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The Manufacture of Electrical Apparatus in Boston.¹

A DESCRIPTION of the different establishments devoted to the manufacture of electrical and Telegraphic apparatus in Boston will doubtless prove interesting to many readers of THE TELEGRAPHER, especially as that city has obtained an enviable reputation among Telegraphers and electricians for the superior quality and finish of the work turned out by some of its leading manufacturers. One of the principal firms engaged in this business is that of EDMANDS & HAMBLET,² at No. 40

Hanover Street, who are well known to the public and Telegraphic fraternity as the manufacturers of the "Magneto-electric Alphabetical Dial Telegraphs," of which a large number are used upon private lines in different parts of the country.³ This Telegraph is constructed upon the magneto-electrical principle, dispensing entirely with the voltaic battery. The following is a brief description of this admirable apparatus: The transmitter is contained in a small square box, upon which there is a dial plate, with a circle of thirty equidistant keys or buttons radiating from the same centre. Upon the dial plate are marked the alphabet, three points of punctuation and an asterisk; in an inner circle are the numerals. A pointer in the circle revolves in connection with the handle of the rotating armature, and is stopped at any letter by depressing one of the buttons. Four soft iron cores, with their enveloping helices of fine wire, are fixed upon the poles of a compound permanent magnet, these cores being placed at equal distances from each other in the circumference of a circle. On an axis passing through the centre of this circle, in connection with the handle, revolves a soft iron armature, whose breadth is a little greater than the distance between two adjacent cores. When the armature revolves it approaches one pole as it recedes from the one diagonally opposite, and induces simultaneously in the two coils currents having the same polarity. Immediately under the transmitter is an arm, upon the same axis as the pointer above, whose motion is arrested when a button or key is depressed, and the current which would otherwise pass over the wire is "short-circuited."

The face of the indicator is similar to that of the transmitter, having a small pointer, which is thrown around from letter to letter by a very curious and delicate escapement in connection with a polarized magnet, similar to that invented by SIEMENS, and which is actuated by currents of different polarities, generated by the permanent magnets.⁴

The coils of the indicator and permanent magnets are connected in one common circuit. When the armature of the magnets is turned around by means of the handle, if the pointer is free to move round the dial, a current traverses the line at every letter which the pointer passes, and moves the hand of the indicator correspondingly, but as soon as the carrier-arm on the same axis as the transmitting pointer is stopped, by coming in contact with a depressed key, the currents which would follow are "short-circuited." The pointers of the transmitter and indicator, therefore, stand still upon the

same letter until the key is raised and the "short-circuit" removed. Alarm or call bells are also attached in such a manner that when no communication is being sent the indicators are cut out and the call bells put in circuit, and *vice versa*.

In operating this instrument no knowledge of the usual Telegraphic signs or sounds are necessary; the operator simply places his fingers upon the letters of the alphabet which compose the Telegram, and the person receiving simply takes notice of the letters as they are successively pointed out upon the indicator at the other terminus.

Several trials have been made with this instrument over the wires between Boston and New York, to determine their applicability for railroad lines, all of which have proved highly successful. The working of this beautiful instrument, as well as the neatness with which it is constructed, and its advantages over the clumsy apparatus for similar purposes of a foreign manufacture, cannot be too highly spoken of, as it shows that America can successfully compete with Europe in the manufacture of Telegraphic apparatus, even if they are turned out of the shops of a FROMENT⁵ or SIEMENS-HALSKE.

This firm also manufacture another piece of curious electrical mechanism, which is called "HAMBLET'S Electro-magnetic Watch-clock," which is in use in nearly all of the fire alarm offices, hospitals, and prisons in the Union, and in a large number of the principal manufacturing establishments of New England.

It is for recording the rounds of a night watchman every hour, or half hour, which it does upon a paper dial, marked with the hours and subdivisions of time similar to the dial of a common time-piece, and which is made to revolve in such a manner as to receive the impress of a lead pencil bearing thereupon, which, as time passes, makes its mark upon the paper.

The electric current being in the quiescent state of the electrical mechanism, open (*i.e.* not actuated at the point of operation), will cause the pencil to make a regular continuous line, which in twelve hours would form a perfect and unbroken circle round the dial.

