THE MURRAY AUTOMATIC PAGE-PRINTING TELEGRAPH —ITS HISTORY AND ITS PROGRESS.

The accompanying photograph shows the Murray automatic page-printing telegraph system recently installed in the head telegraph office, St. Petersburg. The system is now working between St. Petersburg and Moscow. While the apparatus was being installed some very successful experiments were made with it on long Russian lines. In these trials from 50 to 100 per cent higher speeds were obtained with the Murray system than with the Wheatstone system under exactly the same conditions. In one case a telegraphic loop line was made up as follows: St. Petersburg-Yaroslav-Kazan-Moscow-St. Petersburg, the length of the line being 1,926 miles of iron wire with three repeating stations. The Wheatstone system got from 35 to 40 words per minute. The Murray system reached 56 words per minute. This is the first time on record that a printing telegraph has worked over such a distance as 1,900 miles even of copper wire, and in this case it was iron wire. A very successful trial was also made with the Murray system from Berlin to St. Petersburg, direct without a repeater, 1,080 miles. A speed of 70 words per minute was reached perfectly. The Murray automatic system is now working between London and Edinburgh, Berlin and Hamburg, St. Petersburg and Moscow, and sets are being made for London-Dublin, Bombay-Calcutta (1,200 miles) and Vienna-Prague. The inventor, Donald Murray, who is sitting at the table, is a New Zealander by birth, and evolved his system in Sydney, Australia, while engaged in newspaper work.

The story of the development of the Murray printing telegraph is rather curious. Most printing telegraphs have been exploited by companies, which have almost invariably lost money, often heavily. The Murray system, on the other hand, like a good mine, has paid for its own development. Mr. Murray constructed a working model of this and brought it from Sydney to New York in 1899 to have it patented by Messrs. Munn & Co. and to have it taken up by one of the typesetting machine companies, the idea at the back of the invention at that time being the construction of an automatic typesetter, something like the Monotype, but with telegraphic possibilities. When the model was unpacked at the SCIENTIFIC AMERICAN offices in New York it was found to have been wrecked by careless handling in transit, and inquiry showed that there was no field worth troubling about for automatic typesetting on the lines proposed. An unknown journalist in a strange city with a smashed-up model of an invention that nobody wanted was hardly the sort of combination to win success on lower Broadway. But the model was patched up, and after the necessary patents had been taken out, it was exhibited at the Astor House. The novelty of the thing attracted attention, and although there was no field for it as an automatic typesetter, its telegraphic possibilities attracted the notice of the Postal Telegraph Company, and the inventor was engaged by the company to develop it as a printing telegraph. After two years work with the Postal Company it had grown almost out of recognition and had evolved into the "Murray Automatic Page-Printing Telegraph System," and was able to transmit and print messages in page form at the rate of 100 words a minute. "The Baby," as friends jokingly called the system, was then brought by the inventor to London, where it was taken up by the British Post Office. The infant, however, was still very delicate and required most careful nursing. After a year in London a circuit equipped with the system between London and Edinburgh was started on regular telegraph traffic. It was then exhibited in Berlin, and the German government had a set constructed to work between Emden and Berlin. What the German telegraph engineers described as *Kinderkrankheiten* or ailments of childhood were, however, so numerous that both in England and Germany the system led a very precarious existence for a couple of years, and a long series of radical improvements had to be made before it could really be described as a success. In fact it is only with the last twelve months that all weaknesses have been at length eliminated. An obstacle that has delayed progress has been the difficulty of adapting the system to meet the varied requirements of different telegraph administrations. Rival systems have also made telegraph administrations slow in coming to a decision. These obstacles, however, are now disappearing, and the Murray automatic system has proved itself to be without a rival for its own special work, namely, for long telegraph lines, underground cables, and press messages.

