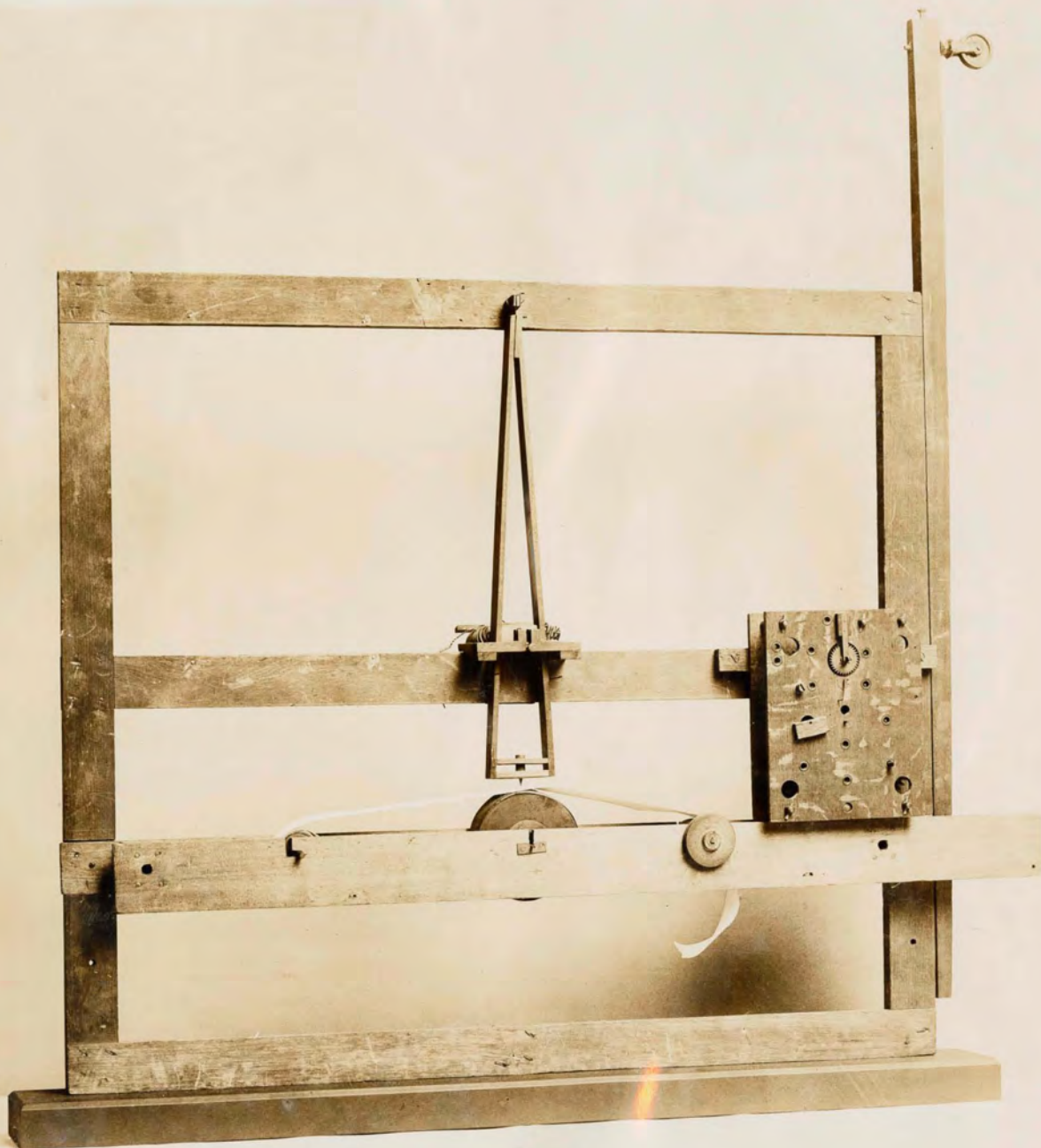


THE FIRST TELEGRAPH

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1. INTRODUCTION

The telegraph has linked together more closely the different races of the world by the band of communication, has made it possible to transmit messages with the speed of light; and has brought into touch the remotest points on the globe which places friends, relatives, and lovers ever in reach of each other. The telegraph that has bound more closely the kingdom of God was conceived, designed, and forced on a skeptic world by Samuel F. B. Morse, an artist.

Perhaps Morse did not discover any new principle and though he did incorporate the ideas of friends and associates, the invention was truly his. He conceived of a practical application of the discoveries of others and had faith in his vision. He realized the value of such an instrument to humanity and suffered the privations of poverty to make his gift of inestimable value. He never claimed to have made any remarkable discovery in connection with the telegraph but he did claim the invention of the first practical telegraph. The world at large has accorded to Morse against the claims of many others the credit for the first telegraph and its inseparable companion, the Morse Code.

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2. HISTORY OF COMMUNICATION

Since the beginning of creation men have realized a need for communication beyond the carriage of the voice; but until comparatively recent there has been a limited use of signals for distant communication. Military operations have had the greatest need of signals and have been the source and incentive for most of the semaphors.

King Agamemnon was not satisfied to send word of the progress of the Siege of Troy by the slow couriers. To send the news of the battle to Greece and his Queen he planted beacon fires on the tops of Mt. Ida, Mt. Athos, Mt. Cithaeron, and intervening points of commanding height. Thus was the news of the Fall of Troy carried to far off Greece. The early Egyptians and Assyrians used fire, smoke, and flags to transmit their messages. From tower to tower on the wall of China signals were passed by light or by flag.

Probably the first marine signaling was done by Theseus. When sailing into battle he hoisted a black sail. If he was victor he hoisted a red sail. After one battle he neglected to raise his red sail and his father Aegeus drowned himself believing his son killed.

The most common method of signaling was by couriers or runners. The Greeks, Romans, and Aztecs used couriers.

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almost exclusively. In our own country the Pony Express Riders were couriers. When the distance was too great for one runner they had a relay of runners. This relay introduced a possibility of errors. Errors were also possible in the methods used by the Persians and Gauls. Sentinals were stationed as far apart as their voices would carry and thus the message was carried from one sentinal to the other. Ceasar sent the news of the massacre of the Romans from Orleans to Auvergne, a distance of 150 miles by this method.

The large mirrors of the Pharaohs were probably used to send signals by light flashes. News of the Battle of Marathon was conveyed by light flashes from the shields of the Persians. These methods were the forerunners of the Heliograph using the Morse Code. Alexander the Great used sound for the transmission of his messages by means of a gigantic megaphone, a drawing of which is preserved in the Vatican.

A Clepsydra was an ingeneous device for signaling prearranged messages. Two similar tubes filled with water and having an outlet faucets at the bottom were used, one at the sending and the other at the receiving station. The messages were printed on paper in duplicate and placed at the same points on the two tubes. The sending station

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showed a light when it was ready to give a message. When the answering light from the receiving station was lit the operators at both stations opened the faucets. The light at the sending station was extinguished when the top of the water column was opposite the desired message. The receiving station received the message by turning off the faucet when the light went out, noting the position of the top of the column.

Watch towers were built in many parts of the world for distant communication and rapid transmission of signals. There are Roman and Gallic towers still standing in France. Hannibal built many of them in Africa and Spain. Colored tunics and spears were often used in battle with prearranged meanings. The American Indians used smoke puffs and arrows for their signals.

Naval signals were more needed than land signals, and more difficult to convey. Until the middle of the seventeenth century these signals were limited. Messengers were dispatched in small boats, but this method was slow and impractical in battle. With the advent of naval guns, signal guns were conceived. Another method of dropping a sail a number of times from a yard arm was much used.

Either Admiral Sir William Penn or James II while Duke of York invented the signal flag used by the navies.

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The position of one flag was varied. It was not until 1780 that Admiral Kempenfeldt thought of adding other signal flags which are still used. They consist of sets of alphabet, numeral and special flags. Special combinations of letters are used with code meanings. There is an international code in use for intercommunication between ships of different nations. Admiral Colomb devised the light flashes for night signals using the Morse Code.

The Wig Wag System is one of large application and is still used because it is simple and does not require any instruments. It consist of a standard code depending on the position of flags or arms. The popularity is shown by its use in the Army, Navy, Boy Scouts, and many other organizations.

Most of the signals now in use were developed after the 19th Century, using the Morse Code. The system of communication of the German Army which was one of the first to be highly systematized was developed in 1902. Signals by sight with the Morse Code became popular. The Helio-graph was used in India and Africa by the British and especially in the British-Boer War. The British Navy used flashing lights while the United States and other navies used fixed colored lights. Most sight and sound signals have now been displaced by Wireless with the exception of the Wig-Wag System.

