HISTORY OF THE AMERICAN ELECTRO-MAGNETIC TELEGRAPH.

CHAPTER XXXI.

Invention of the Telegraph—The first Model of the Apparatus—Specimen of the Telegraph Writing—The Combined Circuits invented—Favorable Report of the Committee on Commerce in Congress—Construction of the Experimental Line—Invention of the Local Circuit—Improvements of the Apparatus—Administration of the Patents by Hon. F. O. J. Smith and Hon. Amos Kendall—Extensions of the Lines in America.

INVENTION OF THE TELEGRAPH.

THE patented American electro-magnetic telegraph was invented by Samuel Findley Breese Morse. It is not my purpose to discuss the questionable claims of others, in regard to their participation as auxiliaries in the perfection of the telegraph bearing the above name. It *is* my purpose to give the facts with but little comment. The reader can exercise his own judgment in the premises.

Mr. Morse was an historical painter, and much of his early life was spent in Europe in the perfection of his profession. In reference to the invention of the telegraph, Mr. Morse has deposed, in a case before the Supreme Court of the United States, as follows, viz.:

"Shortly after the commencement of my return voyage from Europe, in the autumn of 1832, before referred to, the then recent experiments and discoveries in relation to electro-magnetism, and the affinity of electricity to magnetism, or their probable identity, became the subject of conversation.

The special subject of conversation was the obtaining the electric spark from the magnet. In the course of the discussion, it occurred to me that by means of electricity, signs representing figures, letters, or words, might be *legibly written down* at any distance.

With sincere respect & esteem
Y. friend & Servt
Saml. F. B. Morse

At this time the idea of telegraphing in any way by electricity was new to me, and so far as I could judge, to every one on board the ship. So far as my knowledge then extended, I was ignorant that any one had previously entertained even the idea of an electric telegraph. Subsequent investigation has, however, shown me that the first *idea* of telegraphing by electricity does not belong to me, and I therefore disclaim it; but in the modes proposed by me I *do* claim to have invented an entirely novel and useful mode and art of telegraphing.

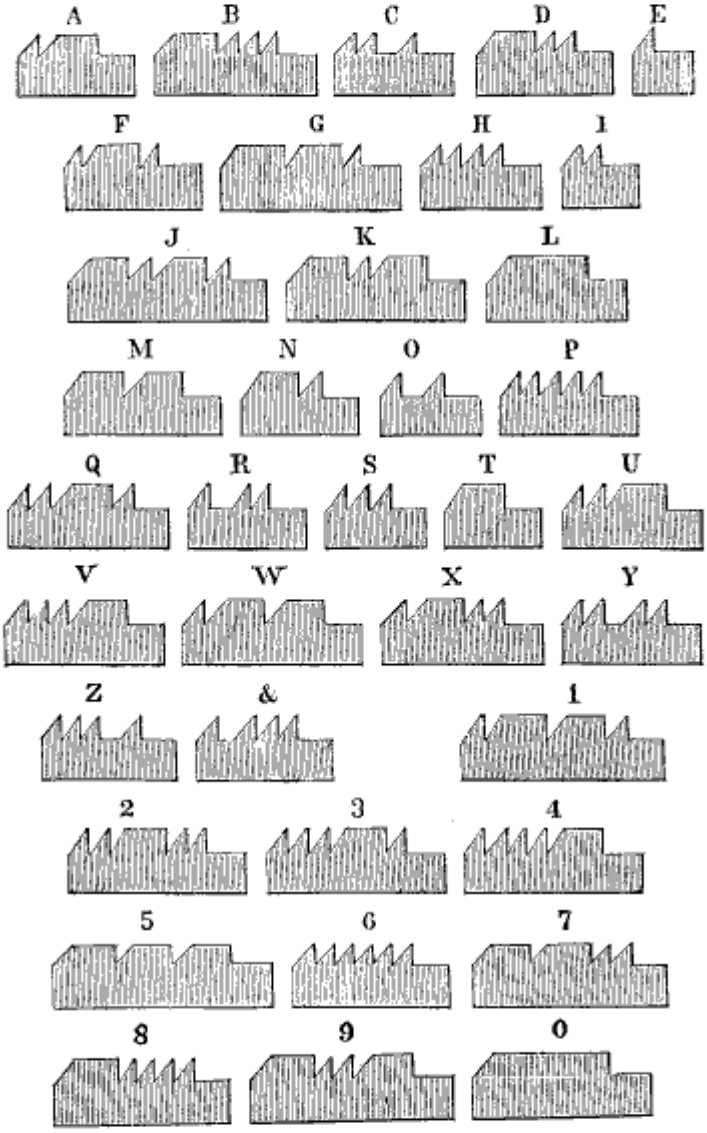
All previously known modes of telegraphing were by evanescent signs. Had my invention rested merely in the idea, it would have been comparatively valueless; but at the same time I conceived a practical mode of carrying into effect my original idea. I claim then to have invented a new *art: the art of imprinting characters at a distance for telegraphing purposes*, and the mode and means of performing the same are set forth in my several letters patent. And I also claim the use of sounds for telegraphing as are set forth in my letters patent.

