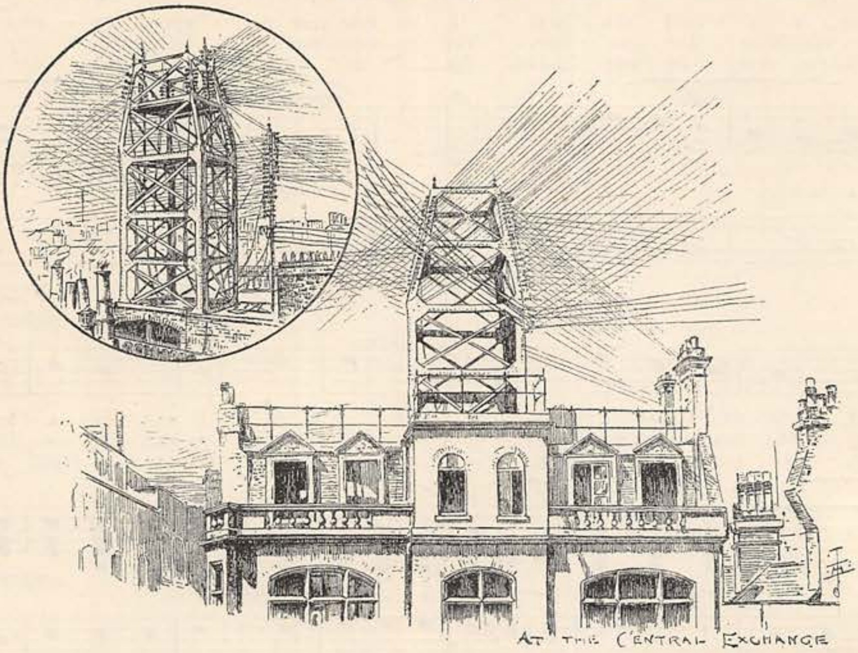
THE WORKING OF THE TELEPHONE.

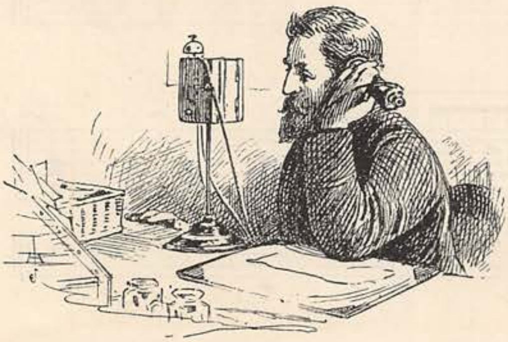
BY J. MUNRO, C.E.



DERRICKS AND OVERHEAD WIRES.

THE telephone service in the United Kingdom is a social development of the last ten years. To-day there is hardly a town of any size in England, Scotland, or Ireland which is without its telephone exchange, and many of the large towns, such as Liverpool and Manchester, London and Birmingham, Edinburgh and Glasgow, are connected together by "trunk" lines, so that a subscriber to the exchange of one town can converse by telephone with any of the subscribers to the exchanges in the distant town.

By-and-by this useful means of intercommunication will doubtless be much extended, and probably in two directions: that is to say, in the direction of increasing the number of trunk lines between towns and cities as yet unconnected, and also in the way of domestic telephones, fitted up like electric bells in one's own home, and connected first to the nearest exchange, and through that to the other towns in telephonic communication with it. Thus it may ultimately be possible for a person sitting in his parlour to hold a conversation with some distant friend at the other end of the island—say, from John o' Groat's to Land's End, or at least to "Maidenkirk."



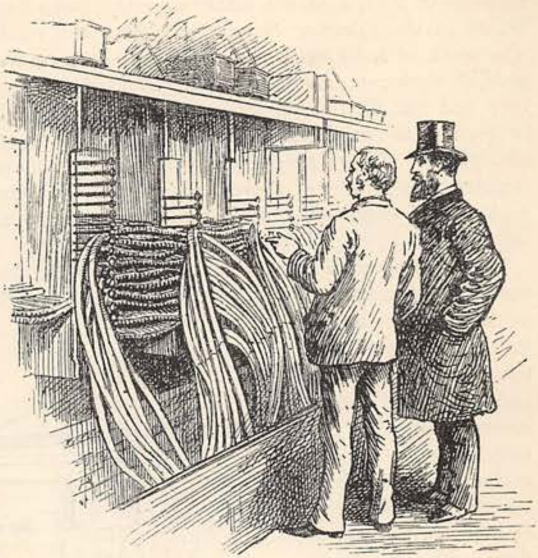
A SUBSCRIBER.