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The disadvantage of most of these systems of communication has been their limited application. In many cases it was impossible with unfavorable atmospheric conditions. When it was cloudy, foggy, raining, snowing or hailing the transmission of messages by light or in any way dependent on sight, was impaired or impossible. In the din and hue of battle, sound signals were impracticable. Even the most ingenious devices were not good for any distance except by relays which introduced errors and occupied time. Therefore it was not until the advent of the electric telegraph that distant communication was made possible under all circumstances and rapid enough to be of any great use.

3. HISTORY OF TELEGRAPH

The telegraph was impossible or if possible impractical without electricity, because of its intricate machinery and the serious effects of nature's obstacles. Therefore the history of the telegraph is the history of electricity and magnetism.

It was many centuries ago that a Greek Shepherd called Magnes discovered lodestone. It was probably from his name that the attractive properties derived its name. The ancient people knew of the property of amber to attract straw. The term electricity came from the Greek word

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Electron meaning amber. Chinese and Persians experimented with lodestone. The Romans knew that lodestone would attract iron even through a stone wall. Magicians of ancient times often mystified their subjects by the application of the magnetic property of lodestone. Benjamin Franklin with his famous kite demonstrated that frictional and atmospheric electricity were one and the same thing.

✓ The first conception of an electric telegraph must be credited to an unknown author of the eighteenth century. An article appeared in the Scots Magazine on February 17, 1755 signed by C. M. proposing or suggesting an electric telegraph. His plan was to use one wire for each letter of the alphabet and have staticly charge discs at the receiving station with each letter which would be attracted by the opposite charge transmitted over the wires.

The battery was invented in the nineteenth century furnishing a practical source of electricity. Hans Christian Oersted of Denmark discovered that electricity flowing in a conductor produced a magnetic field at right angles to its direction of flow. Oersted made this discovery when he noted that a compass needle was deflected when it was brought near a wire conducting electricity. A Frenchman named Ampere found that this magnetism could be increased by passing current through a coiled conductor. Faraday unearthed the principle

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of the dynamo, showing a conductor moving in a magnetic field would produce electricity. Gauss and Weber used this principle for a telegraph by having a magnetic key generate current in a line and attract a magnet at the sending station the motion of which was magnified by a mirror.

Steinheil used a call bell, made a recorder of dots and dashes on a ribbon of paper, and also was the first to use the earth as the return circuit. Davy used a needle telegraph with galvanic current. Arago discovered that a bar of soft iron could be magnified by placing it in a coil and passing a current through the coil. There seems to be a difference of opinion as to who invented the relay. Towers gives Davy the credit for the invention while Horsford says that Morse made this discovery. Several authors attribute the relay to Joseph Henry's efforts.

Though every principle embodied in the electromagnetic telegraph as patented by Morse had been demonstrated before he used it, it is reasonable to suppose that he re-discovered some of them. The knowledge of electricity was not very well circulated and few men had a complete knowledge of the field.

4. THE LIFE OF MORSE

Since Morse did more than anyone else to give us a satisfactory method of communication and suffered so actually

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in making us appreciate the blessing, it seems but justice to include a brief sketch of his life.

Samuel Finley Breese Morse was born at Charlestown, Mass. in 1791. It is interesting to note that his birth-place was a mile from that of Benjamin Franklin, another giver of gifts. He was of Puritan stock. His father who was English was a divine and the author of the first notable geography. At the age of seven he went to school in Andover, Mass. and prepared for Phillips Academy. After graduating from the academy he went to Yale. While there he gained his first knowledge of electricity. Morse attended Professor Day's lectures and experiments on electricity and was interested. Jeremiah Day was professor of natural philosophy and Americas ablest teacher. The principle which interest him the most was that electric fluid was made visible when the circuit was interrupted. Though he was midly interested in these experiments his main interest was art. While still at Yale he painted minatures for \$5. a piece and this helped defray his expenses. He graduated from Yale in 1810 and devoted himself to the study of art while depending on his parents for support. He became the friend and pupil of Washington Allston, a famous painter. In the year 1811 he accompanied Allston to England. In London he met West, a painter of world-wide reputation. At the suggestion of West he entered in a contest of exhibition, a model

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of Hercules which he had made for a painting; he won the offered prize. Morse lived in London during the war of 1812 and though he lived in poverty he was unmolested. As the man who was destined to make communication nearly instantaneous left for home, the news of the defeat of Napoleon reached London two days after the occurrence. Upon his return to America he became a wandering painter and made his living painting portraits. In 1818 he went to Charleston, S.C., following the advice of his uncle. He was prosperous at Charleston and married Lucretia Walker of Concord, N.Y. After four year of success in the South he returned North and again faced failure. He could not sell his large historical paintings though he could make a living by painting portraits. In 1825 shortly after his return north his wife died. He assisted in organizing the National Academy of Design and was elected its first president. In 1829 he left for Europe on his second trip and spent three years principally in Paris and Rome.

5. MORSE AND THE TELEGRAPH

On the packet ship Sully, the birthplace of the telegraph, Morse returned from France. At the luncheon table Dr. Charles F. Jackson exhibited an electro-magnet he had procured in Europe and performed some experiments. Morse discussed with Dr. Jackson and other passengers the

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possibility of electro-magnetism in telegraphy. On this ship Morse had the conception of the telegraph that was to make him famous and a benefactor of the world. On leaving the ship he said to its Commander, "Well, Captain, should you hear of the telegraph one of these days as the wonder of the world, remember that the discovery was made on board the good ship Sully". The idea of using an electro-magnet for a receiver and of using dots and dashes for the letters of the alphabet was original with him. Later Dr. Jackson claimed the ideas, but at this time he said they were impractical. Morse was the only one on board who had faith in the electro-magnetic telegraph.

He made little progress with the telegraph between 1832 and 1835 because all of his time was occupied with art to make a living. In 1835 he was made Professor of The Literature of the Fine Arts of Design at the College of the City of New York. His professorship gave him more leisure, so the telegraph occupied more of his thoughts. Professor Gale, a chemistry teacher at the same college aided Morse. Gale brought to his attention experiments that had been performed by Joseph Henry. Gale suggested that he substitute many turns of small wire for the few turns of heavy wire that he had been using. Some believe that Gale suggested the relay after reading of Professor Henry's use of it.

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In 1837 he completed a small model of his telegraph for experimental purposes. In the same year the House of Representatives ordered the Secretary of the Treasury to investigate telegraphs for possible use by the U.S. Morse immediately set out to make a working model that would transmit messages for ten miles or more. The financial and mechanical aid of Alfred Vail was an important factor in the completion of this instrument. Alfred Vail was the son of the head of the Speedwell Iron Works of Morriston, N. J. On Sept. 23, 1837 an agreement was drawn up between Vail and Morse. By the terms of this agreement Vail was to construct the apparatus at his own expense, suitable for exhibition to Congress and to receive one-fourth interest in the invention. Shortly after a caveat was filed at the Patent Office. In 1838 the telegraph was in working order and was demonstrated before the older Vail.

6. INTRODUCTION OF INSTRUMENT

This instrument was exhibited in New York and Philadelphia without arousing any general interest. There were many who were interested in it as a curiosity but few believed it practical. Hon. F.C.J. Smith, Chairman of the Commerce Committee, was interest. Smith prevailed upon the committee to attend a demonstration. This demonstration was made in

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Feb. 1838 over 10 miles of wire and was entirely successful. The whole committee was enthusiastically interested. Thus a bill appropriating \$30,000 for a test of the telegraph between Washington and Baltimore was favorably reported.

Smith then resigned to fight for the measure and to take an interest in the invention. Sixteen shares in the invention were distributed as follows: Morse - nine, Smith-four, Vail-two, and Gale-one. Morse went to London to get a British patent but they would not even grant him a hearing. In France he was better received but was unable to obtain a patent. At this time Dr. Jackson presented his claim to Morse's invention. At first he only claimed parts of it but finally he laid claim to the whole invention. Other passengers of the Sully did not support Dr. Jackson in his claim that he had suggested the invention to Morse. A political campaign delayed the action of congress. It was in this period waiting for the action of Congress that Morse suffered the most. He was without aid and nearly starved to death. Smith was claimed by the political campaign. Gale was of limited means and therefore could be of no financial aid. Even in the supreme test Morse had confidence in the ultimate outcome of his endeavors. On June 20, 1840 Morse took out his patent, the first to be granted for

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a practical electro-magnetic telegraph. The House of Representatives passed the bill appropriating \$30,000 by six votes. Morse held little hope of its passing the Senate and was advised by a friend to give up the project. Miss Annie Ellsworth brought Morse the unexpected news of the passage of the bill by the Senate and Morse was so overjoyed he promised that she should dictate the first message sent by telegraph for any great distance. Work began immediately on the Washington - Baltimore Line. Cornell had invented a machine for laying wires under ground in a pipe which it was decided to use. Fisher, Gale, Vail, and Cornell aided in the construction work. Cornell was the man who later founded Cornell University. After the wire had been run out five miles from Baltimore it was found that this method of underground laying was impractical. More than half of the appropriation had been spent. It was decided to string the wires on poles. The wires were passed through holes bored near the top of the poles and bottle neck insulators were used to insulate the wire from the poles. The construction was completed on May 23, 1844. On May 24, 1844 in the presence of members of Congress and many other notables Morse sent from the Supreme Court room at the suggestion of Miss Ellsworth the message, "What Hath God Wrought". Vail in Baltimore received the message and repeated it. While many were surprised at the extraordinary feat they probably would not have been so much impressed but for another incident. There was a Democratic

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Convention in session in Baltimore that nominated Wright for Vice-President before consulting him. Wright was in Washington so Vail sent the news of Wright's nomination to Morse and Morse communicated with Wright. He declined the nomination and Morse sent the message declining the nomination to Vail. When Vail presented the message to the Baltimore Convention they were astounded. This incident insured the success of the telegraph.