The idea thus conceived of an electric telegraph took full possession of my mind, and during the residue of the voyage, I occupied myself, in a great measure, by devising means of giving it practical effect. Before I landed in the United States, I had conceived and drawn out in my sketch book the form of an instrument for an electro-magnetic telegraph, and had arranged and noted down a system of signs, composed of a combination of dots and spaces, which were to represent figures or numerals, and these were to indicate words, to which they were to be prefixed in a telegraphic dictionary, where each word was to have its own number. I had also conceived and drawn out a mode of applying the electric or galvanic current, so as to make these signs by its chemical effects in the decomposition of salts; and so also to make sounds for telegraphing. Immediately after my landing in the United States, I communicated my invention to a number of my friends, and employed myself in preparations to prove its practicability and value by actual experiments.

To that end, before the commencement of the year 1833, being at the house of my brother, in New-York, I made a mould and cast a set of type representing dots and spaces, intended to be used for the purpose of closing and breaking the circuit in my contemplated experiments."

The type referred to in the above were precisely as those represented in fig. 1. The application of the type will be explained hereinafter. Their value is indicated by the top, thus, A is a dot and a dash, B a dash and three dots, &c.

Fig. 1.

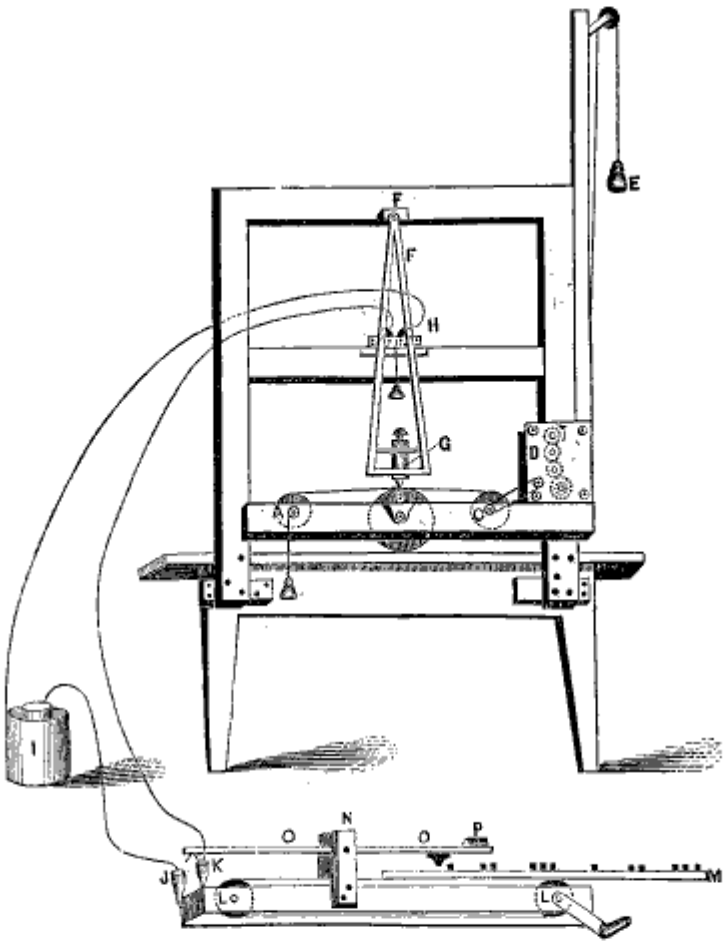


THE FIRST MODEL OF THE APPARATUS.

Morse's first instrument was made of an old picture frame, F A C F, fastened to a small table, as in fig. 2. The wheels of an old clock D were arranged to carry the paper forward, by the endless band connecting D with the cylinder axle C. The

weight E put in motion the clock-work. A is a cylinder on which rolls the ribbon paper, and B is an auxiliary drum in the movement of the paper. The paper unrolls from C, passes over the drum B, and winds around A. The movement of A is regulated by the weight attached to it. The pen lever is sus-

Fig. 2.



pended from F. It is composed of two diverging rods connected by two cross pieces at G, and at H is a steel bar to serve as an armature to the electro-magnet at H, the ends of which face the armature represented by the dotted bar. The wire runs from the battery cup I to the magnet coils, thence to K, and from J