To attain this end will necessarily be a work of some time, but we are travelling towards it. The multiplication of public call-offices, too, in London and other large towns, is another development of the system which is likely to grow. These call-offices are open to the general public, who may or may not be annual subscribers to the telephone company. They are, in short, a kind of public telephone office, like the public telegraph station, where any person, by paying a small fee, can speak by telephone to any of the company's subscribers. Of course the more subscribers the company has the more advantage there is in the privilege.

I propose in the present article to give a general account of the telephone service, taking as an example the metropolitan system of the United Telephone Company. This important corporation is the "parent" telephone company for these islands, it having acquired the patent rights for the electro-magnetic receiving telephone of Professor Graham Bell, and the carbon transmitter of Mr. Edison.

A number of subsidiary or affiliated companies were formed under the rights of the United Telephone Company, to work the provinces. Thus, for example, the Manchester and Liverpool system is operated by the Lancashire and Cheshire Telephone Company. The Glasgow, Edinburgh, Dundee, and other systems in Scotland are the work of the National Telephone Company. In Ireland, too, there are local companies charged with the telephone service. The United Telephone Company reserved to itself the metropolitan district, including all Middlesex, and as much of the Home counties as comes within the twelve-mile radius. There is an ample field for effort here, the population forming, as it were, a nation of itself, and the commercial interests being enormous.

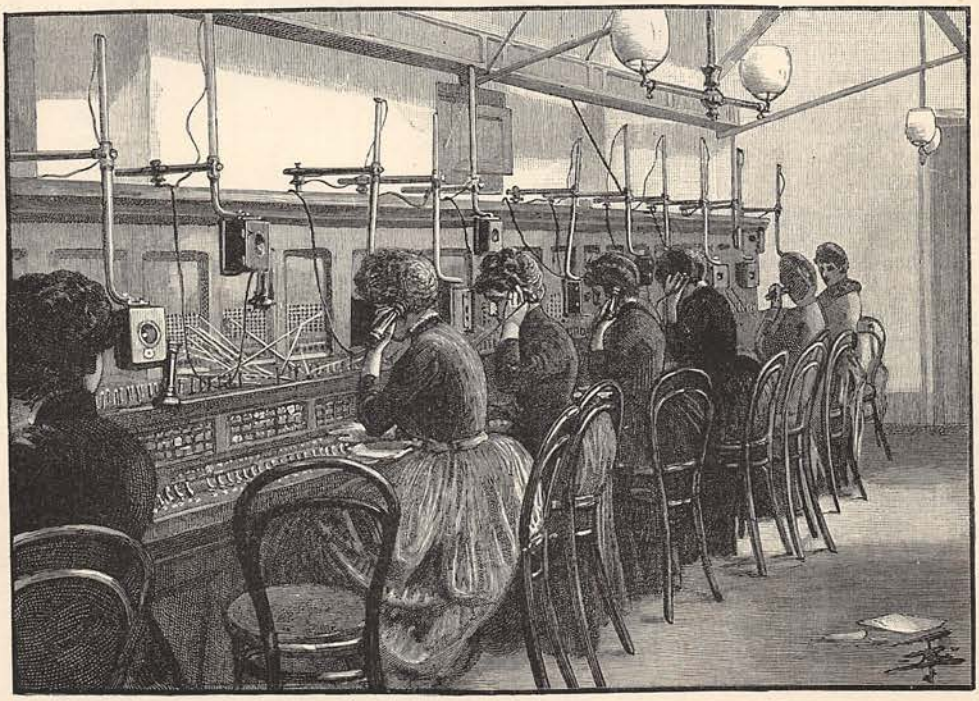
During the last ten years the company's system has been spread out like a network over the whole London area, and extended far into the suburbs, not to speak of the trunk lines to Brighton, Birmingham, and other centres without the limits. Telephone exchanges, as well as call-offices, have been opened in every part ot London, and a large number of private lines have been run. There are nearly 5,000 subscribers to the exchange system, any one of whom can speak by wire to all the rest, if he wishes, by night or day, either from his own office or home, or from any of the public call-offices in the streets, if he should happen to be out in the town. Moreover, any of the general public, on payment of a small fee, can communicate with these 5,000 subscribers.



THE WIRES AT THE BACK OF THE SWITCH-BOARD.

The working of the company is, of course, carried on by division of labour, the whole staff being divided into several departments. One of these is concerned with the purely business portion of the work. The others have to do with the construction and maintenance of the lines and apparatus, and the working of the exchanges.