✓ The instrument was simple. The sending apparatus consisted of a pair of cells and a key to make and break the circuit. The receiving apparatus was an electro-magnet and armature. This electro-magnet was in the circuit of the other sending station. When the key was closed at the sending station the armature was attracted to the magnet thus closing an auxiliary circuit that operated the recording instrument. The recording instrument was an arm with a point that made impressions on a recording ribbon. This arm made the impressions when it was attracted by an electro-magnet in the auxiliary circuit. The impressions being dashes when the key at the sending station was closed a length of time and a dot when it was closed for only an instant.

Photographs of the original recording instrument and the original key used in transmitting the first message are appended. These instruments are kept at the U.S. National

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Museum of Washington. The type shown by one of the photographs is a model of the first type used by Morse for automatic making and breaking of the sending circuit. The fourth photograph is of a model of the first improved recording instrument. The patents are copies of the first and second patents taken out by Morse with one reissued patent following each.

✓ The value of the telegraph we all know today, but Morse's task was not only one of invention but one of instruction of the people to appreciate his invention. He suffered and strived to give to us an instrument which has become indispensable. There have been many attacks on his character by people who thought or pretended that he had usurped undue reward. His character is unassailable.

Th' invention all admir'd and
each how, he
To be the inventor miss'd, so
easy it seemed
Once found, which yet unfound
most would have thought
Impossible

MILTON

BIOBLIOGRAPHY

Horsford's Address at the Morse Memorial

E. M. Horford

Morse's Patents - Amos Kendall

Masters of Space - W. K. Towers

History of Electro-Magnetic Telegraph

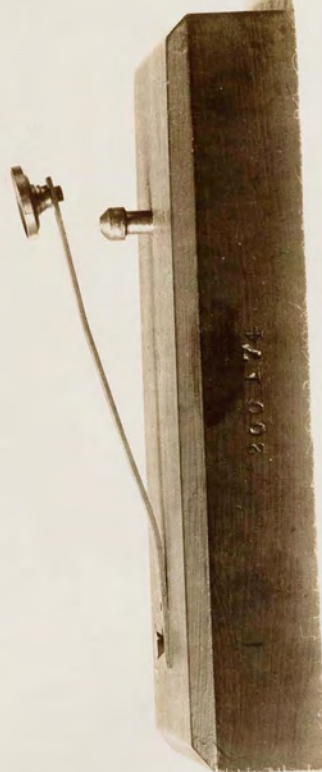
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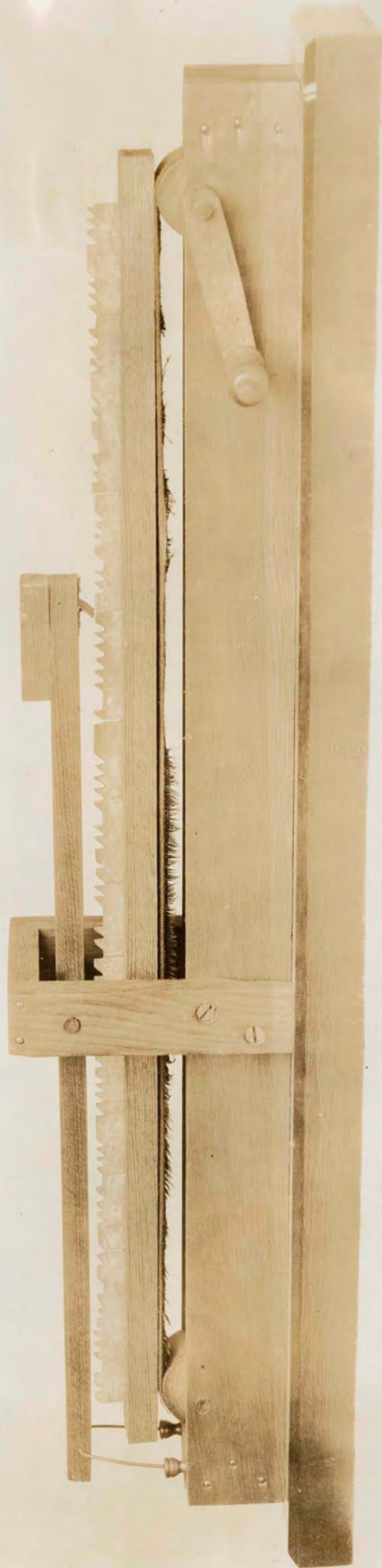
E. L. Morse

Memorial of S.F.B.Morse - U.S. Congress

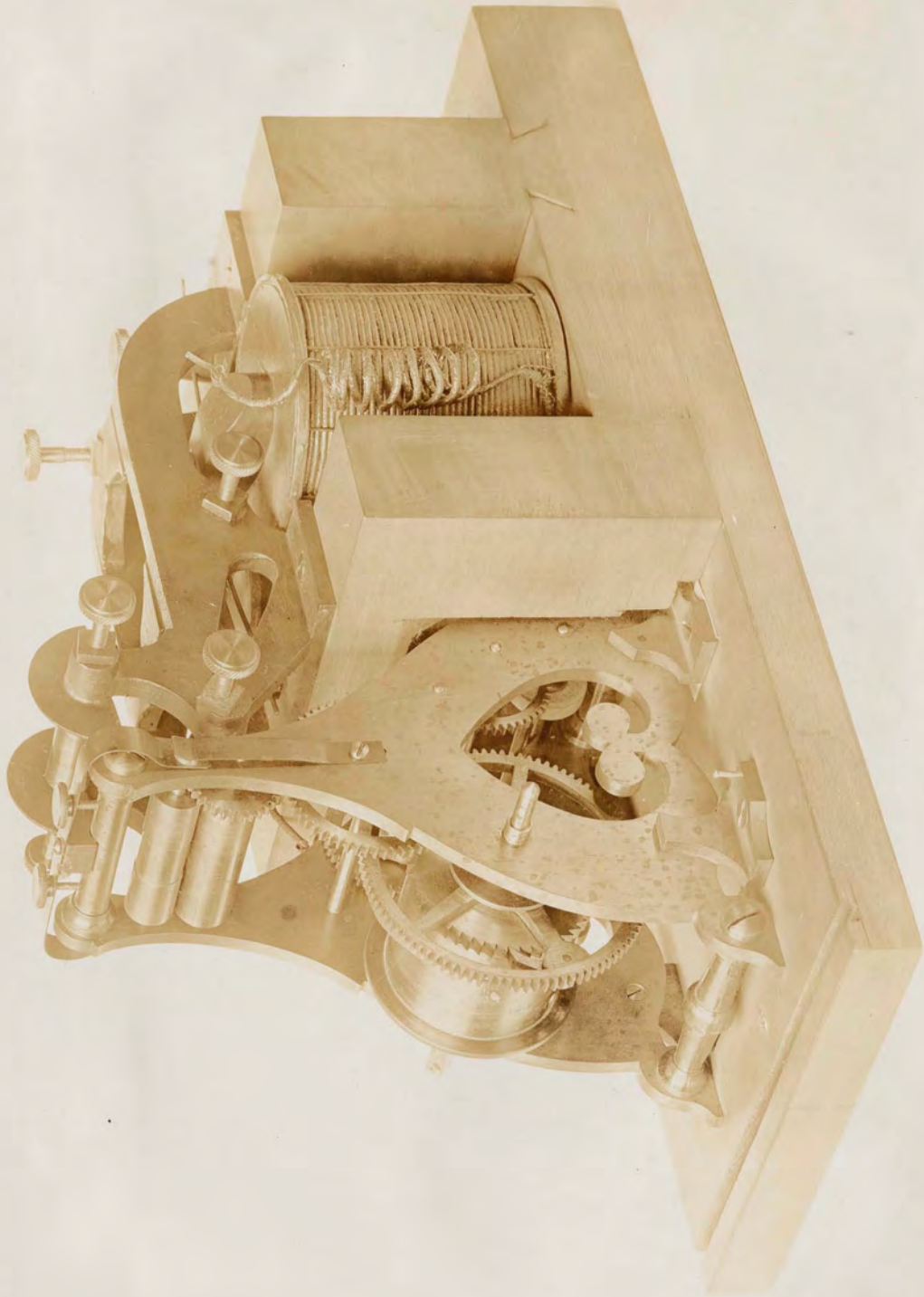
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UNITED STATES PATENT OFFICE.