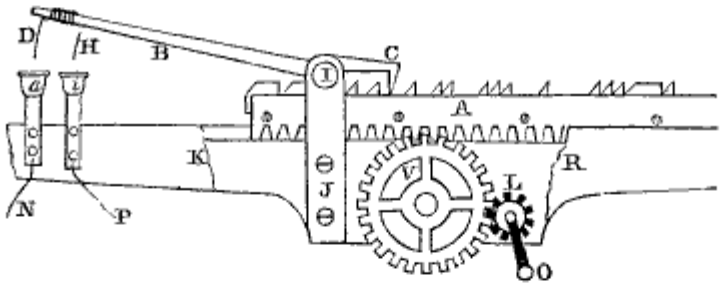
back to the battery. When the battery is in electrical action, the magnet H attracts the armature, which draws the pen lever F H G. When the circuit is opened, a spring draws the pen lever from the magnet. The dotted lines from G, run to the pencil adjusted in the base of the lever. When the magnets attract the lever, the pencil makes a mark on the paper, and if the paper is in motion the mark will be oblique across, forming the half of the letter V. When the current is no longer in the magnet spools, the spring draws the lever back again, which forms the other half of the letter V. Mr. Morse formed his alphabet by a combination of the angles, as will be presently shown. I have in the above explained this primitive apparatus—the clock-work, magnet, paper rollers, pen lever, pencil, and the wire circuit. I will now describe the manner of opening and closing the voltaic circuit, which is consumated at J K by a simple mechanical arrangement. L L are the two cylinders or drums upon which is an endless band, moveable by a crank as seen to the right in the figure. O O is the circuit lever, N is its fulcrum and P a small weight to bear down that end of the lever so as to elevate the fork seen at the other end. J K are two small cups filled with mercury, into which is immersed at intervals the line wire. When the fork is made to descend into the mercury cup it closes the metallic circuit, and the electricity flows through the wires, the magnet spools, and then to the battery. M is a port-rule or a grooved piece of wood or metal. It is filled with the type represented in fig. 1. These type are moveable, but they fit solid in the port rule. When the crank is turned, the projection of the type presses under the subtending piece seen attached to the lever O O, which raises the lever at that end and depresses the other end, so that the forked ends enter the mercury in the cups J K. After the first type has passed the hanging projection O, the lever is elevated from the mercury cups. The crank then carries on the port-rule and another type passes, elevating the lever, closing the circuit at J K, which magnetizes the cores of the magnet H, attracting the armature of the pen lever F H G, and then the pencil makes its mark upon the paper.

In order that the port-rule may be the better understood, I will present the following as given by Mr. Alfred Vail:

"These type were set up in a cavity, made by putting two pieces of long rules of brass plate together, side by side, with a strip of half their width between them; so as to make the cavity sufficiently large to receive the type. This was denominated the *port rule*, and is represented in fig. 3 by A. Parts of the type are seen rising above the edge of the rule, and

below it are seen the cogs, by which with the wheel V, the pinion L, and the crank O, the port rule, with its type, were carried along at a uniform rate, in a groove of the frame, K R, under the short lever C, which has a tooth or cam at its extremity. J is a support, one on each side of the frame, for the axis of the lever B and C, at its axis I; *a* and *i* are two brass

Fig. 3.



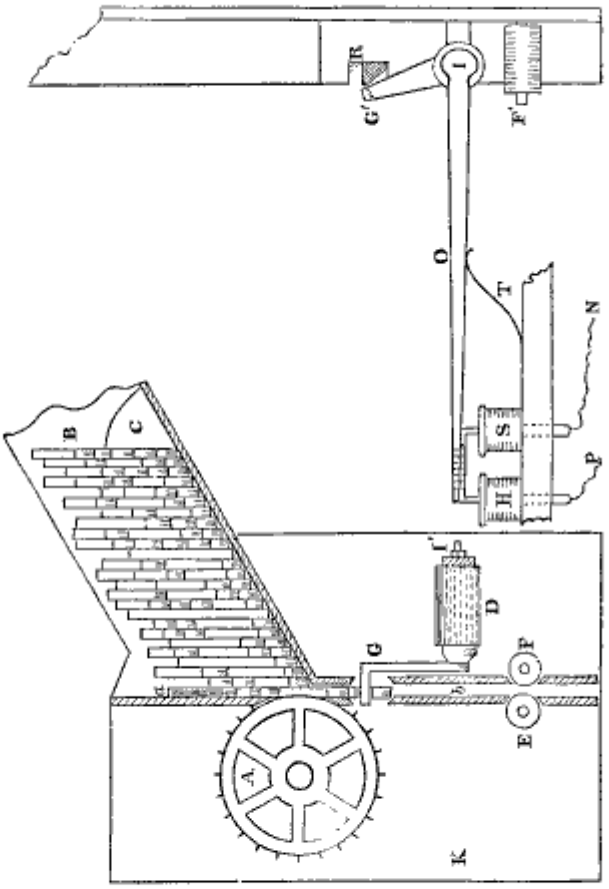
cr copper mercury cups, fastened to the frame. Those cups have the negative and positive wires soldered to them, N and P. D and H are the ends of *one* copper wire, bent at right angles at that portion of it fastened to the lever B. The ends of the copper wire were amalgamated, and so adjusted that when the lever is raised at C, by the action of its cam passing over the teeth of the type, the lever B is depressed, and the wires D and H dip into the mercury cups, and thus complete the connection. This plan worked well, but was too inconvenient and unwieldy.

The second method was upon the same principle, with a more compact arrangement. The type being put into a hopper and carried one by one upon the periphery of a wheel, the teeth acting upon a lever in the same manner as in the figure preceding. The wheel being horizontal.