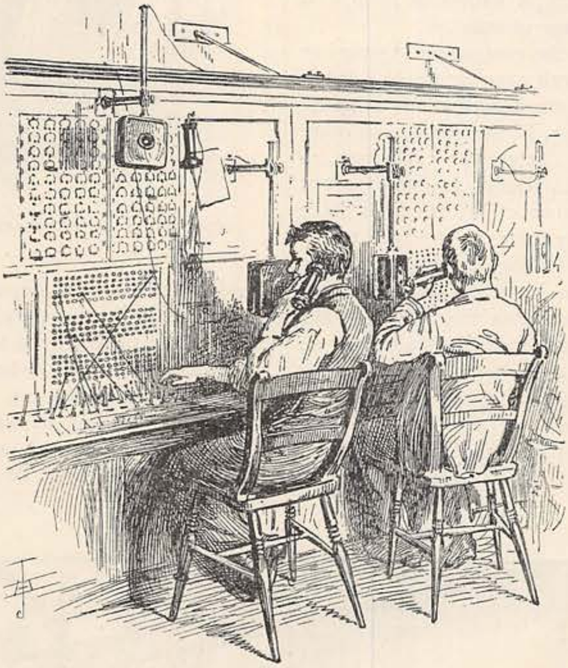
The engineering department is directly charged with the erection and maintenance of the lines. These consist of wires of iron, copper, or bronze run



TRANSMITTERS' ROOM AT THE QUEEN VICTORIA STREET EXCHANGE.

on poles or other supports, either over the house-tops or, as in the suburbs, along the streets and roads. The work of building the lines is done by a trained staff of workmen, under the supervision of the foremen and the district engineers. The "way-leaves," or permits to run the lines over private property, are obtained by officers specially appointed. The maintenance and testing of these lines is also the business of the engineering staff, which is sub-divided into sections having charge of certain districts.

The instrumental department of the staff has the duty of installing all the indoor apparatus for working the lines: that is to say, the telephones, batteries, and accessory instruments, such as the switch-boards in the exchanges. The testing and maintenance of this internal apparatus is also the business of this department, which, in addition to periodical examiners, includes a special band of what the Americans call "Trouble-men," who are prepared to attend at once to sudden calls for assistance due to unforeseen accidents. The operators, who, with the exception of a few exchanges worked by boys, are all young women, form a separate department, under the governance of a lady superintendent and her deputy assistants, who visit the exchanges. In each exchange, moreover, there is a lady clerk-in-charge, with her assistants, who take turns in superintending the operators while on duty.



BOY OPERATORS.

The young lady operators belong to a very good class of society. They are mostly the daughters of professional men, or the higher members of the middle class; and a number of them have entered the service from the desire of having an occupation, in preference to being idle. They are as a rule intelligent and well-bred young ladies, and they perform this work, which indeed seems adapted to them, with a deftness and skill which is highly pleasing.

The duty of each consists in sitting at her particular section of the switch-board, watching for the call signal from some subscriber, then speaking to him by telephone to ascertain whom he wishes to be put in communication with; and finally connecting his wire on the switch-board with that of the person he intends to speak to. This is done by means of two brass plugs, joined by a flexible conductor. The operator thrusts the plugs into holes corresponding to the "telephone numbers" of the two subscribers, and leaves them to talk until the signal is given that they have "finished." In the "multiple" switch-board, which is now used in the best exchanges, the whole of the subscribers' wires are brought to every section of the board, so that each operator can join any two subscribers together without moving from her place, or asking the help of any other operator. This arrangement, while it complicates the rear of the board with a multiplicity of connecting wires, is well calculated to expedite the correspondence, and a quick silent manipulation of the board.

The lady operators have different hours of duty. Some begin at 9 o'clock in the morning, and leave off at 5 o'clock in the evening. Others go on at 10 a.m., and off at 6 p.m. Others again at 11 a.m. or 12 noon, and finish at 7 or 9 p.m. Then there is the night work, which is attended to by one operator in each exchange, from 9 p.m. to 9 a.m. next morning; but this is taken by two of them on alternate nights during a week at a time, the others taking it in rotation.

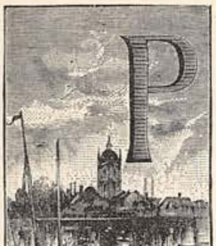
In one of the London exchanges there are as many as twenty-five lady operators; and in some others, seventeen to nineteen.

Candidates for the service are taken on without any preliminary training in the work; but they require, of course, to have good manners and education. They receive a small weekly wage to begin with, which is gradually raised as they improve in skill or advance in the service. If the work does not offer a career for women, it at least provides a neat and lady-like employment.