SAMUEL F. B. MORSE, OF NEW YORK, N. Y.

IMPROVEMENT IN THE MODE OF COMMUNICATING INFORMATION BY SIGNALS BY THE APPLICATION OF ELECTRO-MAGNETISM.

Specification forming part of Letters Patent No. 1,647, dated June 20, 1840.

To all whom it may concern:

Be it known that I, the undersigned, SAMUEL F. B. MORSE, of the city, county, and State of New York, have invented a new and useful machine and system of signs for transmitting intelligence between distant points by the means of a new application and effect of electro-magnetism in producing sounds and signs, or either, and also for recording permanently by the same means and application and effect of electro-magnetism any signs thus produced and representing intelligence transmitted, as before named, between distant points; and I denominate said invention the "American Electro-Magnetic Telegraph," of which the following is a full and exact description, to wit:

It consists of the following parts: first, of a circuit of electric or galvanic conductors from any generator of electricity or galvanism, and of electro-magnets at any one or more points in said circuit; second, a system of signs by which numerals and words represented by numerals, and thereby sentences of words as well as of numerals, and letters of any extent and combination of each, are communicated to any one or more points in the before-described circuit; third, a set of type adapted to regulate the communication of the above-mentioned signs, also cases for convenient keeping of the type, and rules in which to set and use the type; fourth, an apparatus called the "straight port-rule," and another called the "circular port-rule," each of which regulates the movement of the type when in use, and also that of the signal-lever; fifth, a signal-lever which breaks and connects the circuit of conductors; sixth, a register which records permanently the signs communicated at any desired points in the circuit; seventh, a dictionary or vocabulary of words, to which are prefixed numerals for the uses hereinafter described; eighth, modes of laying the circuit of conductors.

The circuit of conductors may be made of any metal—such as copper or iron wire or strips of copper or iron, or of cord or twine, or other substances—gilt, silvered, or covered with any thin metal leaf properly insulated and in the ground, or through or beneath the water, or through the air. By causing an electric or galvanic current to pass through the circuit of conductors laid as aforesaid by means of any

generator of electricity or galvanism to one or more electro-magnets placed at any point or points in said circuit, the magnetic power thus concentrated in such magnet or magnets is used for the purposes of producing sounds and visible signs, and for permanently recording the latter at any and each of said points, at the pleasure of the operator, and in the manner hereinafter described—that is to say, by using the system of signs which is formed of the following parts and variations, viz:

Signs of numerals consist, first, of ten dots or punctures, made in measured distances of equal extent from each other, upon paper or any substitute for paper, and in number corresponding with the numeral desired to be represented. Thus one dot or puncture for the numeral 1, two dots or punctures for the numeral 2, three of the same for 3, four for 4, five for 5, six for 6, seven for 7, eight for 8, nine for 9, and ten for 0, as particularly represented on the annexed drawing, marked Example 1, Mode 1, in which is also included a second character, to represent a cipher, if preferred.

Signs of numerals consist, secondly, of marks made as in the case of dots, and particularly represented on the annexed drawing, marked Example 1, Mode 2.

Signs of numerals consist, thirdly, of characters drawn at measured distances in the shape of the teeth of a common saw by the use of a pencil or any instrument for marking. The points corresponding to the teeth of a saw are in number to correspond with the numeral desired to be represented, as in the case of dots or marks in the other modes described, and as particularly represented in the annexed drawing, marked Example 1, Mode 3.

Signs of numerals consist, fourthly, of dots and lines separately and conjunctively used as follows, the numerals 1, 2, 3, and 4 being represented by dots, as in Mode 1, first given above: The numeral 5 is represented by a line equal in length to the space between the two dots of any other numeral; 6 is represented by the addition of a dot to the line representing 5; 7 is represented by the addition of two dots to said line; 8 is represented by prefixing a dot to said line; 9 is represented by two dots prefixed to said line; and 0 is represented by two lines, each of the length of said line that represents

the number 5. Said signs are particularly set forth in the annexed drawings, marked Example 1, Mode 4.

Either of said modes are to be used as may be preferred or desired and in the method hereinafter described.

The sign of a distinct numeral or of a compound numeral when used in a sentence of words or of numerals consists of a distance or space of separation between the characters of greater extent than the distance used in separating the characters that compose any such distinct or compound numeral. An illustration of this sign is particularly exhibited in the annexed drawing, marked Example 2.

Signs of letters consist in variations of the dots, marks, and dots and lines, and spaces of separation of the same formation as compose the signs of numerals, varied and combined differently to represent the letters of the alphabet, in the manner particularly illustrated and represented in the annexed drawing, marked Example 3.

The sign of a distinct letter, or of distinct words when used in a sentence, is the same as that used in regard to numerals and described above.

Signs of words, and even of set phrases or sentences, may be adopted for use and communication in like manner under various forms, as convenience may suggest.

The type for producing the signs of numerals consist, first, of fourteen pieces or plates of thin metal—such as type-metal, brass, iron, or like substances—with teeth or indentations upon one side or edge of ten of said type, corresponding in number to the dots or punctures or marks requisite to constitute the numerals, respectively, heretofore described in the system of signs, and having also a space left upon the side or edge of each type, at one end thereof, without teeth or indentations, corresponding in length with the distance or separation desired between each sign of a numeral. Another of said type has two indentations, forming thereby three teeth only, and without any space at either end, to correspond with the size of a cipher, as heretofore described by reference to Example 1, Modes 1, 2, 3, of drawings in said system of signs. One other of said type is without any indentation on its side or edge, and being in length to correspond with the distance or separation desired between distinct or compound numerals, and with the sign heretofore described for that purpose. One of the remaining two of said type is formed with one corner of it beveled, (system of type, Example 4, Fig. 1,) and is called a “rest;” and the other is in a pointed form and called a “stop.”

Each of said type is particularly delineated on the annexed drawing, marked Example 4, Fig. 1, and numbered or labeled in accordance with the purpose for which they are designed respectively, and are used in like manner for producing each of the several signs of numerals heretofore described in the system of signs.

The type for producing the signs of numer-

als consist, secondly, of five pieces or plates of metal, first described above, four of which are the same as are numbered 1, 2, 3, and 4 in the annexed drawing, marked Example 4, Fig. 1, and the fifth one being the same as is denominated in the same example “the long space,” and heretofore alluded to; also, of six other pieces or plates of said metal, varied in indentations and teeth and spaces, as represented on the annexed drawing, marked Example 4, Fig. 2, to produce signs of the denominations described in the fourth mode of the before-mentioned system of signs, Example 1.

The type for producing the signs of letters are of the same denomination with those used in producing signs of numerals, and only varied in form from one to twenty-three, as exhibited in the annexed drawing, marked Example 5.

The type for producing both signs of numerals and signs of letters are adapted for use to either a straight rule, called the “straight port-rule,” and are in that case made straight lengthwise, as described in the drawings annexed, and heretofore referred to in Example 5, or to a circular port-rule, in which case they are lengthwise circular or formed into sections of a circle, as represented in the drawings annexed, marked Example 6, Figs. 2 and 3, and as will be further understood by the descriptions hereinafter contained of the straight and circular port-rules. On the under side of the type for the circular port-rule (which type are of greater thickness than those for the straight port-rule) is a groove (system of type, Example 6, A in Figs. 1 and 3) about midway of their width, and in depth about half the thickness aforesaid, and extending from the space ends, as B, Example 6, Fig. 3—that is, the ends without indentations—of said type, along the length, and conforming to the curve thereof, to a point, D D, equal in distance from the opposite ends to half the width of the pointed teeth cut upon their edges. For a delineation of these type reference is made to sections thereof in Figs. 1 and 3 upon the annexed drawings, marked Example 6.

The type-cases are wood or of any other material, with small compartments of the exact length of the type, for greater convenience in distributing, and resembling those in common use among printers.

The type-rules are of wood or metal or other material that may be preferred, and about three feet in length, with a groove, into which the type, when used, are placed. On the under side of each type rule are cogs, by which they are adapted to a pinion-wheel having corresponding cogs and forming part of a port-rule. The type-rule in use is moved onward as motion is given to the said wheel. A delineation of the type-rule is contained in the annexed drawing, marked Example 7.

The straight port-rule consists of a pinion-wheel, (before mentioned,) turned by a hand-crank attached to a horizontal screw that plays into the cogs of the pinion-wheel, as the latter do into the cogs of the type-rule, or by any

other power, in any of the well-known methods of mechanism. It is connected with a railway or groove, in and by which the type-rule, from the motion imparted to it by said wheel, is conveyed in a direct line beneath a lever that breaks and connects the galvanic circuit in the manner hereinafter mentioned. A delineation of said wheel, crank, and screw is contained in the drawings hereunto annexed, marked Example 8, Figs. 1, 2, 3.

