RONALD'S ELECTRIC TELEGRAPH.

CHAPTER XI.

Invention of Ronald's Electric Telegraph—Experiments and Description of the Apparatus—Description of an Electrograph.

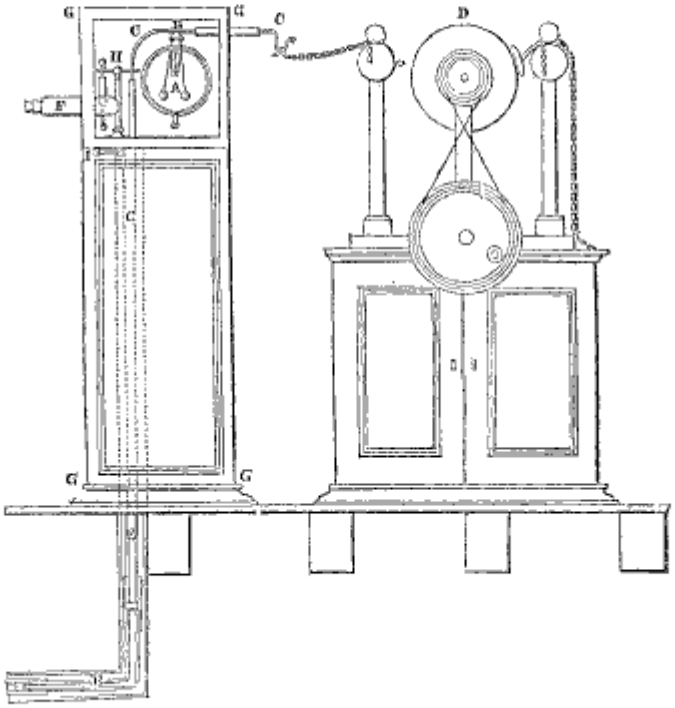
INVENTION OF RONALD'S ELECTRIC TELEGRAPH.

The Ronald Electric Telegraph was invented in 1816, at Hammersmith, London, England, by Mr. Francis Ronald, and a description of it was published by him in 1823. He erected eight miles of insulated wire on his lawn, and besides, he buried in the earth five hundred and twenty-five feet, in a trench dug for that purpose, four feet deep. The wire through the air was insulated with silk strings suspended from trees and poles. The subterranean wire was placed through thick glass tubes, and these were placed in troughs made of dry wood, two inches square. The troughs were filled with pitch. He employed the ordinary electric machine, generating high-tension electricity, and the pith-ball electrometer, in the following manner. He placed two clocks at two stations; these clocks had upon the second-hand arbor a dial with twenty letters on it; a screen was placed in front of each of these dials, and an orifice was cut in each screen, so that one letter only at a time could be seen on the revolving dial. These clocks were made to go isochronously, and, as the dial moved round, the same letter always appeared through the orifices of each of these screens. The pith-ball electrometers were hung in front of the dials.

It is evident, therefore, that, if these pith-balls could be made to move at the same instant of time, a person at the transmitting station, by causing such motion in both those electrometers, would be able to inform the attendant at the distant

or receiving station what letters to note down as they appeared before him in succession on the dial of the clock.

Fig. 1



This was accomplished in the following manner: The transmitter caused a current of electricity to be constantly operating upon the electrometers, so as to separate the balls of those electrometers, except only when it was required to denote a letter, and then he discharged the electricity from the wire, and instantly both balls collapsed. The distant observer was thereby informed to note down the letter then visible. In this way letter after letter could be denoted, words spelled, and intelligence of any kind transmitted. All that was absolutely required for this form of telegraph was, that the clocks should go isochronously *during the time* that the intelligence was being transmitted; for it was easy enough, by a preconcerted arrangement between the parties, and upon a given signal, for each party to start their clocks at the same letter, and thus, if the clocks went together during the transmission of the intelligence, the proper letters would appear simultaneously, until the commu-

nication was finished. The attention of the distant observer was called by the explosion of gas by means of electricity from a Leyden jar.

Fig. 2.

Fig. 3.

EXPERIMENTS AND DESCRIPTION OF THE APPARATUS.

Mr. Ronald has given the following additional explanations of his invention in his work, entitled a "Description of an Electric Telegraph, and some other Electrical Apparatus:"

In fig. 1, D is an electrical machine; B, the pith-ball electrometer; A, the screen hiding the letters on the dial behind it; F, the gas alarum; E, the tube conveying the wires.