The third plan differed only in one respect, instead of the types moving in a circle they were made to move in a straight line. Fig. 4 represents that instrument. The type were all made with small holes through their sides, so as to correspond with the teeth of the wheel A driven by the clock-work and weight. K is the side of the frame containing the clock-work. B is the hopper containing the types, with their teeth outward. The hopper is inclined at an angle, so that the type may slide down as fast as one is carried through the cavity *a* and *b*. C is a brass block to keep the type upright, and sliding down with them. E and F are two small rollers, with springs (not shown) to sustain the type after the wheel A has carried them beyond its reach. G is a lever for the same purpose as C in fig. 3. D

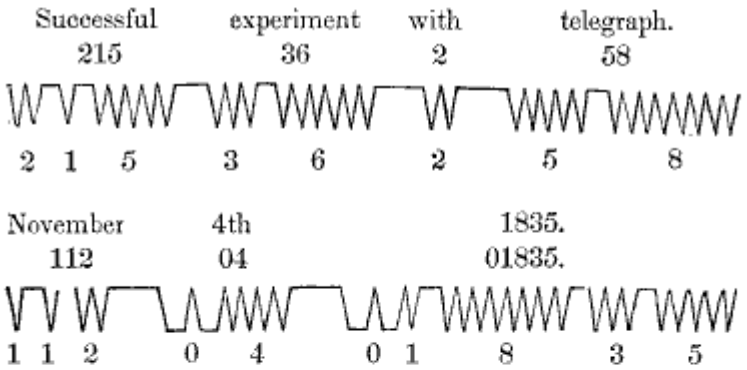
its support, through which its axis passes. At I is the long lever O of the right-side figure, to the end of which is the bent wire in the mercury cups H and S, and to which are soldered the wires P and N. T is the spring to carry back the lever O. F′ is one of the small rollers, and G′ the short lever. At R may be seen a part of one of the type passing, the tooth having the short lever upon its point, thereby connecting the circuit at the mercury cups H and S, by the depression of the long lever O. The hopper B may be of considerable length, and at a less angle. when a communication is to be sent, it is set up in type and put in the hopper. The clock work is then put in motion, and the wheel A will carry them down one by one.

Fig. 4.



SPECIMEN OF THE TELEGRAPH WRITING.

The writing upon the paper with the pencil or fountain pen was rapid and intelligible and practically effective, though far less so than the more modern organizations of the alphabet. The following are specimens of the writing done by this plain and simple arrangement, at a public exhibition in the New-York City University, at a distance of one third of a mile.



The *words* in the diagram were the intelligence transmitted.

The *numbers* (in this instance arbitrary) are the number of the words in a telegraphic dictionary.

The *points* are the markings of the register, each point being marked every time the electric fluid passes.

The register marks but one kind of mark, to wit, (V). This can be varied two ways. By intervals, thus, (V VV VVV,) signifying one, two, three, &c., and by reversing, thus, (Λ). Examples of both these varieties are seen in the diagram.

The single numbers are separated by *short* and the whole numbers by *long intervals.*

To illustrate by the diagram: the word "successful" is first found in the dictionary, and its telegraphic number, 215, is set up in a species of type prepared for the purpose, and so of the other words. The type then operate upon the machinery, and serve to regulate the times and intervals of the passage of electricity. Each passage of the fluid causes a pencil at the extremity of the wire to mark the points as in the diagram.

To read the marks, count the points at the bottom of each line. It will be perceived that two points come first, separated by a *short* interval from the next point. Set 2 beneath it. Then comes one point, likewise separated by a short interval. Set one beneath it. Then comes five points. Set 5 beneath

them. But the interval in this case is a *long* interval; consequently the three numbers comprise the whole number, 215.

So proceed with the rest until the numbers are all set down. Then, by referring to the telegraphic dictionary, the words corresponding to the numbers are found, and the communication read. Thus it will be seen that, by means of the changes upon *ten* characters, all words can be transmitted. But there are *two points* reversed in the lower line. These are the *eleventh* character, placed before a number to signify that it is to be read as a *number*, and not as the representative of a word.

The telegraph apparatus above described was worked by Professor Morse, November, 1835, in the New-York City University, in the presence of Leonard D. Gale, D. Huntington, O. Loomis, Robert Rankin, and others. The facts are fully substantiated by the evidence given in various telegraph suits, and particularly in the case, Morse vs. O'Rielly, adjudicated upon by the Supreme Court of the United States. The apparatus above described is precisely in accordance with the idea held by Morse on the ship Sully in 1832. In substantiation of this fact, Captain Pell, the master of the ship, and others have testified, as will be found in the records of the Supreme Court of the United States, and the Federal Courts of Kentucky, Pennsylvania and Massachusetts.

Captain Pell deposed as follows:

"His plan of communicating intelligence at a distance was by imprinting signs at a distance. While on board the ship, he described his use of a galvanic trough, the circuit from which was to be broken and closed by means of a lever, acted upon by the tooth types, which were to be moved by a crank.

At the other extremity of the circuit was an artificial horseshoe magnet, with a moveable armature, holding a pencil or pen, and carrying it by the movement communicated by the closing and breaking of the circuit, over a papered cylinder, on which it traced a succession of toothed marks. This was in the month of October, 1832. On that passage, Prof. Morse also showed me a sketch-book, in which were contained drawings of some of said telegraphic apparatus.

The said sketch-book was shown to me last spring, and I recognized it as the same sketch book shown to me in the possession of said Morse during said voyage of 1832. When it was so shown to me last spring, I wrote my name upon it and the date of my said signature.