The instant that the watchman touches a simple piece of mechanism at any point upon his beat—upon which there are several—he causes the circuit to be opened and closed, and the pencil advances a degree towards the centre of the paper dial, leaving its impress as it advances, and then commences its mark on a new concentric parallel, and this action is re-

peated as often as, and whenever the apparatus is operated upon at different points in the circuit. An angular record is thus produced, which, on comparison of the angles with the marks of subdivision of time, will show not only that watch duty has been done, but will also show the exact time that each point has been visited. When a watchman operates the last point on his round the pencil falls back to its original level, and is ready for the next round.

If the pencil marks are all regular and similar in the different hours, it is proof that the twelve hours' watch duty have been performed; if, on the contrary, there are irregularities in the angles, they will be evidence that something has occurred requiring investigation.

This apparatus may be seen in nearly every Fire Alarm Telegraph office in this country—where, perhaps, many of our readers have observed it in operation.

In this establishment is also made the "Electric Plural Time Dial," an ingenious contrivance, by which the time indicated by one standard regulator clock is shown upon any number of duplicate time dials or electric clocks, situated at any distance from each other, and all connected in one electric circuit. The most curious part of this system is that the duplicate clocks have neither springs, weights, nor trains of wheels, to produce a movement of the index, but contain a simple though curious escapement, operated by an electro-magnet in the regulating circuit; they, therefore, require no winding up or attention. Another curious piece of electrical mechanism is also manufactured by this firm, called the "Electric Pendulum Gauge," for measuring and recording the varying heights, depths, and quantities of gas or water in reservoirs, but is of too complicated a nature for an accurate description without the aid of drawings. This apparatus has, after a series of severe tests, been adopted by the Boston Gas Co.

Electric Wind Indicators, Astronomical Clocks and Apparatus, Chronographs, Printing Telegraph Instruments, Repeaters, Galvanometers, Electrometers, Philosophical Apparatus,⁶ Fire Alarms, and every variety of magneto-electric and electro-magnetic mechanism, are also manufactured by this firm—all of which compare favorably with, if they do not excel any similar mechanism of foreign manufacture. Twelve persons are employed here, among whom are several of the best mechanics in the country. Telegraphers visiting the "Hub"⁷ would do well to call at the office of Messrs. EDMANDS & HAMBLET, where all of the apparatus described may be seen in actual operation.

The next on the list is that of CHARLES WILLIAMS, JR. The establishment of Mr. WILLIAMS is located at 109 Court Street, and though but a short time since damaged by fire, is again in full blast. Very little apparatus, except that used for Telegraphic purposes, is manufactured here, and in this particular branch the work is of a most excellent character, consisting of Repeaters, Switch-boards, Relays, Registers, Sounders, Keys, Rheostats, Galvanometers and batteries, all of which are made in large quantities. The most noticeable instrument manufactured here is the well known "Boston Relay," of which an large number are turned out weekly, mostly for use on railroad wires.⁸ Ten men are employed here. The office of the well known electrician and Telegraph inventor, MOSES G. FARMER, is also at this establishment.

The next is H. B. & W. O. CHAMBERLAIN,⁹ manufacturers, dealers, and importers of Mathematical, Astronomical, Chemical, Electrical and Philosophical Apparatus, at 310 Washington Street. This establishment is probably the largest and best of its kind in the United States. Every conceivable form of experimental apparatus appertaining to the above mentioned sciences can be found here. This firm have recently imported a large number of monster induction coils from the shops of RHUMKOFF,¹⁰ of Paris, one of which is probably the largest in this country.

The next is RITCHIE & SONS,¹¹ of 149 Tremont Street, manufacturers and importers of Philosophical and Electrical Apparatus, similar to that of the Messrs. CHAMBERLAIN. Mr. RITCHIE is known to the scientific public as the inventor of several important improvements on the original form of the RHUMKOFF, or PAGE¹² Induction Coil, and as the maker of the largest and most powerful induction coil hitherto constructed, now in the possession of M. GASSOIT.¹³ A description of this coil may be found in "NOAD'S Manual of Electricity," page 326, and in the "Philosophical Magazine," vol. xv, page 466.¹⁴

The last is THOMAS HALL.¹⁵

Very little Telegraphic mechanism is manufactured at this establishment at the present time, it being almost exclusively devoted to the manufacture of Electrical Toys and Medical Electrical Machines.

Mr. HALL'S shop is situated at No. 19 Bromfield St.

E.¹⁶

PD, *Telegr.* 4 (1867-68): 413-14.