Fig. 2 shows the moveable dial hidden by the screen in fig. 1.

Fig. 3 is an enlarged drawing of the screen, with orifice and pith-ball electrometer.

Mr. Ronald entered on the subject of the comparative merits of wires suspended in the air and wires buried in the earth, and arrived at the conclusion that subterranean wires were much to be preferred, although many persons were found to object to that plan.

He says: "The liability of the subterranean part of the apparatus to be injured by an enemy or by mischievously disposed persons has been vehemently objected to—more vehemently than rationally, I presume to hope (as is not unfrequently the case on these as on many other sorts of occasions). If an enemy had occupation of all the roads which covered the wires, he could undoubtedly disconcert my electric signs without difficulty; but would those now in use escape? And this case relates only to invasions and civil war; therefore let us have smokers enough to prevent invasions, and kings that love their subjects enough to prevent civil wars.

"To protect the apparatus from mischievously disposed per-

sons, let the tubes be buried six feet below the surface of the middle of the high roads, and let each tube take a different route to arrive at the same place. Could any number of rogues then open trenches six feet deep, in two or more different public high roads or streets, and get through two or more strong cast-iron troughs, in less space of time than forty minutes? for we shall presently see that they would be detected before the expiration of that time. *If they could*, render their difficulties greater by cutting the trench deeper, and should they still succeed in breaking the communication by these means, hang them if you catch them, damn them if you cannot, and mend it immediately in both cases."

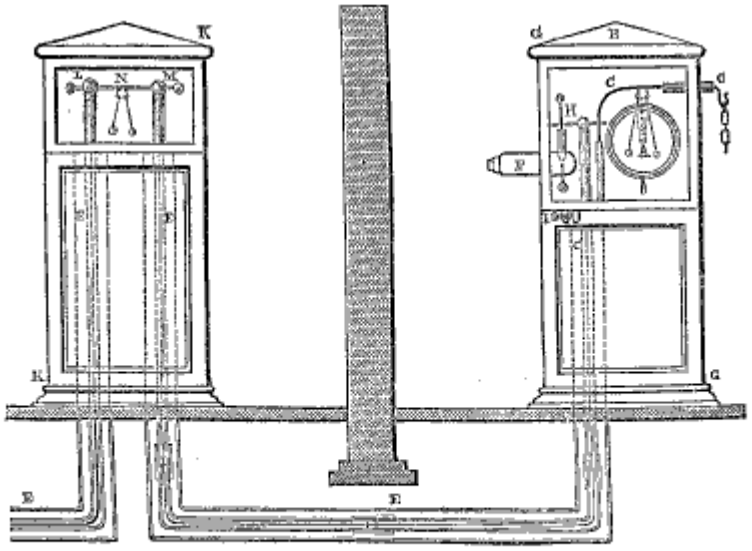
In further explanation Mr. Roland states, that the circular brass plate, fig. 2, was divided into 20 equal parts, and it was fixed upon the seconds' arbor of a clock which beat dead seconds. Each division was marked by a figure, a letter and a preparatory sign. The figures were divided into two series, from 1 to 10, the letters were arranged alphabetically, leaving out J, Q, U, W, X, Z. The preparatory signs are indicated by the position of the rays indicated by A, B, C, D, E, F, G, H, I, K, and represent as follows, viz., A, prepare; B, ready; C, repeat sentence; D, repeat word; E, finish; F, annul sentence; G, annul word; H, note figures; I, note letters; K, dictionary.

Before and over the disk, fig. 2, was fixed a brass plate, fig. 3, capable of being occasionally moved by the hand round its centre, and which had an aperture of such dimensions, that while the disk was carried round by the motion of the clock, only one of the letters, figures, and preparatory signs upon it could be seen through the aperture at the same time; for instance, the figure 9, the letter V, and the sign "Ready," are now visible through the aperture in fig. 3. In front of this pair of plates, A, fig. 1 and 4, was suspended an electrometer of Canton's pith balls, from a wire E, which was insulated, and communicated with a cylindric electrical machine of only 6 inches in diameter, and with the wire C 525 feet long, which was insulated in glass tubes, surrounded by the wooden trough filled with pitch, and buried in a trench cut 4 feet deep in the ground.