I distinctly recollect that the said sketch-book, at the time that I saw it on board the packet-ship Sully, had in it certain drawings which I recognized when I wrote my name upon

said leaf, as before stated; and also on another page, other drawings of the part of the apparatus and machines described by Professor Morse for his telegraph, which I also recollected having seen in said book during the voyage aforesaid, and I recognized them when so shown to me last spring, and then wrote my name upon the page containing them.

When said Morse showed me an apparatus and machine in operation at the University, in the city of New-York, I recognized the instrument the moment I saw it as being constructed upon the same general principles of the telegraphic instrument described by Professor Morse on board the ship Sully, on his passage from Havre, in 1832."

Such was the telegraphic apparatus devised by Morse on the ship Sully in 1832, and exhibited to his friends in 1835. In the year 1836 he had the same telegraph on public exhibition in the city of New-York.

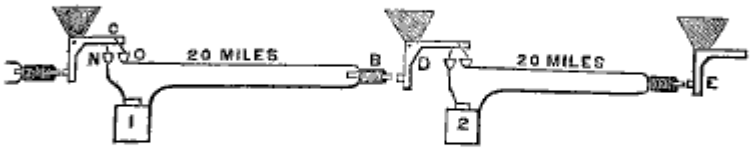
THE COMBINED CIRCUITS INVENTED.

The combination above described satisfied every one of its practicability on short voltaic circuits, and it became a question how far the current could be transmitted over a wire to produce magnetism in a piece of soft iron.

The following extracts are taken from the deposition of Prof. Morse, filed in the Supreme Court of the United States:

"Early in 1836, I procured forty feet of wire, and putting it in the circuit I found that my battery of one cup was not sufficient to work my instrument. This result suggested to me the probability that the magnetism to be obtained from the electric current would diminish in proportion as the circuit was lengthened, so as to be insufficient for any practical purposes at great distances; and to remove that probable obstacle to my success, I conceived the idea of combining two or more circuits together in the manner described in my first patent, each with an independent battery, making use of the magnetism of the current on the first to close and break the second; the second, the third; and so on."

Fig. 5.



This arrangement is represented by fig. 5, in which three electro magnets, B, are shown, and numerals 1 and 2 are two

stations twenty miles apart. At station 1 are two mercury cups, N O, into which the forked wire at C descends and closes the circuit. The battery current of station 1 follows the wire to N, through the forked wire C to O, thence to the magnet B, and after passing around the soft iron, it returns to the battery at 1. When the current passes around B, the magnet attracts the armature of the right angle lever D, which causes the forked wire to descend into the mercury cups of the station 2, which puts in action the battery of 2. The second twenty-mile circuit is then charged and the magnet at E attracts the armature, and thus another circuit is put in motion. The three equilateral triangular pieces attached to the right-angled levers are weights to draw from the mercury cups the forked wires when the magnets cease to attract the subtending part of the armature lever. The levers D are fixed to pivots as fulcrums at their angles. This arrangement was termed the "combined circuits," and was publicly exhibited at the University in March, 1837. The plan represented could telegraph only in one direction. To communicate back another combination of circuits would have to be organized upon the reverse order. At that time there was no evidence on record demonstrating that a circuit as great as twenty miles could be operated. The apparatus, therefore, was based upon theory, but that problem has long since been solved by the practical extension of the circuit several hundred miles for telegraphic purposes.

Prof. Morse further deposed that, "In 1836 and the early part of 1837, I directed my experiments mainly to modifications of the marking apparatus, contrivances for using fountain pens, marking with a hard point through pentagraphic or blackened paper, varying in the modes of using and moving the paper; at one time on a revolving disk spirally from the centre, at another on a cylinder, by which means a large ordinary sheet of paper might be so written upon that it could be read as a commonplace book, and bound for reference in volumes, and devising modes of marking upon chemically prepared paper. As my means and the duties of my profession would admit, the spring and autumn of 1837 were employed in improving the instrument, varying the mode of writing, experimenting with plumbago and various kinds of ink or coloring matter, substituting a pen for a pencil, and devising a mode of writing on a whole sheet of paper instead of upon a strip or ribbon; and in the latter part of August or the beginning of September of that year, the instrument was shown in the cabinet of the University to numerous visitors, operating through a circuit of one thousand seven hundred feet of wire running back and forth in that room."

In the perfection of the apparatus and the scientific appliances, Prof. Morse had the invaluable aid of Prof. Leonard D. Gale and Messrs. George and Alfred Vail. These gentlemen became interested in the patents subsequently obtained.

In September, 1837, the government of the United States issued a circular, in conformity to a resolution that passed Congress in February, 1837, seeking propositions upon the subject of telegraphs. A correspondence followed with Prof. Morse, but nothing was effected. In October, 1837, Morse filed his caveat in the United States Patent Office. Later in the year 1837, a model instrument was completed and operated before the Franklin Institute at Philadelphia on a circuit of ten miles. Thence the apparatus was removed to Washington, where it was exhibited in successful operation to a multitude of persons, among whom were the President, members of the Cabinet, Senators and Representatives in Congress. It was placed in the room of the Committee on Commerce in the Capitol.

FAVORABLE REPORT OF THE COMMITTEE ON COMMERCE IN CONGRESS.