The circular port-rule is a substitute, when preferred, for both the type-rule and the straight port-rule, and consists of a horizontal or inclined wheel, Example 9, Fig. 1, A, of any convenient diameter, of wood or metal, having its axis connected on the under side of the wheel with a pinion-wheel, K, and as in the case of the straight port-rule. It is moved by the motion of the pinion-wheel, as is the type-rule in the former description. On the entire circumference of said horizontal or inclined wheel, and upon its upper surface, is a shoulder or cavity, *a*, Figs. 1, 2, corresponding in depth with the thickness of the type used, and in width, *b*, equal to that of the type, exclusive of their teeth or indentations. Near the outer edge of the surface of said shoulder or cavity are cogs *c*, throughout the circumference of the wheel, projecting upward at a distance from each other equal to one-half of the width of the teeth or indentations of the type, and otherwise corresponding in size to the width and depth of the groove D D, Fig. 4, in the under side of the circular type before described and illustrated by reference to Example 6, Figs. 1 and 3. Directly over said shoulder or cavity and cogs, and at one or more points on the circumference of said wheel, is extended, from a fixture outside of the orbit of the wheel, a stationary type-feeder, E, Fig. 1, formed of one end, *e*, and one side, *E*, perpendicular, of tin or brass plate or other substance, and of interior size and shape to receive any number of the type which are therein deposited, with their indentations projecting outward, as in Fig. 2, and their grooves downward, as in Fig. 4. Said type-feeder is so suspended from its fixture F F over the shoulder or cavity of the wheel A, before described, as to admit of the passage under it of said wheel in its circuit as near the bottom of the feeder as practicable without coming in contact therewith. The type deposited in the feeder, as before mentioned, form a perpendicular column, as in Fig. 2, the lower type of which rests upon the surface of the before-named shoulder of the wheel *b*, Fig. 2, and the cog of the wheel, projecting upward, enters the groove D D, Fig. 4, of the type hereinbefore described.

The operation of said circular port-rule in regulating the movement of the type in use is as follows: When the wheel A is set in motion the type resting immediately upon the shoulder of the wheel in the manner mentioned above, as in Fig. 2, is carried forward on the curvature of the wheel from beneath the column of type resting upon it in the stationary

type-feeder by means of one of the before-named cogs coming in contact with that point D, Fig. 3, Example 6, in the groove of the type hereinbefore described as forming the termination of said groove, and which is particularly delineated at the points D D in the annexed drawing, marked Example 6, Fig. 3. As by said process the lower type in the column that is held by the stationary feeder is carried forward and removed, the next type settles immediately upon the shoulder of the wheel, and, after the manner of the removed type, is brought in contact with another cog of said shoulder within the groove of the type, and thence carried forward from beneath the incumbent column, as was its predecessor. Then follows consecutively in the same method each type deposited within the feeder so long as the wheel is kept in motion. The deposit of the type in the stationary feeder is regulated by the order in which the letters or numerals, or words they represent, are designed to be communicated at any distant point or points. After the type are respectively carried forward on the curvature of the wheel in the manner stated above beyond the point where they are acted upon by the signal-lever, as is hereinafter described, they are lifted, each in its turn, from the shoulder of the wheel A and cast off into a box or pocket, G, below the wheel by means of a slender shaft or spindle, H, made of any metal, and resembling in form a common plowshare, extending downward from a fixture, *o*, placed outside of the wheel, into a groove, K, within the before-named shoulder of said wheel A, and on the inner side of the cogs *c*, already described. By means of said groove the downward point of said shaft or spindle H is brought within the curvature and below the surface of said shoulder *b*, Fig. 2, and consequently under the approaching end of the type, so that each type successively, as it is carried forward on said curvature in the manner before described is lifted from the shoulder and forced upward on the inclined shaft or spindle by the type in contact with it at the other end, until turned off into the before-named box or pocket G below, ready for a redistribution.

For a more particular delineation of the several parts of said circular port rule reference is made to the annexed drawings, marked Example 9, Figs. 1 and 2.

The signal-lever, Example 9, Fig. 3, consists, first, for use with the straight port-rule, (Example 8, Fig. 1, A,) of a strip of wood of any length from six to twenty-four inches, resting upon a pivot, *a*, or in a notched pillar formed into a fulcrum by a metal pin, *a*, passing through it and the lever. At one end of the lever a metallic wire, bent to a semicircular or half-square form, as at A, or resembling the prongs of a fork distended, is attached by its center, as described in the annexed drawings, Example 8, at the point marked A. Between said end of the lever and the fulcrum *a*, and near the latter, on the under side of the lever A, is inserted a metallic tooth or cog, *b*, curved

on the side nearest to the fulcrum, and in other respects corresponding to the teeth or indentations upon the type already described. On the opposite extremity of the lever is a small weight, C, to balance or offset in part when needed, the weight of the lever on the opposite side of the fulcrum. The lever thus formed is stationed directly over the railway or groove D D, heretofore described as forming a connected part of the straight port-rule. The movement of the type-rule brings the tooth of each type therein set in contact with the tooth or cog of the lever, and thereby forces the lever upward until the points of the two teeth in contact have passed each other, when the lever again descends as the teeth of the type proceed onward from the tooth of the lever. This operation is repeated as frequently as the teeth of the type are brought in contact with the tooth of the lever. By thus forcing the said lever upward and downward the ends of the semicircular or pronged wire are made alternately to rise from and fall into two small cups or vessels of mercury, E E, in each of which is an end or termination of the metallic circuit-conductors first described above. This termination of the metallic circuit in the two cups or vessels breaks and limits the current of electricity or galvanism through the circuit; but a connection of the circuit is effected or restored by the falling of the two ends of the pronged wire A, attached to said lever, into the two cups, connecting the one cup with the other in that way. By the rising of the lever, and consequently the wire upon its end, from its connection with said cups said circuit is in like manner again broken and the current of electricity or galvanism destroyed. To effect at pleasure these two purposes of breaking and connecting said circuit is the design of said motion that is imparted in the before-mentioned manner to said lever, and to regulate this motion and reduce it to the system of intelligible signs before described is the design and use of the variations in the form of the type, also before described. A plate of copper, silver, or other conductor connected with the broken parts of said circuit of conductors, and receiving the contact of the wire attached to said lever, may be substituted, if preferred, for said cups of mercury. For a particular delineation of the several parts of said lever reference is made to the annexed drawing, marked Example 8.

The signal-lever consists, secondly, for use with the circular port-rule, (Example 9, Fig. 3,) of a strip of wood, G, with a metallic wire, A, at one end, of the form and for the purposes of the lever already described above. It turns on a pivot or fulcrum, *a*, placed either near the middle or in the end of the lever. At the end of the lever, at C, opposite to the metallic wire A, an elbow, *e*, is formed on a right angle with the main lever, and extending downward from the level with the pivot or fulcrum sufficiently for a metallic tooth, H, in the end thereof, corresponding with the teeth or indentations of

the type already described, to press against the type projecting from the shoulder or cavity of the wheel A, Fig. 1, that forms the circular port-rule before described. Said wheel is placed beneath the said lever, as seen at G, Fig. 1, in a position to be reached by the extremity or tooth H of the arm of the lever just mentioned. The tooth H in the arm of the lever is kept in constant contact with the type of the circular port-rule by the pressure of a spring, B, upon it, as described in the annexed drawing, marked Example 9, at B. Figs. 1 and 3 in the same example exhibit sections of the said lever. The action thus produced by the contact of the teeth of the type in the port-rule when said wheel is in motion with the tooth in the arm of the lever lifts up and drops down the opposite extremity A of said lever having the metallic wire upon it as the tooth of said lever passes into or out of the indentations of the type, and in the same manner and to the same effect as the first-described lever rises and falls, and accordingly breaks and closes the circuit of conductors, as in the former instance. In the use of this circular port-rule and its appropriate lever (Fig. 3) type may be used having the points of their teeth and their indentations shaped as counterparts or reverses to those delineated in the annexed drawings, heretofore referred to and marked Examples 4, 5, and 6, and thereby the forms of the recorded signs will be changed in a corresponding manner.

The register consists—

First, of a lever of the shape of the lever connected with the circular port-rule above described, and is delineated in the annexed drawings, marked Example 10, Figs. 1, 2, and 4, at A. Said lever A operates upon a fulcrum, *a*, that passes through the end that forms the elbow *a*, upon the lower extremity of which, and facing an electro-magnet, is attached the armature of a magnet, *f*. In the other extreme of the lever, at B, is inserted one or more pencils, fountain-pens, printing-wheels, or other marking-instruments, as may be seen in the Fig. 4 of example last mentioned at letter B. The magnet is at letter C in the same figure.