Another similar electrometer was suspended in the same manner before another clock, similarly furnished with the same kind of plates and electrical machine. This second clock and machine were situated at the other end of the buried wire, and it was adjusted to go as nearly as possible synchronously with the first. Hence, it is evident, that when the wire was charged by the machine at either end, the electrometers at both ends

diverged; when it was discharged suddenly at either station, they both collapsed at the same instant; and when it was discharged at the moment that a given letter, figure, and sign, on the lower plate of one clock appeared in view through the aperture, the same figure, letter, and sign appeared also in view at the other clock; and that, by such discharges of the wire at one station, and by noting down the letters, figures, or signs in *view*, at the other, any required words could be spelled, and

Fig. 4.



figures transmitted. But by the use of a telegraphic dictionary, a word, or even a whole sentence, could be conveyed by only 3 discharges, which could be effected in the shortest time in 9 seconds, and in the longest, in 90 seconds, making a mean of 54 seconds. This dictionary consisted of 10 leaves cut in the manner of a common-place book, or ledger; each leaf was also divided into 10 columns, and each column numbered on the top of the page. The columns were intersected by 10 horizontal lines, each numbered on the left side. Tthe space produced by the intersections was occupied by words or sentences.

It was necessary to distinguish the preparatory signs from those intended to spell or refer to the dictionary, by giving the wire a rather higher charge than usual, and thus causing the

pith balls to diverge more; and it was always understood that the first sign, viz., "*Prepare*," was made when that word, the letter A, and figure 1, were in view at the communicator's clock; so that should the communicant's clock not exhibit the same sign (in consequence of its having gained or lost more than the communicator's), he noted how many seconds it had lost or gained, and moved his upper plate on its centre through just so many seconds to the right or left as occasion required, and the communicator continually repeated his sign "Prepare," until the communicant had adjusted his clock, and had discharged the wire at the moment when the word "Ready," appeared in view.

A second preparatory sign was now made by the communicator, provided that the word or sentence was not contained in the dictionary, or that the figures were to be noted, not as referring to the dictionary, but in composition; and this was done by discharging the wire at the moment when the term "Note Letters," or "Note Figures," came into view. The gas pistol, F, in figs. 1 and 4, which passed through the side of the clock-case, G, was furnished with an apparatus, H, by means of which a spark might pass through it when the communicator made the sign "Prepare," in order that the explosion might excite the attention of the communicant, and the handle I, enabled him to break the connection of it with the wire when necessary. The explosion of the gas pistol served as an alarm, but to what extent it was used to communicate by sound, I have not been able to ascertain.

At half the distance between the two ends of the wire was placed the apparatus, K, by which its continuity could be broken at pleasure, for the purpose of ascertaining (in case any accident had happened to injure the insulation of the buried wire) which half had sustained the injury, or if both had. It is seen that the two portions of the wire and tube rose out of the earth, and terminated in two clasps, or forks, L and M, and the wire, N, carrying a pair of pith balls resting on these forks, connected them. Now, by detaching this connecting wire from the fork L, while it still remained in contact with the fork M, or *vice versa*, it could be seen which portion of the wire did not allow the balls of the electrometer to diverge, and consequently which had lost its insulation, or if both had. Mr. Ronald submitted his telegraph to the Admiralty, for adoption by the government, but he was informed that "telegraphs of any kind were then wholly unnecessary," and that "no other than the one then in use would be adopted." There the matter ended.

DESCRIPTION OF RONALD'S ELECTROGRAPH.