At that session Prof. Morse had an application pending before Congress, for an appropriation to aid in the construction of an experimental line between Washington and Baltimore. The subject had been referred to the Committee on Commerce, the chairman of which was the distinguished representative, Mr. Francis O. J. Smith. That gentleman was at once struck with the practicability of the invention, and he exerted his great powers in its behalf. The invention was novel, and it was difficult to get members of Congress to believe in the possibility of success. The Honorable Mr. Smith, however, never ceased his efforts in behalf of Morse, fully believing his telegraph to be, as he declared, "the most wondrous birth of this wonder-teeming age." He succeeded in getting the entire committee to sign the following report:

Mr. Smith, from the Committee on Commerce, made the following report, April 6th, 1838:

"The Committee on Commerce, to whom the subject was referred, have had the same under consideration and report: On the 3d of February, 1837, the House of Representatives passed a resolution requesting the Secretary of the Treasury to report to the House, at its present session, upon the propriety of establishing a system of telegraphs for the United States.

In pursuance of this request, the Secretary of the Treasury, at an early day after the passage of said resolution, addressed a circular of inquiry to numerous scientific and practical indi-

viduals in different parts of the Union; and on the 6th of December last, reported the result of this proceeding to the House.

This report of the Secretary embodies many useful suggestions on the necessity and practicability of a system of telegraphic despatches, both for public and individual purposes; and the committee cannot doubt that the American public is fully prepared, and even desirous that every requisite effort be made on the part of Congress to consummate an object of so deep interest to the purposes of government in peace and in war, and to the enterprise of the age.

Amid the suggestions thus elicited from various sources, and embodied in the before mentioned report of the Secretary of the Treasury, a plan for an electro-magnetic telegraph is communicated by Professor Morse, of the University of the City of New York, pre-eminently interesting, and even wonderful.

This invention consists in the application, by mechanism, of galvanic electricity to telegraphic purposes, and is claimed by Professor Morse and his associates as original with them; and being so, in fact, as the committee believe, letters patent have been secured, under the authority of the United States, for the invention. It has, moreover, been subjected to the test of experiment, upon a scale of ten miles' distance, by a select committee of the Franklin Institute of the city of Philadelphia, and reported upon by that eminently high tribunal in the most favorable and confident terms.

In additional confirmation of the merits of his proposed system of telegraphs, Professor Morse has exhibited it in operation (by a coil of metallic wire measuring about ten miles in length, rendering the action equal to a telegraph of half that distance) to the Committee on Commerce of the House of Representatives, to the President of the United States, and the several heads of departments, to members of Congress generally, who have taken interest in the examination, and to a vast number of scientific and practical individuals from various parts of the Union; and all concur, it is believed, and without a dissenting doubt, in admiration of the ingenious and scientific character of the invention, and in the opinion that it is successfully adapted to the purposes of telegraphic dispatches, and in a conviction of its great and incalculable practical importance and usefulness to the country, and ultimately to the whole world.

But it would be presumptuous in any one (and the inventor himself is most sensible of this) to attempt, at this stage of the invention, to calculate in anticipation, or to hold out

promises of what its whole extent of capacity for usefulness may be, in either a political, commercial or social point of view, if the electrical power upon which it depends for successful action shall prove to be efficient, as is now supposed it will, to carry intelligence through any of the distances of fifty, one hundred, five hundred or more miles now contemplated. No such attempt, therefore, will be indulged in this report. It is obvious, however, that the influence of this invention over the political, commercial, and social relations of the people of this widely-extended country, looking to nothing beyond, will, in the event of success, of itself amount to a revolution unsurpassed in moral grandeur by any discovery that has been made in the arts and sciences, from the most distant period to which authentic history extends to the present day. With the means of almost instantaneous communication of intelligence between the most distant points of the country, and simultaneously between any given number of intermediate points, which this invention contemplates, space will be, to all practical purposes of information, completely annihilated between the States of the Union, as also between the individual citizens thereof. The citizen will be invested with, and reduce to daily and familiar use, an approach to the HIGH ATTRIBUTE OF UBIQUITY, in a degree that the human mind, until recently, had hardly dared to contemplate seriously as belonging to human agency, from an instinctive feeling of religious reverence and reserve on a power of such awful grandeur.

Referring to the annexed report of the Franklin Institute, already adverted to, and also to the letters of Professor Morse, marked 2, 8, and 9, for other details of the superiority of this system of telegraphs over all other methods heretofore reduced to practice by any individual or government, the committee agree unanimously, that it is worthy to engross the attention and means of the Federal Government, to the full extent that may be necessary to put the invention to the most decisive test that can be desirable. The power of the invention, if successful, is so extensive for good or for evil, that the Government alone should possess the right to control and regulate it. The mode of proceeding to test it, as suggested, as also the relations which the inventor and his associates are willing to recognize with the Government on the subject of the future ownership, use, and control of the invention, are succinctly set forth in the annexed letters of Professor Morse, marked 8 and 9.

The probable outlay of an experiment upon a scale equal to fifty miles of telegraph, and equal to a circuit of double that distance, is estimated at $30,000. Two thirds of this expen-

diture will be for material, which, whether the experiment shall succeed or fail, will remain uninjured, and of very little diminished value below the price that will be paid for it.

