TRANSMISSION LINE WORK.

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DEVELOPMENTS in transmission line practice during recent years have insistently sounded the keynote of reliability. With increase in operating pressures from 40 and 60 up to 130 and 150 kilovolts it has been realized that the weakest part of any power system is the transmission line and practice has shown the weakest link in the transmission line to be the insulators. Notwithstanding the relative perfection to which insulator design and construction have been brought it has still to be accepted as an axiom that the fewer the insulators the less will be the risk of breakdown. This has been the chief factor urging the adoption of long spans in transmission line work and the long span has called forth the very best properties of conductor material in general; moreover, it has brought into the field the reinforced conductor by which is understood a wire or cable in which the tension is carried mainly by a core of high tenacity steel wire.

When aluminium was first used for transmission purposes the opponents of this material asserted that a metal of such relatively poor physical properties would be useful on the very shortest pole-spacings only. Improved manufacturing methods and better understanding of the laws of sag and tension have assisted to make the long-span aluminium line an every-day engineering proposition. It is granted that the sag will be greater with aluminium than copper and that the towers will, as a rule, be more costly. Aluminium is, however, in most countries and under usual market conditions, so much cheaper than copper that the credit balance more than pays for the extra high structures. The relative economy effected by the use of aluminium is, however, powerfully influenced by the conditions under which the line is put up. Under what may be called northern conditions, figuring with ½" ice and a wind velocity of 65 miles per hour, the sags will be much greater and towers more costly than where the line is being laid out in California or Mexico where no ice or snow have to be allowed for. It is proposed in this article to discuss only northern conditions, so that any conclusions which tend to be unfavorable to the light metal may be reversed with a change in latitude. The

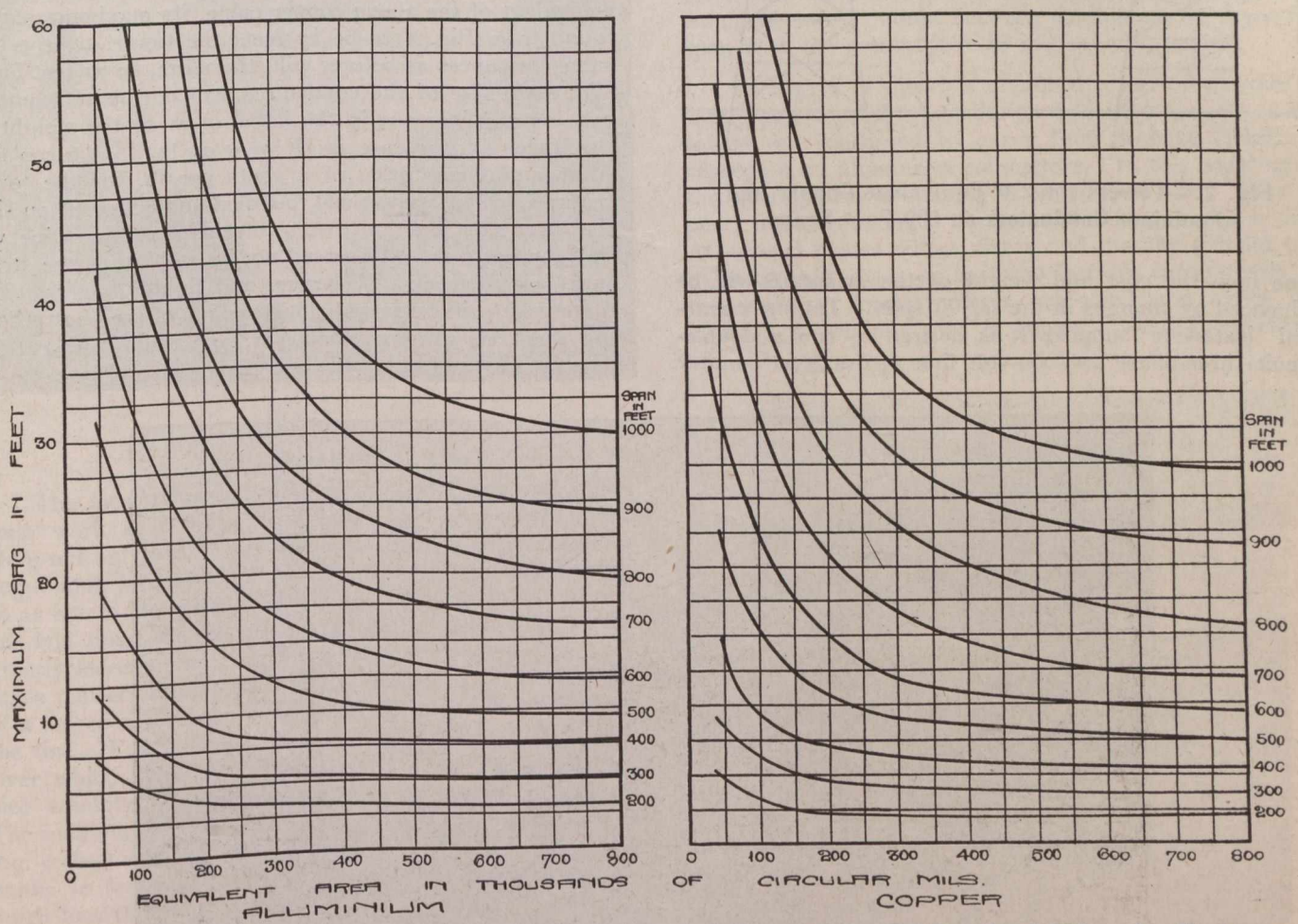

Fig. 1 (a and b).—Maximum Summer Sag on Aluminium and Copper Stranded Overhead Wires for Various Lengths of Span.

maximum vertical summer sags on equivalent sizes of copper and aluminium conductors are shown by the curves in Fig. 1. The constants on which these curves were calculated are as follows:—

	Aluminium.	Copper.
Tensile strength, lbs. per sq. in.	28,000	60,000
Yield-point, per cent.	75	60
Working stress	14,000	30,000
Per cent. extension per deg. F.	.00130	.00093
Modulus of elasticity	9,000,000	12,000,000

The design of transmission line towers is at the present stage of development a somewhat complex subject, as there is no recognized standard for the type to be em-