Secondly, of a cylinder or barrel of metal or wood and covered with cloth or yielding coating, to turn upon an axis, and occupying a position directly beneath the pencil, fountain-pen, printing-wheel, or other marking-instrument, to be used as exhibited in the last-mentioned example of drawing, Fig. 4, D. Two rollers, marked *b b* in said figure of drawings, are connected with said cylinder, on the upper-side curvatures thereof, and being connected with each other by two narrow bands of tape passing over and beneath each, near the ends thereof, and over the intervening surface of the cylinder, in a manner to cause a friction of the bands of tape upon the latter when in motion, as delineated in the last-named example, Fig. 4, at points marked *c c c*. The distance between said bands of tape on the rollers is such as to admit of the pencil or other

marking-instrument in the lever to drop upon the intervening space of the cylinder. Near by said cylinder is a spool to turn on an axis, and marked *d* in the said figure, to receive any desired length of paper or other substance formed into slips or a continuous ribbon, and for the purpose of receiving a record of the signs of intelligence communicated. When the register is in motion, one end of the paper on said spool being inserted between the under surfaces of said two rollers, under the strips of tape that connect them and the cylinder, it is drawn by the friction or pressure thus caused upon it forward from said spool gradually and passed over said cylinder, and is thence deposited in a box on the opposite side or is cut off at any desired length as it passes from the cylinder and rollers.

Thirdly, of an alarm-bell, A, Example 10, Fig. 5, which is struck by means of a lever-hammer, B, that is acted upon by a movable cog, *b*, placed upon an axis or pin, *b*, that confines it in the lower extremity of a pendulum-lever, (marked E in Fig. 5 of Example 10) having an armature of a magnet attached to it at *d* and acted upon by an electro-magnet, *o*, placed near it and the before-named magnet, and in the same circuit of conductors with the latter. Said cog *b* moves in a quarter-circle only, as the motion of said arm of the lever passes backward and forward in the act of recording, as hereinafter described. When forced into a horizontal position in said quarter-circle it ceases to act upon the hammer; but when moved from a perpendicular position it presses upon the projection in the end of the hammer, causing the opposite end of the hammer to be raised, from which elevation it again falls upon a stationary bell, A, as soon as said cog reaches a horizontal position, and ceases, as before mentioned, to press upon the hammer. Thus a notice by sound or an alarm is given at the point to which intelligence is to be communicated as soon as the register begins to act, and such sound may be continued or not, at pleasure, for the purpose mentioned, or for any other uses, as the hammer shall be suspended or not from contact with the bell or with any number of bells that may be employed. Fig. 5 of said example, marked 10 in the annexed drawings, represents sections of said hammer and bell.

Said several parts of the register are set in motion by the communication to or action upon the before-named armature of a magnet attached to the lever of the register, of the electric or galvanic current in the circuit of conductors, and from an electro-magnet in said circuit, as before described, stationed near the said armature. As said armature is drawn or attracted from its stationary and horizontal position toward the said magnet, when the latter is charged from the circuit of conductors, said lever is turned upon its fulcrum, and the opposite end thereof necessarily descends and brings the pen or marking-in-

strument which it contains in contact with the paper or other substance on the revolving cylinder directly beneath it. As said armature ceases to be thus drawn or attracted by said magnet, as is the case as soon as said magnet ceases to be charged from the circuit of conductors, or as the current in said circuit is broken in the manner hereinbefore described, the said armature is forced back by its own specific gravity or by a spring or weight, as may be needed, to its former position, and the pen or marking-instrument in the opposite end of the lever is again raised from its contact with the paper or other substance on the before-named revolving cylinder. This same action is communicated simultaneously from the same circuit of conductors to as many registers as there are corresponding magnets provided within any circuit and at any desired distances from each other.

The cylinder and its two associate rollers are set in motion simultaneously with the first motion of the lever by the withdrawal of a small wire or spindle, *g*, Example 10, Figs. 2 and 5, from beneath one branch of a fly-wheel, *k*, that forms a part of the clock machinery hereinafter named. Said wire *g* is withdrawn by the action upon said wire of a small electro-magnet, *o*, Figs. 2 and 5, stationed in the circuit and near the large magnet before named, as delineated in Fig. 5 of Example 10. Said cylinder and rollers are subsequently kept in motion by a train of wheels similar to common clock-wheels, as in Figs. 2 and 3, acted upon by a weight, raised as occasion may require by a hand-crank, and their motion is regulated by the same wheels to correspond with the action of the registering-pen or marking-instrument. Said train is represented in Figs. 1, 2, and 3 of said Example 10.

The electro-magnet thus used is made in any of the usual modes, such as winding insulated copper wire, or strips of copper, or tin-foil, or other metal around a bar of soft iron, either straight or bent into a circular form, and having the two extremities of the coils connected with the circuit of conductors, so that the coils around the magnet make part of the circuit.

To extend more effectually the length of any desired circuit of conductors, and to perpetuate the power of the electric or galvanic current equally throughout the same, I adopt the following mode, and also for connecting and using any desired number of additional and intervening batteries or generators of said current, and for connecting progressively any number of consecutive circuits, viz: Place at any point in a circuit an electro-magnet of the denomination already described, with an armature upon a lever of the form and structure, and in the position of that used at the register to hold and operate the marking-instrument, with only a substitution therein for such marking-instrument of a forked wire, A, Example 9, Fig. 3, like that upon the end of the signal-lever herebefore described. Directly beneath the latter

wire place two cups of mercury, E E, or two metallic plates joined to terminations of a circuit leading from the fresh or additional battery or generator of said circuit, in the same manner as they are to be provided in the first circuit of conductors at the points where the cups of mercury are hereinbefore described. As the current in the first circuit acts upon the magnet thus provided the armature thereof and lever are thereby moved to dip the forked wire A into the cups of the second circuit, as in the circuit first described. This operation instantly connects the break in said second circuit, and thus produces an additional and original power or current of electricity or galvanism from the battery of said second circuit to the magnet or magnets placed at any one or more points in such circuit, to be broken at pleasure, as in the first circuit; and from thence, by the same operation, the same results may again be repeated, extending and breaking at pleasure such current through yet another and another circuit, *ad infinitum*, and with as many intervening registers for simultaneous action as may be desired, and at any distances from each other.

The dictionary or vocabulary consists of words alphabetically arranged and regularly numbered, beginning with the letters of the alphabet, so that each word in the language has its telegraphic number, and is designated at pleasure through the signs of numerals.

The modes which I propose of insulating the wires or other metal for conductors and of laying the circuits are various. The wires may be insulated by winding each wire with silk, cotton, flax, or hemp, and then dipping them into a solution of caoutchouc, or into a solution of shellac, or into pitch or resin and caoutchouc. They may be laid through the air, inclosed above the ground, in the ground, or in the water. When through the air they may be insulated by a covering that shall protect them from the weather—such as cotton, flax, or hemp—and dipped into any solution which is a non-conductor, and elevated upon pillars. When inclosed above the ground they may be laid in tubes of iron or lead, and these, again, may be inclosed in wood, if desirable. When laid in the ground they may be inclosed in iron, leaden, wooden, or earthen tubes, and buried beneath the surface. Across rivers the circuit may be carried beneath the bridges, or, where there are no bridges, inclosed in lead or iron and sunk at the bottom, or stretched across, where the banks are high, upon pillars elevated on each side of the river.

What I claim as my invention, and desire to secure by Letters Patent, is as follows:

1. The formation and arrangement of the several parts of mechanism constituting the type-rule, the straight port-rule, the circular port-rule, the two signal-levers, and the register-lever and alarm-lever, with its hammer, as combining respectively with each of said

levers one or more armatures of an electro-magnet, and as said parts are severally described in the foregoing specification.

2. The combination of the mechanism constituting the recording-cylinder and the accompanying rollers and train-wheels with the formation and arrangement of the several parts of mechanism, the formation and arrangement of which are claimed as above and as described in the foregoing specification.

3. The use, system, formation, and arrangement of type and of signs for transmitting intelligence between distant points by the application of electro-magnetism and metallic conductors combined with mechanism described in the foregoing specification.

4. The mode and process of breaking and connecting by mechanism currents of electricity or galvanism in any circuit of metallic conductors, as described in the foregoing specification.

5. The mode and process of propelling and connecting currents of electricity or galvanism in and through any desired number of circuits of metallic conductors from any known generator of electricity or galvanism, as described in the foregoing specification.

6. The application of electro-magnets by means of one or more circuits of metallic conductors from any known generator of electricity or galvanism to the several levers in the machinery described in the foregoing specification, for the purpose of imparting motion to said levers and operating said machinery, and for transmitting by signs and sounds intelligence between distant points and simultaneously to different points.

7. The mode and process of recording or marking permanently signs of intelligence transmitted between distant points and simultaneously to different points by the application and use of electro-magnetism or galvanism, as described in the foregoing specification.

8. The combination and arrangement of electro-magnets in one or more circuits of metallic conductors with armatures of magnets for transmitting intelligence by signs and sounds, or either, between distant points and to different points simultaneously.