The Murray system in the form that it has reached in its final development consists of a group of machines at each end of a telegraph line. Several operators working on perforating machines with keyboards like typewriters prepare the messages for transmission in the form of holes punched in a narrow paper tape. The paper tapes with the messages recorded on them in this way, are then run through an automatic transmitter, a small machine which sends over the telegraph line signals corresponding with the holes in the paper tape. These signals are transmitted over the line at a speed sufficiently high to permit the transmission of the messages punched by several operators over one telegraph line. At the receiving station an electrical perforating mechanism under the control of the transmitted signals makes an exact reproduction of the transmitting tape. This received tape then runs into the automatic typewriter or "printer," which prints the messages in ordinary typewriting in page form under the control of the perforated receiving tape somewhat after the fashion of a mechanical piano. The speed of the printer is now very high, not less than 150 words (900 letters) a minute, but practical considerations of durability and maintenance of the typewriter limit the speed at present to about 100 or 120 words a minute. The limit of speed in transmission of the signals over the line is in the receiving perforator which reproduces the tape at the distant station. With the improved machinery now in use it has recently been found possible to punch the received tape faultlessly at the rate of 184 words (1,104 letters) per minute. At this speed no less than ninety-two holes per second have to be punched in the paper tape successively by a single punch. A similar group of machines in the reverse order are required for transmitting messages in the opposite direction on the same wire at the same time. It was a model of the printer, at that time in a very crude form, that Mr. Murray brought with him from Sydney to New York in 1899. In New York the electrical portion of the system for perforating the tape, transmitting the signals and perforating the received tape, was evolved. At that time the printer appeared to be a sort of cross between a sewing machine and a barrel organ. An operator had to work the printer by turning a handle, and the machine was variously known as "Murray's coffee mill," and "the Australian sausage machine," but more frequently as "the Baby." In London the printer was very greatly improved. An electric motor to drive it was provided, and all the actions were made automatic, the machine stopping at the end of each line, running the typewriter carriage back, turning up to a new line, and starting again, and finally stopping at the end of each message, all under the control of the perforations in the paper tape. A very necessary improvement was a method of invisible correction of errors in the transmitting tape. With the system in its now perfected form, if an operator on one of the keyboard perforators at the sending station strikes a wrong key or perforates a wrong word, all he or she has to do is to press a back-spacing lever and a "rub-out" key once for each wrong letter. This action punches the erroneous portion of the tape full of holes so as to obliterate the wrong letter or letters. This obliteration is reproduced in the receiving tape at the distant station, but the printer is so arranged that it stops work for the moment during which the obliterated portion of the tape is passing through it. The result is that no trace of the error, not even a blank space, appears in the printed message.

The system has been in steady commercial use for about three years between London and Edinburgh, and a circuit is now being equipped with Murray apparatus between London and Dublin. For about 18 months it has been working between Hamburg and Berlin, and the St. Petersburg end of the Murray circuit recently established between St. Petersburg and Moscow is shown in the illustration. An installation of the apparatus for Calcutta-Bombay (1,200 miles) is now approaching completion and arrangements are being made for a staff of Murray experts to go out to India to install the system. A set is nearly finished for working between Vienna and Prague, and arrangements are also being made for manufacturing Murray apparatus to equip several other circuits.

It may be mentioned that Mr. Murray has been engaged by the British Post Office for a term of years to invent and develop some new printing telegraphs to suit special conditions. Mr. Murray points out that this engagement is in accordance with a tendency that has become very marked of recent years.

THE MURRAY PAGE-PRINTING TELEGRAPH USED AT ST. PETERSBURG.

Mr. Murray, the inventor, is seated at the table.

An Experiment Station for Economic Botany in Sweden.

The rational cultivation of medicinal and other economic plants for home use is receiving a timely impetus by the establishment of a botanical garden near Landskrona in Sweden. It is noted with interest that herbarium botany, plant registration, and the fabrication of new species form no feature of the station, but that the economic welfare of the small farmer and the principle of home production for home use are the considerations on which Consul Oscar Ekman made the philanthropic bequest that places the establishment on a real and permanent footing.

Sweden, like most other European countries, imports most of its medicinal herbs, even such as might be cultivated within the country itself. Technical vegetable products likewise are derived mostly from abroad, and in spite of the high protective tariffs—which, in this case, hitherto protected none but foreign dealers—no concerted action had been made toward the rational cultivation even of such plants as grow well in Sweden.

Consul Ekman, now in his ninety-fourth year, a native of Sweden and for many years closely associated with Mr. Carnegie, conceived the idea of establishing the station named Esperanza as a teaching institution where could be found such information in the shape of museum specimens, experimental fields, and preparation of raw plant products, as would be necessary for the instruction of farmers, gardeners, and others concerned with agricultural products.

Of primary interest is the culture of mint. The importance in medicine and in various manufactures of the essential oil of peppermint is so great that the market is never fully supplied, and high prices are often paid for a mediocre product. The same is true of the flowers of Chamomilla, a plant formerly cultivated in nearly every country garden; also of various pigment plants, fiber plants, and, not the least, of seeds of caraway (*Carum carvi*).

The establishment was dedicated in the early part of July. As above said, it is located near the city of Landskrona, and consists of a museum and experimental fields. The success of the work will determine its future development. Two directors have been designated, one a practical botanist, the other an apothecary. The botanical work is in the hands of Tom von Post, director of the seed control station at Upsala, author of "Lexicon Generum Chanerogamarum," who is thoroughly familiar with the status of economic botany in Sweden. Mr. Hjalmar Lindström, of Landskrona, is in charge of the technical branch of the work.

Viewed in the light of social economy, the station Esperanza represents a most interesting movement. In the northern countries more than anywhere else, the times are ripe for an energetic cultivation of small areas of land, and the very scarcity of land renders the problem of profitable crops a constant and serious question. The founder, as a practical man, has recognized this, and in his search for a useful application of his great wealth that has already benefited the national institutions of learning in Sweden as well as the cause of popular enlightenment, has struck a happy note. Botanical institutions are not scarce where scientific problems are solved, but there is a pressing need everywhere of practical work immediately useful in the small industries.

An engineer named Fisher, according to a dispatch from Berlin, Germany, has taken out a patent for wireless electrical appliances by which steam will be automatically shut off in two vessels that are approaching each other in a fog at a distance of from one-half to three-quarters of a mile.

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