

Adjustment of the Kelvin Bridge

This content has been downloaded from IOPscience. Please scroll down to see the full text.

1895 Proc. Phys. Soc. London 14 243

(<http://iopscience.iop.org/1478-7814/14/1/319>)

View [the table of contents for this issue](#), or go to the [journal homepage](#) for more

Download details:

IP Address: 128.119.168.112

This content was downloaded on 04/10/2015 at 03:56

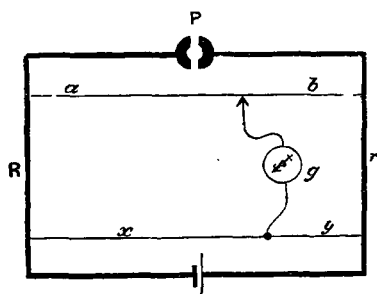
Please note that [terms and conditions apply](#).

XVIII. *Adjustment of the Kelvin Bridge.**By* ROLLO APPELYARD*.

IN a recent paper by Mr. J. H. Reeves† an alternative method of adjusting the ratios of the resistances in the Kelvin bridge was described; the following remarks may be regarded as a note upon that paper.

The measurement of a resistance by the arrangement adopted by Mr. Reeves involves two operations. It may be shown, however, that for certain purposes the two adjustments can be combined mechanically, and balance effected by a single test.

Fig. 1.



Consider the conductors R , r , a , b , x , and y in fig. 1. It is required to compare R with r . In the accepted form of the Kelvin bridge a , b , x , and y have fixed values, such that $ay = bx$, and balance is obtained by the one operation of varying R or r . Mr. Reeves prefers to keep R and r fixed; and, consequently, he has first to find provisional values of a , b , x , and y such that $ay \approx bx$; and then to balance again, using these values, to find $R : r$; with the plug, this time, inserted at P .

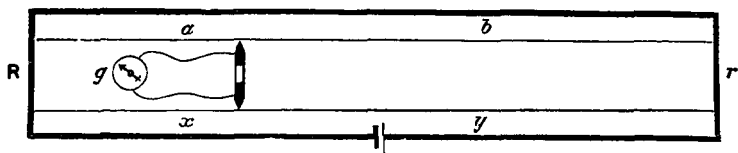
But fig. 1 suggests that $a + b$, and $x + y$, or convenient parts of them, may each be formed into a slide-wire, and that these two slide-wires may be placed parallel to one another, with a double sliding-contact between them, as

* Read April 24, 1896.

† *Supra*, p. 166.

shown in fig. 2. Then, in whatever position the slider may be, the fundamental ratio $ay = bx$ is always maintained, and

Fig. 2.



the first condition of the Kelvin bridge is mechanically fulfilled. The one adjustment consists in moving the double slider along the bridge until there is no deflexion of the galvanometer at g ; in which case

$$\frac{a}{b} = \frac{x}{y} = \frac{R}{r}.$$

Since writing the above, I have referred to the original paper of Lord Kelvin (Proc. Roy. Soc. vol. xi. p. 313, 1861), and find that he proposes the use of parallel slide-wires for his auxiliary conductors; I have no doubt he had in view some such apparatus as that which I have here suggested. A Kelvin bridge with a single slide-wire was used by Matthiessen and Hockin in their differential method; it is described by Clerk-Maxwell in 'Elec. and Mag.' vol. i. p. 406 (1873).

DISCUSSION.

Mr. REEVES said that apparently the author had completely missed the object of his (the speaker's) paper. For the object there aimed at was to make use of such sets of resistance-coils as are always to be found in any laboratory. In the author's arrangement it would be necessary to carefully calibrate the two wires, and also, since the resistances used must necessarily be small, to determine the resistance of the contacts.

Prof. AYRTON (communicated) said the author's suggestion was ingenious, but did not obviate the necessity for much of Mr. Reeves' "addition." Further, Mr. Reeves' proposal to employ ordinary resistance boxes was not made because such resistances are absolutely necessary, but because, since

they are to be found in every laboratory, their use saves the expense of such a wire resistance, accurately calibrated, as Mr. Appleyard employed.

Mr. APPLEYARD, in his reply, said that his instrument was designed for use in a factory, where the time saved in making a series of tests was of more importance than the cost of the instrument.

XIX. *The Effect of Wave Form on the Alternate Current Arc.* By JULIUS FRITH, 1851 *Exhibition Scholar**.

In the paper by Dr. Fleming and Mr. Petavel, recently read before the Physical Society, on the Alternate Current Arc†, I think too little attention was paid to the wave form of the alternate current used.

It is known that if the arc is allowed to exert a preponderating influence at all on the alternate current circuit, it alters the wave form of both the current and the P.D. in a very marked degree.

As an illustration of the change produced in the wave form by the character of the external circuit, I give some curves for alternate current arcs taken from a paper which I read before the Manchester Literary and Philosophical Society in March 1894.

Here is shown, first the E.M.F. curve of the machine on open circuit, which is rather more peaked than a sine curve and involves the third harmonic largely. Next is shown the curve obtained under the same conditions, but with an arc lamp taking 10 amperes at 40 volts joined direct to the machine.

The lag recorded is due to the self-induction of the machine, which was a "Wilde" alternator, the armature of which contained iron.

It will also be noticed that the first ordinates of the curves are not quite equal to the last ordinates; this is due to the

* Read April 24, 1896.

† *Supra*, p. 115.