At all of the exchanges there is a luncheon-room, where the girls can retire to their meal, be it luncheon or tea. They are allowed a sufficient time off duty for this purpose, and can either go out and purchase what they want, or bring it with them when they come. Their tea, of course, is made on the premises.

A telephone exchange in full operation is an interesting sight, and quite as worthy of an artist's pencil as the bead-stringers of Venice, which Mr. Fildes has travelled so far to paint. The graceful and busy movements of the girls, the different types of face, and variety of character, would afford material for a picture, apart from any touch of romance that might be added; and behind it all would be the invisible presence of the great world to whose affairs these sisters of the wire were ministering.

MIND YOUR STOPS.



PARAPHRASING an old copy-book maxim of my childhood, I am strongly minded to say, "Punctuation is the soul of style." It is true that the ancient literatures got along very well without it; and I have heard an ingenious argument to the effect that the very absence of any such aid to the reader strengthened the fibre of his understanding, inasmuch as it compelled the exercise of a vigorous common sense; and the smallest schoolboy who has gone as far as Cæsar's "Commentaries" begins to have an inkling of some such idea as soon as he has found out that the principal verb—this being one secret of the great leader's emphasis of statement—is generally to be looked for at the end of the sentence. Commas, colons, and semicolons would have been useless to the Roman writer, the elegant terseness of whose language, which by means of its terminal forms infallibly indicated the arrangement, needed no hedging and fencing round about with parenthetical marks and boundaries. He depended for the security of his meaning on the mere virtue of his exquisite syntax. This would have been thrown out of gear, its whole sense destroyed, or—still worse—disturbed, unsettled, and perverted, by any miscollocation (had such been possible) of related words.

We owe punctuation—all of it except the full point, which closes and seals a sentence—to Faust and Gutenberg. The innovation is due, that is to say, to the far grander innovation—printing. And that same full point, or closure of a sentence, by-the-by, in writing—as afterwards in early printing—was not a round dot, but a downward line, usually sloping towards the left. But this is a trifling detail. First introduced, punctuation was an aid to logic; and as no logic at all is better than false logic, no punctuation is better than false punctuation. Lawyers have a terrible logic at their command, but punctuation, true or false, they discard altogether. Are lawyers, then, not sensible to the luminous effect of a comma happily placed? Yes, answers De Quincey, they *are* sensible. But also they are sensible of the false, prejudicating effect of punctuation carelessly and illogically managed. "Here," says the ratiocinative rhetorician, "is the brief abstract of the case. All punctuation narrows the path, which is else unlimited; and, by narrowing it, may chance to guide the reader into the right groove amongst several that are not right. But also punctuation has the effect very often—and almost always has the power—of biassing and pre-determining the reader to an erroneous choice of meaning. Better, therefore, no guide at all than one which is likely enough to lead astray."

Punctuations in written and printed language answer in some degree to vocal inflections and cadences. They avert, or should avert, frequent recourse to loud underlinings or italics. These are the forcible feeblenesses of a nerveless, flabby style; and they are almost invariably characteristic (if such things can be associated in any way with character) of persons who punctuate badly or not at all. "One of my correspondents," said a man of affairs to me once on a time, "is a patent and portentous bore: a fellow who is not only a bad punctuator himself, but sneers at good punctuation in other men."

Such cases are by no means uncommon. There are writers who glory in putting themselves outside law. *Hamlet* says something about accounting it "a baseness to write fair"; and there is a false nobleness now, as there was in days gone by. Superfine folk, writing for publication, seldom or never trouble themselves about stops, but "leave all that to the printers." This is exactly what the paradoxical Jacob Briant seems to have done; and a pretty mess the printers in Jacob Briant's time have made of Jacob's paradoxes! Exact Monsieur Guizot abhorred looseness of punctuation, and mildly rated his daughter for her indifferently pointed letters.

Two of the most careful and characteristic punctuators of our time have been Carlyle and Landor. Carlyle's manner consequently makes itself *audible* from the page; and as for Landor, I myself have seen him positively furious about a semicolon which ought to have been a colon. He was left alone, and in most beaming mood, in a room of the old *Leader* offices, and the next person who entered found him foaming. He had merely in the interim looked over his proof!

Shakespeare, as I have all but verified to my own satisfaction, at least, punctuated with the decision which we now look for—not vainly—in a Tennyson, a Ruskin, or a Kinglake. I have here named three perfect punctuators. My verification, or *almost* verification, of Shakespeare's own decisive pointing has been attained through the careful study of many passages in a no less authentic edition than "the famous folio of 1623." Here we get back near enough to the original hand and the master mind to form a fair