

small currents due to thermal effects have no value, the electro-chemical effect being evaluated, the daily marked features of earth currents may be observed, but their smaller fluctuations escape observation. To ascertain the thermal effect at each moment would be very difficult indeed; and it would seem as if the magnetical observations of our observatories will form the best guides at some future time in arriving at a satisfactory explanation of the phenomena of earth currents, unless, indeed, the effect is purely a thermal one in the earth's strata, when it may be estimated in telegraphic circuits.

BELGAUM, INDIA, *12th March*, 1891.

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## ON SIGNALLING ACROSS RIVERS IN INDIA WITH CARDEW'S VIBRATING SOUNDERS.

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Adverting to my paper on "Signalling across Rivers in India," which was read at the Institution of Electrical Engineers on the 10th April, 1890, the following will show how these researches subsequently became of practical value.

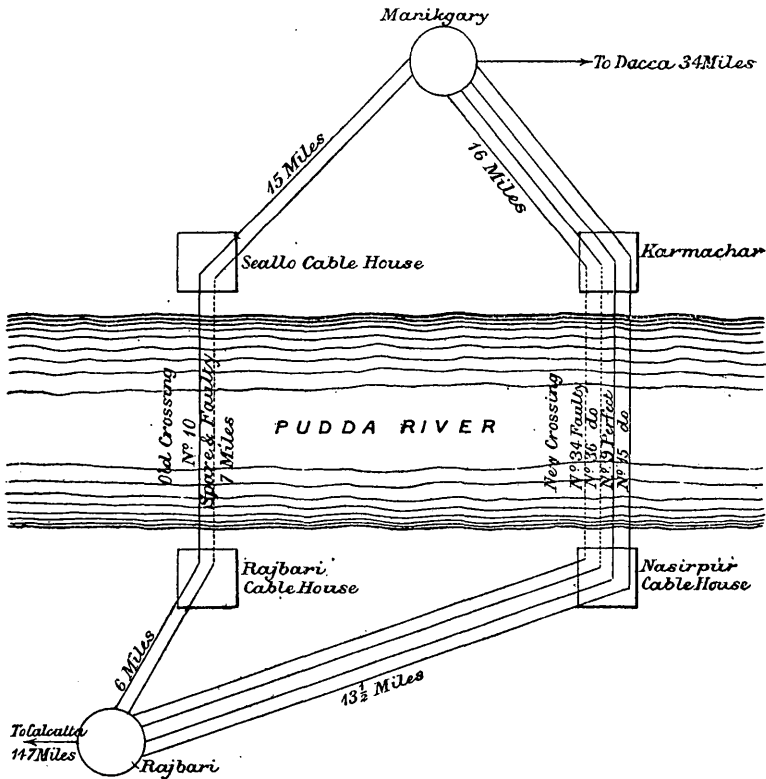
2. Of the several telegraphic circuits which are led out of Calcutta to various parts of India, there are five which branch off almost due east. Three of these circuits convey traffic for Upper and Lower Burma, and the remaining two are utilised for the Dacca, Chittagong, and neighbouring traffic. The country through which the lines above referred to pass, is intersected by rivers, most of which, owing to their great breadth, are cabled.

3. The first river out of Calcutta, called the Pudda, is 7 miles wide, and is cabled at two separate points about 12 miles apart. On the morning of the 8th September, 1890, two out of the five cables which cross this river in the circuits above alluded to, became interrupted. The tests gave evidence of rupture of conductor, with partial earth.

4. The river being in full flood at the time, it was out of the question to attempt to repair the cables; and, moreover, a boat

service to convey messages from bank to bank, though practicable, would have been slow and costly. It was resolved, therefore, to endeavour to utilise the Cardew vibrating sounders.

5. The following sketch shows the length and position of the cables and land lines utilised during the experiments. The dotted line represents a spare cable which has been interrupted for some time owing to an insulated break in the conductor.



6. The following were the experiments tried:—

*Experiment I.*—To work through the guards of the cables at the old, and the guards of the cables at the new crossing, using the former as line and the latter as earth. While this experiment was being carried out the land lines between Seallo and Manickgunge got into contact, putting a stop to the experiment. A few signals had, however, been passed through this complete metallic:

loop, and from the strength of these signals it is thought the experiment would have been entirely, instead of but partially successful, had the experiment not been interrupted.

*Experiment II.*—To work through the guards of the cables at the east crossing, using any of them as line, with the land line on either side earthed at Dacca and Rajbari. The vibrators were somewhat in the middle of the circuit, *i.e.*, at the two cable-houses.

7. To enable Experiment II. to be made, the Rajbari and Dacca offices were directed to “earth” the connecting land lines, and the vibrators were inserted at the cable-houses at Nasirpur and Kurmachar, the guards of one of the cables being used as line, and the land lines on either side being used as earths. Although this arrangement does not provide a complete metallic circuit for the current, the experiment was nevertheless *quite successful*, the signals being very clear, and readable at a distance of about 4 inches from the ear. The success met with in this experiment is an important and valuable advance on all previous attempts to signal across Indian rivers.

8. In addition to the experiments named, the vibrators were joined up through the severed conductor of the spare cable at the western crossing, and the signals passed through this were also loud and distinct.

9. It will be seen from the foregoing facts that the vibrating sounders have been of practical use in establishing telegraphic communication across one of the widest rivers in India, at a time when no other yet known means might have been possible. The success of Experiment II. greatly made up for the sudden failure in the conductors of two cables, and enabled the Indian Telegraph Department to dispose of a certain amount of local traffic, thereby keeping free the Burma lines for their legitimate work, preventing their congestion, and obviating delays to messages which might otherwise have ensued.