1. This is the featured article on the first page of the issue.

2. Benjamin Edmands and James Hamblet, Jr., manufacturers of clocks and telegraph apparatus in Boston from 1862 to 1870, patented an electric clock in 1864 (U.S. Pat. 41,217) and a magneto-electric dial telegraph in 1868 (U.S. Pat. 79,741). Edison had instruments made at Edmands and Hamblet's shop, and in 1869 joined in a business venture with one of Hamblet's assistants, George Anders (see Chapter 3 introduction). *Boston Directory* 1868, 213, 278, 1069; Taltavall 1893, 96; *Elec. W.* 35 (1900): 56; App. 1.A26.

3. Private lines were owned or leased by individuals or companies, in contrast to lines owned by the telegraph companies for their regular business. After the Civil War, a market for telegraphy developed among merchants who wanted rapid intracity communication between distant offices or offices and warehouse. Before the development of small, reliable printing telegraphs (see Docs. 97 and 130), such lines used dial telegraphs, on which a pointer indicated transmitted letters. British inventor and scientist Charles Wheatstone patented the first dial telegraph in 1840. Although used widely in Europe, dial telegraphs were not common in the United States. In 1869 Edison invented his own magneto-electric dial telegraph, the magnetograph (see Chapter 3 introduction). *DSB*, s.v. "Wheatstone, Charles"; Prescott 1877, 562-602; App. 1.A26.

4. Werner Siemens received patents in almost all areas of telegraphy. One of his earliest inventions was his 1846 improvement of Wheatstone's dial telegraph. Ten years later he invented a magneto-electric dial telegraph that employed a polarized relay. In 1847 Siemens, his brother Johann, and Johann Halske formed Telegraphenbauanstalt von Siemens & Halske to manufacture telegraphs, electromedical devices, electrical meters, and railway signaling equipment. They later moved into electric power generation and distribution. Siemens's inventive and business activities made him a major force in the worldwide development of electrical industries during the late nineteenth century. Siemens 1968, 130, 160; Weiher and Goetzeler 1977; *DSB*, s.v. "Siemens, Ernst Werner von."

5. Gustave Froment, a graduate of the Ecole Polytechnique, was a prominent Parisian manufacturer of scientific instruments. He manufactured Giovanni Caselli's facsimile telegraph, David Hughes's printing telegraph, and battery-powered electric motors of his own design. *Dict. des Bio.*, s.v. "Gustave Froment"; Laussedat 1865; "Le pouvoir et la science," *Le Cosmos* 10 (1857): 495-97; and "Mort de M. Froment, membre du Conseil de la Société d'encouragement," *Bull. Soc. l'ind. nat.* 64 (1865): 74-80.

6. "Philosophical Apparatus" meant scientific instruments.

7. Boston.

8. Charles Williams's relay is pictured in Pope 1869, opp. p. 31.

9. Henry and Walter Chamberlain. *Boston Directory* 1868, 133, 880.

10. Heinrich Ruhmkorff, the eponymous German maker of induction coils, had in fact improved the device invented by several others, including American physicist and physician Charles Page. Page's long and bitter priority fight over the invention is detailed in Post 1976. See also *DSB*, s.v. "Ruhmkorff, Heinrich Daniel."

11. Ritchie & Sons comprised Edward Ritchie and his sons T. P. and John. In 1857 Ritchie improved the induction coil by changing the method of wrapping wire around the core from overlaid longitudinal spi-

als to projecting spirals placed side by side. *Boston Directory* 1868, 501; *DSB*, s.v. "Ruhmkorff, Heinrich Daniel."

12. See n. 10.

13. John Gassiot, a wealthy English merchant and physicist, used the induction coil to study the phenomena of striated discharges. *DSB*, s.v. "Gassiot, John Peter."

14. Edison made an error in the first citation. On page 326 of his copy of Noad 1859 there is a reference not to Edward Ritchie but to the English physicist William Ritchie and his torsion galvanometer. The second citation is to John Gassiot, "Description of a Ruhmkorff's induction Apparatus, constructed for John P. Gassiot, V.P.R.S., by Mr. Ritchie, Philosophical Instrument Maker, Boston, U.S."

15. Thomas Hall ran one of the oldest telegraph manufacturing shops in Boston. He began working in 1840 for Daniel Davis, who made the instruments for Samuel Morse's Baltimore-Washington line. When Davis retired in 1849, Hall acquired part of the business and in 1857 took over as sole proprietor. *Boston Directory* 1868, 277, 884; Hall 1874, 7-8.

16. Authorship attributed to Edison. See Doc. 34, n. 10.