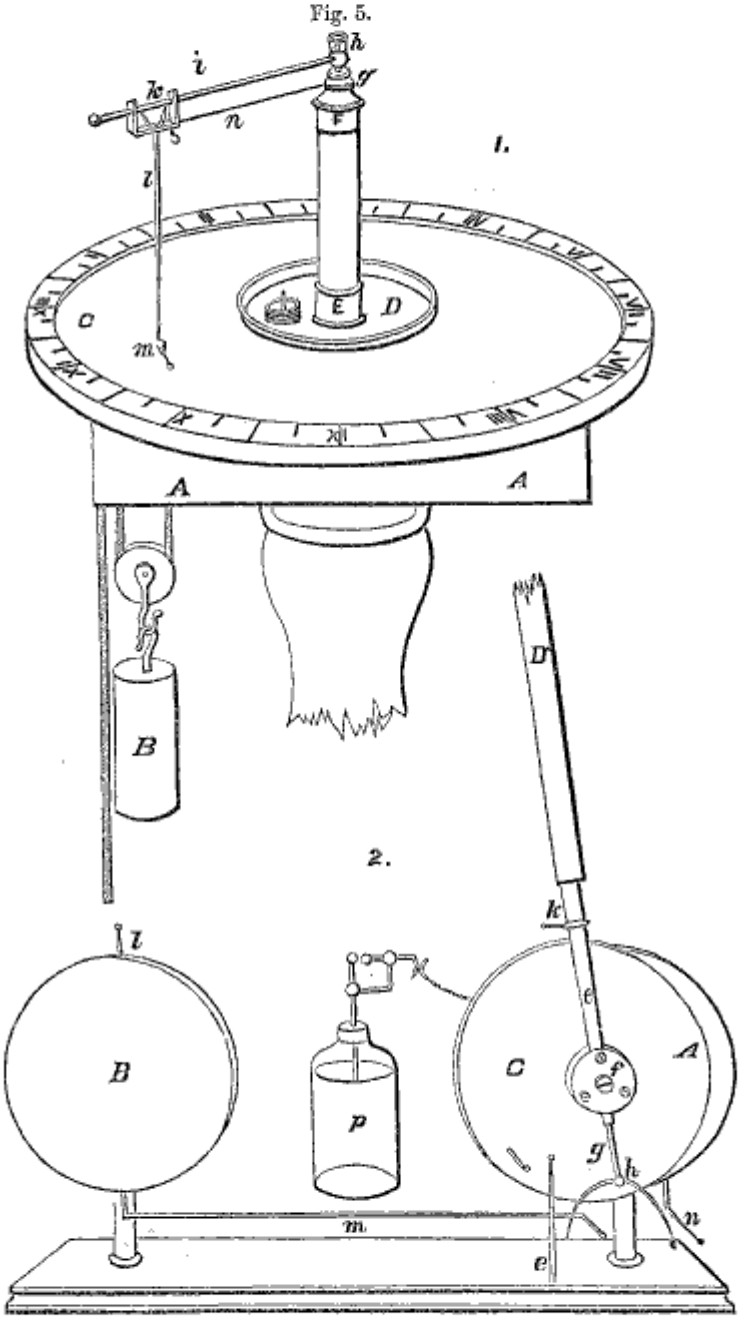
Besides the efforts of Mr. Ronald to establish his electric telegraph in 1816, and in subsequent years, he invented an apparatus called an "electrograph." This instrument has been construed to be a step in the march of telegraphic invention, and in substantiation of which, it was placed in the pleadings of a contesting party in one of his telegraph suits in America.

Fig. 5 represents the new electrograph, a description of which was published by Mr. Ronald in London, in 1823. He said:

Whoever has been possessed of a sufficient share of curiosity and patience to examine the extraordinary and amusing series of phenomena which atmospheric electricity exhibits, as observed by Signior Beccaria's exploring wire, or Mr. Bennett's, Mr. Cavallo's, and Mr. Read's apparatus, &c., must have regretted the impossibility of noting down sometimes the very *rapid* changes in *tension*, as well as in *kind* of electricity, which occur in a thunder-storm, or hard shower of rain, hail, snow, &c., in such manner as to convey *a correct idea* of the different very short intervals of time in which they occur, as well as of the extraordinary phenomena themselves. Hence, *perhaps*, arose the idea of employing an electrograph, a far more *necessary* instrument than the barometrograph, &c., &c. The phenomena displayed by the electricity of serene weather, and of dew, are not, however, less interesting, or less deserving attention, and they equally require an instrument to note them, but for the opposite reason, viz., their tediousness. Fig. 5 is an electrograph, which may be applied to either purpose.

A A is a box, containing a strong timepiece, placed in a horizontal position, and receiving motion from the weight B.; C is a circular plate of baked mahogany wood, eight inches in diameter, having a perforation, D, of two inches and a half diameter. The circumference of this plate, and that also of the perforation, are provided with edges, or rims, and the outer broad rim is divided off, and marked with hours and minutes, in the manner of a common clock. The space between the two edges is nearly filled with cement, composed of resin, bees' wax, and lamp-black, and this part of the apparatus can be detached at will from the box. E F is a glass tube, furnished with brass caps (and covered both inside and out with hard cement), the lower end of which screws upon the dial-plate of the timepiece, and the upper end carries a small cylinder or sheave, *g*. *Within this tube*, E F, a stem of glass is fixed by its lower end on the

