

**THE TELEPHONE AND  
THE PHONOGRAPH: A  
POPULAR ACCOUNT**

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The telephone and the phonograph: a popular account by William Tegg

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## THE TELEPHONE.

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THE success which has attended the experiments with the Telephone, performed in this country by Professor Graham Bell within the past few months, in the transmission of articulate and musical sounds through tens and hundreds of miles of space, has roused universal attention to the latest, and, in some respects, most marvellous of modern scientific inventions. Scarcely a day passes in which one or more of our daily newspapers do not contain paragraphs relating to some new development or application of this extraordinary instrument. Now, we are told, the Telephone is in active practical operation over six hundred miles of Chinese territory; and, again, that in Persia intelligible speech has been sent by its means over a wire five hundred miles in length. It may naturally excite surprise to learn that these two Oriental nations are in advance of Europe and

America in their adoption and working of the Telephone. And this is not all, for a question has just been raised as to whether the principle of the Telephone may not have been known in the East before it was discovered in Europe or America. With regard to this latter point, however, the evidence seems at present to be far from satisfactory. In a recently-published letter, Mr. William Chappell records a conversation he had with Captain C. H. A. Gower, of the Madras Staff Corps, in which that officer asserted that the Telephone was now in use in Burmah. "Seeing a native boy," writes Mr. Chappell, "holding something to his ear, and then taking it down to his mouth, Captain Gower's curiosity induced him to ascertain what the boy was holding. It was something so like the 'Eton Telephone' that, at my request, Captain Gower wrote down an account, giving me permission to make it known. His letter is dated January 13th. Referring to my paper in the *Athenæum*, he says: 'It has recalled to my mind a fact, *vis.*, that the Burmans are well acquainted with the use of the Telephone. More than a year ago I found them using one in the town where I was then living, Maoobin, near Rangoon. The apparatus consisted of two short lengths of bamboo; one end of each was closed with strong paper, and the two were connected by a piece of strong cotton passing through the paper, retained in its place by a knot at each end. I

ascertained by experiment that this simple apparatus answered perfectly for a distance of 100 yards, sounds being conveyed without any apparent loss. The lowest whisper was heard quite distinctly." It is clear enough from this description that the Burman "Telephone" is quite as primitive an instrument as those sold for a copper or two during the past few months at the corners of the streets in London, and in several of our large provincial towns. That this simple contrivance has little or nothing to do with the Telephone need hardly be stated ; but it may remind many persons of an experiment popular with British, and possibly also with Burmese boys, by which the ticking of a watch laid upon the one end of a long log of wood can be distinctly heard at the other by placing the ear close to it. It is to the application of electricity in the conveyance of sound that the marvellous performances of the Telephone are mainly due, and, in this respect, there is no evidence that any Oriental nation has excelled, or even equalled, the achievements of European and American savants. But in addition to the power of transmitting articulate speech, the tones of the human voice, and musical sounds, to any distance to which the necessary wires have been extended, which is claimed for the Telephone, it is asserted that by means of the most recent adaptation of the Phonograph, or Telephon-autograph, a message of any length can be

spoken on to a plate of metal, that plate be sent by post or otherwise to any part of the world, and the message respoken in the very voice of the sender, any time after the plate reaches its destination.

There is generally a good deal of dubiety and controversy in regard to important points connected with the history of most scientific inventions, and to this rule the Telephone is no exception. No complete narrative of the various stages of scientific discovery that have led up to the present position of the art of transmitting sound through space has yet been written, and it is clear that many of the principles involved are, as yet, only at best empirically, and not scientifically understood, even by the ablest of the electricians who have made a special study of the subject. As has already been indicated, the application of electricity to the conveyance of sound is merely the last step that has been taken to render that force useful to mankind. But before this object could be attained, much had to be accomplished, both in regard to the production and manipulation of electric currents, and to the analysis of vocal and musical sounds.

No adequate idea of the working of the Telephone can be formed by any one who is ignorant of the leading principles of the science of electro-magnetism. That the "loadstone," which is now recognized to be one of the ores of iron, and is called magnetite by



our mineralogists, possesses the power of attracting iron, and lifting a mass many times its own weight, was known from a very remote antiquity. In this ore, 72.5 per cent. of its weight consists of iron combined with oxygen; whereas in another ore, called hematite, there is but 70 per cent. of iron. This difference of  $2\frac{1}{2}$  per cent. of iron is enough to make the difference between a magnetically inert mineral and one which may be able to lift a mass of iron many times its own weight. All magnetite, however, does not possess the property called magnetism. It is rare that large masses of it, such as the mountains of Lapland and the iron-mines of Sweden, display this power; and the most powerful natural magnets are found in Siberia, and in the Hartz mountains of northern Germany.

A discovery made by Professor Oersted of Copenhagen, in 1820, that if a properly balanced magnetic needle be placed immediately under and parallel with a wire along which a current of electricity is passing, that end of the needle which is situated next to the negative side of the battery immediately moves to the west; while if the needle is placed parallel to, and over the wire, the same pole moves to the east, led to the identification of magnetism and electricity. By this means a vast field of research was opened up, which was shortly occupied by such ardent and able investigators as Faraday, Ampère, and Schweyzer.

After a series of experiments it was permanently established that the neutral condition of bodies susceptible of magnetism is disturbed by the electrical current, and that the magnetism acquires extraordinary power when the current of electricity is made to circulate a number of times round the bar acted upon. A further step in advance was accomplished in 1825, when William Sturgeon of Woolwich discovered that if a copper wire is wound round a piece of soft iron, and a current of electricity sent through the wire, the soft iron becomes a magnet, but retains its magnetism only while the current of electricity is passing through the coil. The magnetism produced in this way is called electro-magnetism, and the iron so wound is called an electro-magnet. A further improvement was made in this process in 1830, by Professor Henry, of Princetown, New Jersey, who insulated the wire by covering it with silk, and, thereby, was the first to produce a very powerful magnet. The power of the electro-magnet is far greater than that of any permanent magnet. Mr. Joule, the celebrated physical philosopher, has, by skilful arrangement of the coils, produced electro-magnets capable of attracting and supporting thirty-five hundred times their own weight, or one hundred and forty times the proportionate load of Sir Isaac Newton's ring-magnet, which was a small loadstone weighing three grains, that had the power of lifting

seven hundred and fifty grains, or two hundred and fifty times its own weight. The power of imparting and withdrawing electro-magnetic force explains the whole mystery of telegraphic communication. For example, the teeth of a wheel may be attracted in succession, and so a rotatory motion produced; and it is evident that as the electric force may be transmitted through wires for any distance, a wheel or other apparatus at the extreme end of the line may be made to act sympathetically with a similar apparatus at the home end, by means of those transmitted "jerks," or alternate currents and stoppages. The fact that the earth itself, as is tolerably well known, is a huge electro-magnet with currents of electricity perpetually flowing round it, and having its poles, or the neighbourhood of its poles or ends at the axis of rotation,—the familiar north and south poles,—explains why one end of the magnetised steel of the mariner's compass always points to the north.

In some respects electricity differs from magnetism, although electricity induces magnetism, in the manner that has already been described. On this point Professor A. E. Dolbear, of Tuft's College, Massachusetts, United States, says—"We can come to but one conclusion, that both electricity and magnetism are but forms of motion; electricity being a form of motion in ordinary matter, for it cannot be made to pass through a vacuum, while magnetism must be a form