with the voltage of the supply current. You might increase the I^2R considerably, without decreasing the current going over the pin. We got a wooden curtain pole, and stuck the insulator on that, and took different lengths of pin. After the first trial it was found that the loss continually fell off as the length of the pin increased.

F. B. H. Paine: There are some features of transmission engineering which are not altogether electrical. The people along the line are likely to insist on having a method of supporting the cables which will prevent them from falling to the earth, or so close to the earth as to become a menace to travelers on the highway because of the loss of one or more points of support. If the cable is supported from above, it will necessitate some means to catch the cable in case an insulator fails and the cable is lowered. Is this provided for in this design?

Chas. P. Steinmetz: In multigap lightning-arresters very great inequalities exist in the potential distribution only when very many spark gaps are connected in series across a high-potential circuit. With four or five or even ten spark gaps in series, the distribution of potential under lightning-arrester conditions is still practically uniform. There is to be considered, regarding this distribution of potential, between the successive insulator discs the fact that it is a function of the voltage and that when voltage is raised to a point approaching the breakdown strength of one element, then the distribution of the potential changes and becomes more uniform. So it may well be, if there are, say, four elements in series, you get across the first element 50 per cent. instead of 25 per cent. of the total voltage at normal impressed voltage. If now you increase the potential, as soon as it approaches the breakdown strength of the first element, brush discharges occur over the surface etc., and to increase the effective capacity of this condenser, and then the potential distribution becomes more uniform and may be nearly uniform, when you reach the united breakdown strength of the whole system, at least where the number of sections is not very large.