Fig. 5.



minute arbor of the timepiece, and a pivot, attached to its upper end, passes through the cap *r* and the cylinder *g*. This pivot carries the iron ball and cup, *h*, into which is screwed a steel wire, *i*, and this carries the piece, *k*, which may slide with a little friction upon it. The wire *l*, fixed into the piece *k*, terminates at its lower end in a hook, and another short wire, *m*, is furnished with a ring at one end, by which it is attached to the hook, and with a small gold bead at the other, which rests upon the resinous plate. Lastly, a fine thread, *n*, is also attached by one end to the piece *k*, and by the other to the cylinder *g*.

When the clock is in motion, and the apparatus disposed as is represented in the figure, it carries round the arm *k*, and of course carries the thread *n*, to coil itself round the stationary cylinder, *g*, the piece *k* to advance toward the ball *h*, and the gold bead, which *trails* upon the resinous plate, to describe a spiral thereon.

And when a communication is established between the little iron cup above *h* (which contains a globule of mercury, in order to secure perfect contact) and a wire connected with any species of atmospheric apparatus, the gold bead acts upon the resinous plate like Mr. Bennett's electric pen, *i. e.*, it electrifies it in such a manner, that when the plate is removed from the clock, and powdered with pounded resin, or even common *dry* hair powder, the line of the spiral exhibits configurations, which vary in form and in breadth according to the kind and intensity of electricity which the bead has communicated to it; and, by reference to the divisions on the circumference of the resinous plate, it is easy to discover the exact periods at which these occurrences took place. In short, a *comparative picture* of all the phenomena of atmospheric electricity, during the absence of the observer, is thus procured.

If the instrument be used for noting the phenomena of serene weather, dew, &c., the hour arbor is generally preferable; if for those of a thunder-storm, hard shower of rain, or hail, or snow, the minute arbor; but I have sometimes found, that a more rapid motion is required than either, which may, of course, be obtained by the addition of a third arbor, &c.; and the glass tube, E F, with all its appurtenances, can accordingly be easily transferred from any one arbor to another, and the plate adjusted to a new centre. It is also necessary sometimes to employ a cylinder, either larger or smaller than *g*. In the first case, when the more violent and more transient phenomena are to be noted; and, in the second, when a delineation of a longer period is required to be executed by the instrument;

for it is evident that, in proportion to the diameter of the cylinder *g*, will be the proportions of the volute upon the resinous plate; and that the comparatively short duration of a storm, or shower, &c., which draws a larger figure, must require a space of greater breadth, as well as length, than the other, in order to avoid confusion; the cylinder *g* can therefore be removed, and others substituted in its place.

One advantage, which I have derived from this contrivance over a cylindric electrograph, is, the power of conveniently bringing the resin into a fit state to receive the electrical drawing, the only *certain* method of doing which is to pass a heated plate of iron over it, at two or three inches distance, in order to melt it *partially* (so perfectly does it retain the figure, and so difficult is it to destroy that figure without communicating a new one by the ordinary methods); which process of heating it is almost impossible to perform upon any other surface than a plane, so as to preserve a fine even surface.

But the principal advantage over both the cylindric and plane electrograph, *proposed* by Magellan, is that derived from a comparative and comprehensive view of the daily periodical returns of the phenomena: those, for instance, of the morning and evening electricity, which Beccaria found to bear a striking relation with the periods of sunrise and sunset, and which he accounted for by the sun's action upon the vapors which were exhaled from the earth. Magellan's plate electrograph would be very cumbersome and inconvenient for such observations.

Would not the above be also a proper instrument for observations on that most extraordinary tendency which thunder-storms have to reappear, many days successively, about the same hour; and, what is more, at the precise spot where they had appeared at first. "It is necessary to inhabit," says Sig. Volta, the learned and sagacious discoverer of this new phenomenon, "a mountainous country, and particularly the neighborhood of lakes, such as Como, the precincts of Lario, Verbano, Verese, Lugano, Lecco, and the whole mountain of Bianza, Bergamo, &c., in order to be convinced of such periods and fixations (so to speak) of thunder-storms at this or that valley, or opening of a mountain, which last until some wind, or remarkable change in the atmosphere, shall occur to destroy them." Sig. Volta refers the cause of the phenomenon to a modification in the ambient air, produced by the thunder-storm of the preceding day.