The estimates of Professor Morse, as will be seen by his letter, marked 9, amount to $26,000; but, to meet any contingency not now anticipated, and to guard against any want of requisite funds in an enterprise of such moment to the Government, to the people, and to the scientific world, the committee recommend an appropriation of $30,000, to be expended under the direction of the Secretary of the Treasury; and to this end submit herewith a bill.

It is believed by the committee that the subject is one of such universal interest and importance, that an early action upon it will be deemed desirable by Congress, to enable the inventor to complete his trial of the invention upon the extended scale contemplated, in season to furnish Congress with a full report of the result during its present session, if that shall be practicable.

All which is respectfully submitted.

FRANCIS O. J. SMITH,	JAS. M. MASON,
S. C. PHILLIPS,	JOHN T. H. WORTHINGTON,
SAMUEL CUSHMAN,	WM. H. HUNTER,
JOHN I. DE GRAFF,	GEORGE W. TOLAND,
EDWARD CURTIS,	

Committee on Commerce, U. S. H. R."

Nothing further was effected at that session of Congress, and but little hope was entertained that Congress would ever grant the desired appropriation. Mr. F. O. J. Smith was so well convinced of the practicability of the system of telegraph, that he abandoned his seat in Congress, and purchased one quarter interest in the invention for Europe and America, under date of March, 1838. In May, 1838, Professor Morse and Mr. Smith visited Europe to obtain patents and to make sales of the invention. In England a patent was refused, because a brief description of the invention had been published. In France a patent was granted, but by order of the government he was forbidden to put it in operation, and at the end of two years the patent expired. The various efforts in Europe proved of no avail.

In June, 1840, Professor Morse obtained his patent in the United States, based on the specification filed by him in April, 1838. In December, 1842, he petitioned Congress again for aid to test the practicability of his invention, and on the 30th of December the Committee on Commerce reported a bill in

favor of appropriating $30,000 for that purpose. The bill passed the House of Representatives, and in the last hour of the last night of the last session of that Congress, March 3d, 1843, the bill passed the Senate, was signed by the President, and became a law.

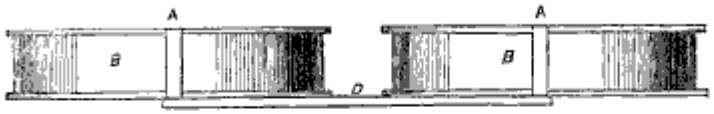
CONSTRUCTION OF THE EXPERIMENTAL LINE.

The experimental line between Washington and Baltimore was placed under course of construction in 1843. It was attempted to make it subterranean. Two copper wires, covered with cotton and gum-lac, were drawn through a leaden tube. From Baltimore to the Relay House, nine miles, were thus laid in the earth. On testing it an earth circuit was found; not even a mile of it could be worked. The plan proved a failure. Professor Morse then, after consultation with his friends, determined to put the wires on poles. The same copper wire that had been drawn through the leaden tubes for much of the distance between Baltimore and Washington were taken from the tubing and stretched on poles.

In May, 1844, the line was completed between those cities, and on the 27th day of May the first dispatch was transmitted over the line from Washington to Baltimore. It fell to the lot of Miss Annie Ellsworth to send that dispatch, which was, "WHAT HATH GOD WROUGHT?" As manipulating assistants, Professor Morse had Mr. Alfred Vail and Mr. L. F. Zantzinger, the former is no more, and the latter still remains attached to the profession of practical telegraphing, and is the oldest now in the service.

The apparatuses used were large and weighty. The electro-magnet weighed one hundred and eighty-five pounds, and its bulky construction made it necessary for two men to handle it whenever it had to be moved. It was placed in a large box. Fig. 4 represents, in part, the receiving magnet as then used.

Fig. 4.



B B were the coils of wire, three and one half inches long and eighteen inches in diameter. The soft iron bars are A A. The copper wire surrounding the spools was No. 16 copper wire covered with cotton thread. It was then supposed, by Professor Morse, as indispensably necessary that the wire surrounding the magnets should be the same size as that stretched

upon the poles of the line. This monster form of magnet was continued for a short time, and replaced by another less in size, devised by Professor Charles G. Page. These latter remained in the service until substituted by some of the size now in use, which had been purchased by Professor Morse in France in the year 1845.

INVENTION OF THE LOCAL CIRCUIT.

In regard to the invention of the local circuit, Professor Morse deposed, viz.:

"I further state, that the combination of machinery in constructing my telegraph as put in operation in 1844, was different from that originally contemplated and described in my first patent in the following respects, viz.: The combined circuits of my first patent, were the combination of two or more circuits as links in a main line for the purpose of renewing the power and propelling forward, indefinitely, the electric current, in such volume as to render the power more available at the distant point, and to charge an electro-magnet with sufficient magnetic force to work a register or move the lever of a relay magnet, suggested by the probability indicated by my own experiments and the experiments of scientific men, that sufficient magnetic power could not be obtained from the electric current through a very long circuit to make a mark of any sort.