9. The combination and mutual adaptation of the several parts of the mechanism and system of type and of signs with and to the dictionary or vocabulary of words, as described in the foregoing specification.

In testimony whereof I, the said SAMUEL F. B. MORSE, hereto subscribe my name, in the presence of the witnesses whose names are hereto subscribed, on the 7th day of April, A. D. 1838.

SAMUEL F. B. MORSE.

Witnesses:

B. B. FRENCH,
CHARLES MONROE.

THE FIRST TELEGRAPH

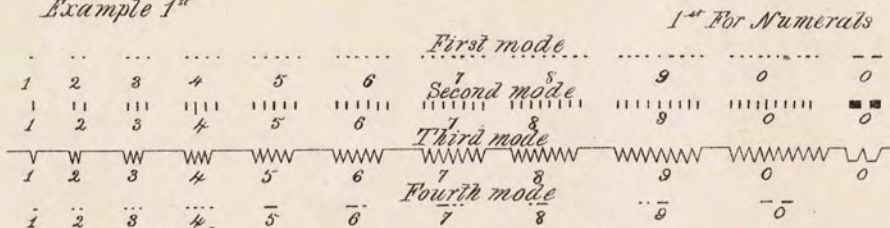
S. F. B. Morse.

Telegraph Signs.

N^o 1,647.

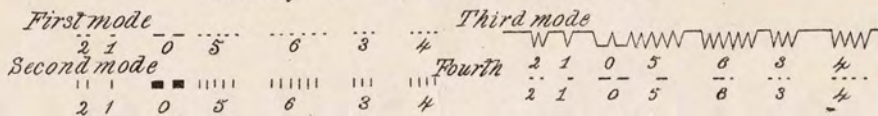
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Example 1st



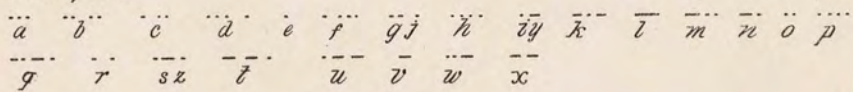
Example 2^d

For Compound Numerals
Showing the numerals combined together



Example 3^d

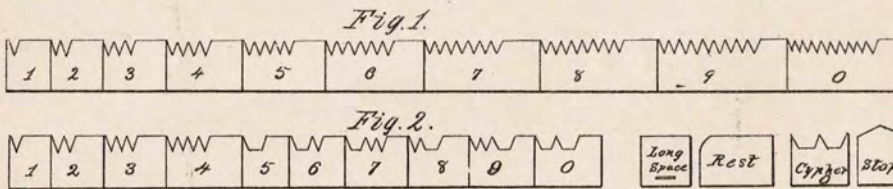
2^d For Letters



The System of Type

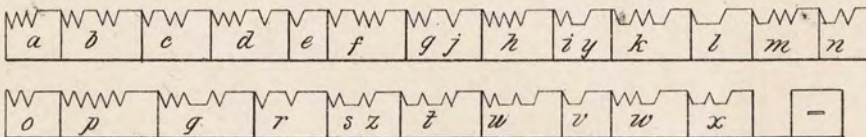
Example 4th

1st For Numerals



Example 5

2^d For Letters



Example 6.

Type for circular Port Rule

Fig. 1.
Witnesses
Thomas Clark
Alex^r Jackson



Inventor
Sam^l F. B. Morse

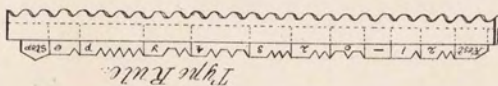
S. F. B. Morse.

Telegraph Signs.

Patented Jan. 20, 1840.

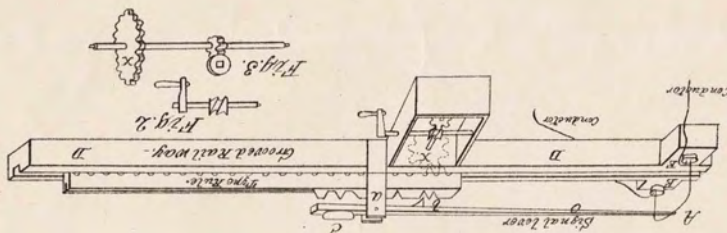
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Example 1.



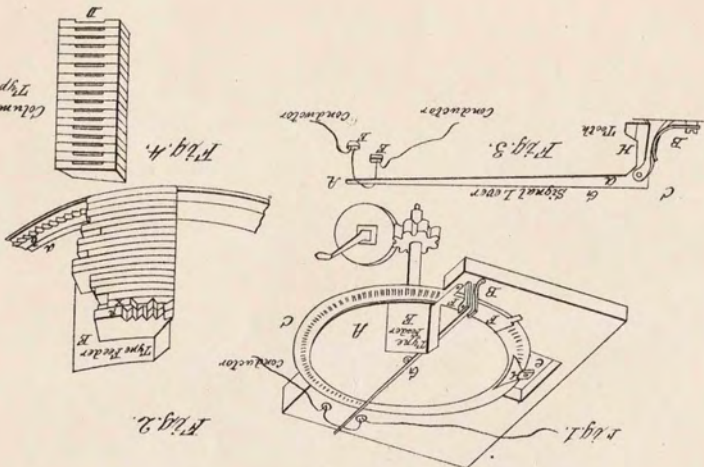
Example 5.

Fig 1. Straight Port Rule



Example 6.

Circular Port Rule.



Column of Type.

Inventor
Saml. F. B. Morse

Witnesses:
Thomas Clark
J. Lee Jackson

S. F. B. Morse.

Telegraph Signs.

N^o 1,647.

Patented Jun. 20, 1840.

Example 10.
Register

Fig. 1.



Fig. 2.

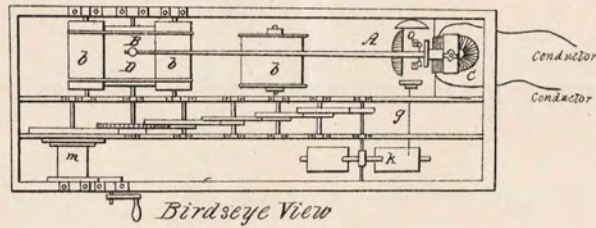


Fig. 3.

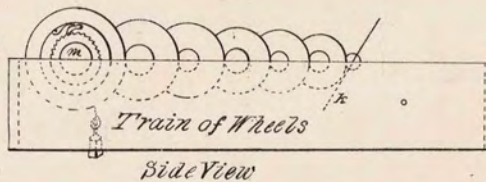
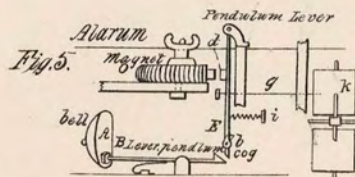
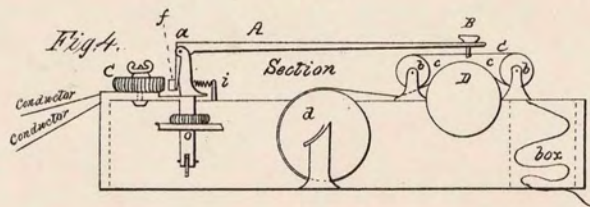


Fig. 4.