This difficulty the undersigned proposed to obviate by means of two or more circuits, each with a battery, coupled together and broken and closed by means of the same principles as the receiving magnet now used; these links of one main line are to be made so short as to secure the necessary magnetic power.

The register was to be placed, not in a short circuit, as now arranged, but on a link in the main line. But this arrangement was liable to the practical inconvenience that it would always require two lines of wire, both always in order; because the receiving magnet would work only in one direction.

While preparing to build the line from Washington to Baltimore, I ascertained, by experiment upon one hundred and sixty miles of insulated wire, and, sometime previously, upon thirty-three miles of wire, that magnetic power sufficient to move a metallic lever could be obtained from the electric current of a circuit of indefinite length, and that there was no necessity for combining two or more circuits together *for the purpose of renewing the power at short intervals on the main line.*

I then devised the present combination, which enables me to work the same wire both ways, dispensing with one of

the two wires originally supposed to be necessary under all circumstances. This combination consists of one main circuit, connected by the receiving magnet with as many short office-circuits as may be desired, upon which respectively are the requisite registers, and not upon the lines of the main line, as originally contemplated. Any of these office-circuits may be separated from the main line without affecting its efficiency; whereas the breaking of a link in the chain of circuits originally contemplated would interrupt all communication. In that combination the battery at each station was to perform the double purpose of working the register and breaking and closing the next circuit in the main line.

In the present combination, the purpose of the battery on the main line is to close and break the short independent office-circuit, which works the register. This new combination of parts was a most valuable improvement upon my first plan. A part of this improvement was used on the experimental line between Washington and Baltimore, for the first time, in May, 1844, and the whole of the improvements in the year 1846.

The combination of circuits mentioned in my French patent of October, 1838, is the same as that mentioned in my American patent of 1840, and not that described in my American patent of April 11th, 1846."

IMPROVEMENT OF THE APPARATUS.

The original mode of manipulating the apparatus for marking on paper, and the mode of making those marks, were changed before the patent of 1840. The crank and port-rule were patented, but a better equivalent was found in the lever key, as in the chapter descriptive of the Morse telegraph apparatus.

The pen lever was changed in its position, so that instead of making the v lines it made a dot or a dash. The mechanism of fig. 2 can be easily changed to make the dot and dash. It is only necessary to place the paper cylinders in a perpendicular position. The face of the paper will be in front of the reader. Change the pencil c to a horizontal position in the lever, so that the marking end will rest opposite to the surface of the ribbon paper. When the paper and the pencil are thus arranged the following will be the result. The paper is moved forward, the current causes the magnets to attract the lever, which brings the pencil point against the paper. The mark on the paper will be in length proportional to the time the lever is held by the magnet. If but a moment, a dot will be made; if longer, a dash. The v marks will, therefore, not be made, but in their stead, dots and dashes.

The first key was very plain and simple, as well as the other parts of the mechanism. Attached to the marking lever were fountain pens, gotten up by Mr. Alfred Vail. To each lever were fastened four pens, which dropped the ink upon the paper. After that improvement the metallic points were adopted. There were at first four pens, then three, then two, and finally one pen. The marking process was soon abandoned, and the indenting of the paper substituted. The object of having more than one pen was to secure the mark, if one failed to drop the ink or to indent the paper the others might not.

Many were the improvements made to the different parts of the mechanism. At that time, and since then, the ingenious telegraphers throughout the world have, from time to time, devised important modifications to the different parts, having in view the perfection of the mechanism. The most remarkable change has been made in the receiving magnet; at first it weighed one hundred and eighty-five pounds, and now it is practically used in weight less than a pound, and so constructed that it can be carried, connected with the key, in the pocket.

ADMINISTRATION OF THE PATENTS.

After the completion of the experimental line between Washington and Baltimore, the commercial advantages resulting from the extension of the telegraph over the country began to be appreciated. It soon became a commercial affair, requiring peculiar powers to manage it, and to this end the Honorable Amos Kendall was made the attorney for Messrs. Morse, Vails, and Gale, the proprietors of three fourths of the patent. Mr. Kendall had been Postmaster-General of the United States, and had managed its affairs with distinguished ability. It was such ability that Professor Morse brought to the management of his telegraph. Mr. Kendall entered into the affairs with great zeal, and in a short time the lines were being spread throughout the country. Mr. Kendall devoted his special attention to the South and Southwest, and Mr. Smith to the East and Northwest. These gentlemen thus combining their remarkable powers, extended the telegraph to all the principal towns and cities in the United States, amounting in the aggregate to some forty-five or fifty thousand miles of telegraph wires, all of which are operated upon commercial principles, beneficial to the affairs of the people and of the government of the nation.

I have now followed the progress of the Morse telegraph from its beginning until its full development by its extension over the widespread territories of the American Union.

From the foregoing it will be seen that Morse devised a system of telegraphing in 1832, and that he made some type for the model; that in 1835–'36, he exhibited it in operation to his friends in New-York; in 1837 he devised his system of combined circuits; in 1844 he applied the local circuit, without the combination of circuits on the main line, and on the 27th day of May, 1844, he worked successfully the line, forty miles long, from Baltimore to Washington; and that the first dispatch, benign in its source and conception, was,

"WHAT HATH GOD WROUGHT?"