Witnesses.
Thomas Clark
Alex. Jackson

Inventor
Sam^l F. B. Morse

THE FIRST TELEGRAPH

CHAPTER I

THE FIRST TELEGRAPH

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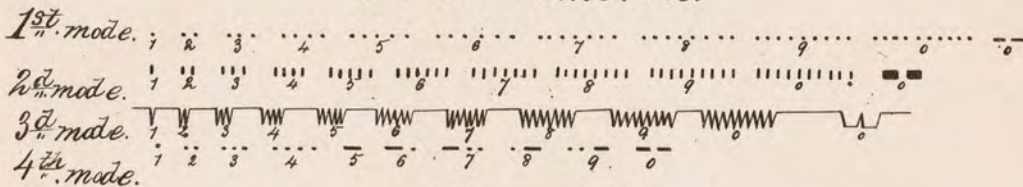
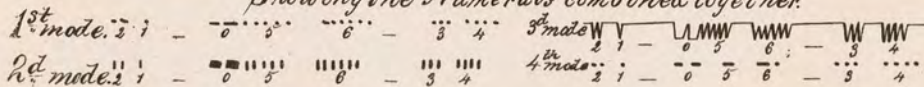
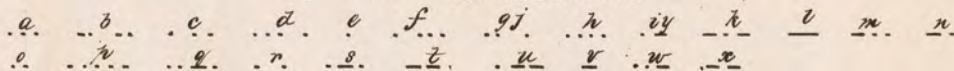
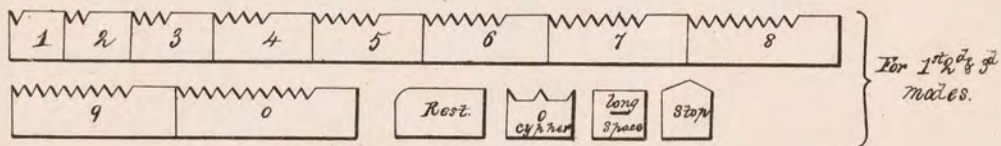
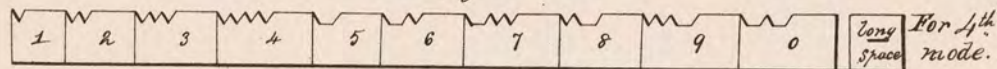
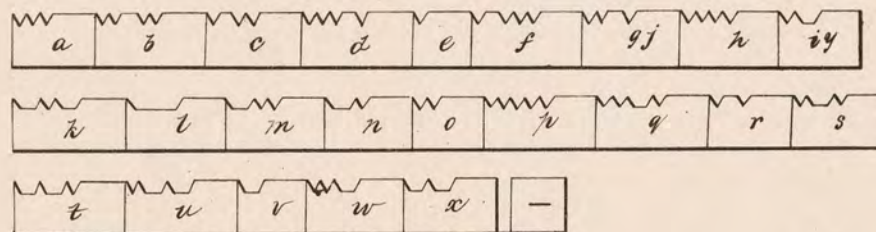
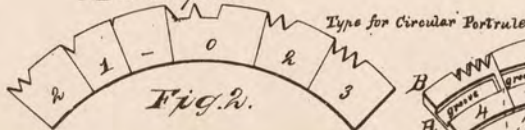
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MODE OF COMMUNICATING INFORMATION BY SIGNALS BY THE
APPLICATION OF ELECTROMAGNETISM.

NO MODEL.

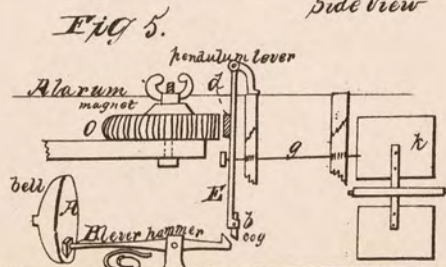
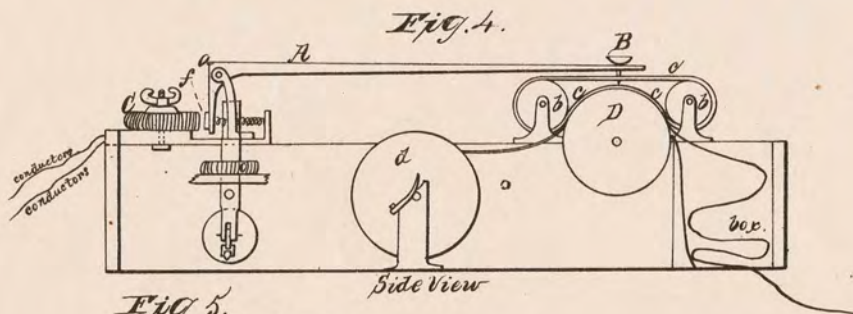
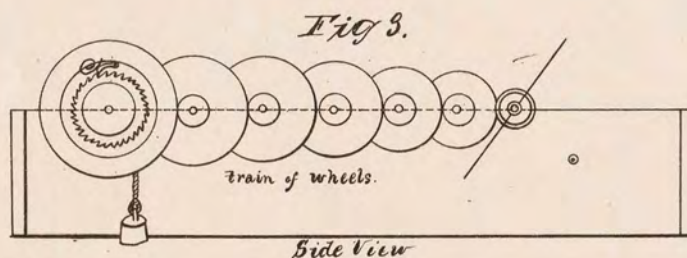
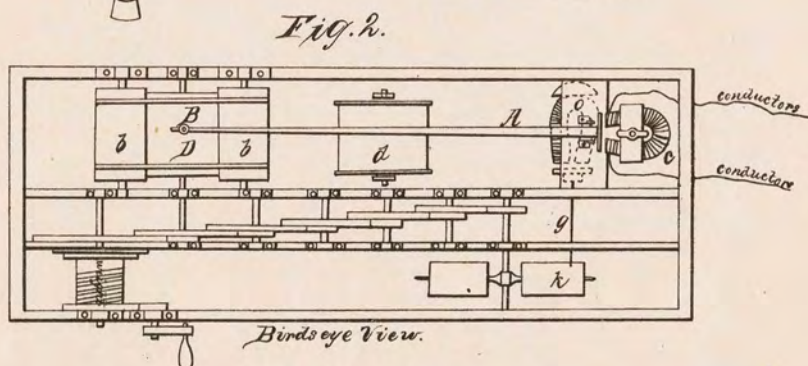
4 SHEETS—SHEET 1.

*Example 1st.**1st. For Numerals.**Example 2^d.**For Compound Numerals.**Showing the Numerals combined together.**Example 3.**2^d. For Letters.**The System of Type.**Fig. 1st. Example 4th. 1st. For Numerals.**Fig. 2nd.**Example 5th. 2^d. For Letters.**Fig. 1.**Example 6th.**Fig. 3.*

MODE OF COMMUNICATING INFORMATION BY SIGNALS BY THE
APPLICATION OF ELECTROMAGNETISM.

NO MODEL.

4 SHEETS—SHEET 2.

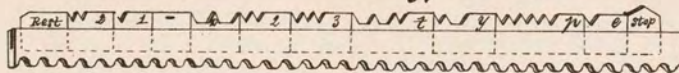


MODE OF COMMUNICATING INFORMATION BY SIGNALS BY THE
APPLICATION OF ELECTROMAGNETISM.

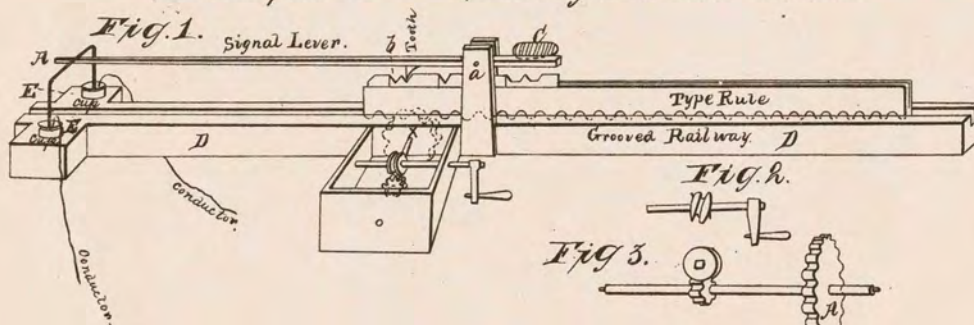
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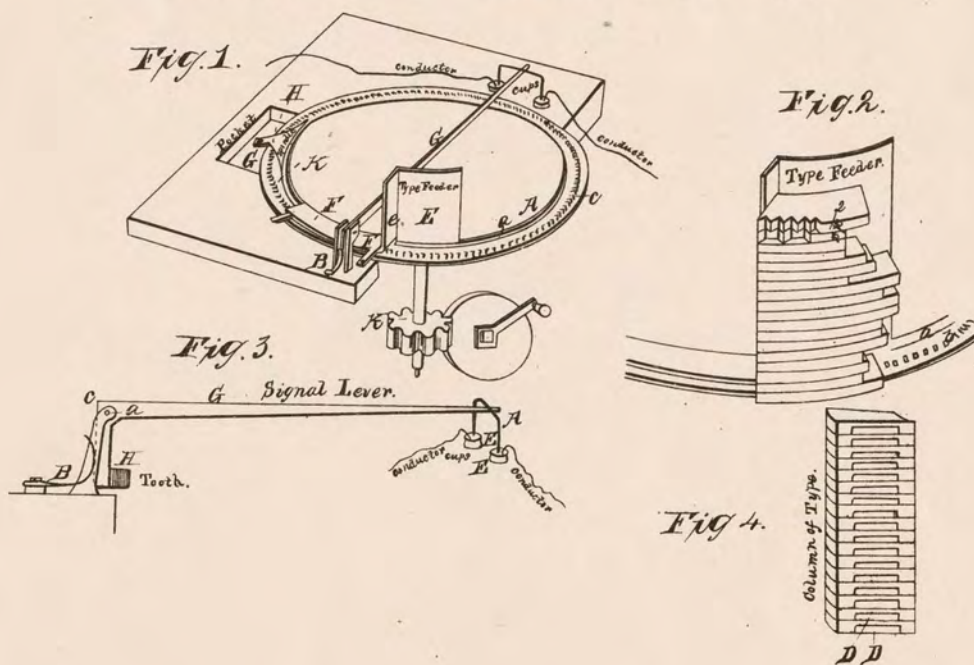
Example. 7. Type Rule.



Example 8.th Straight Port-rule.



Example. 9th Circular Port-rule.



No. 79.

S. F. B. MORSE.

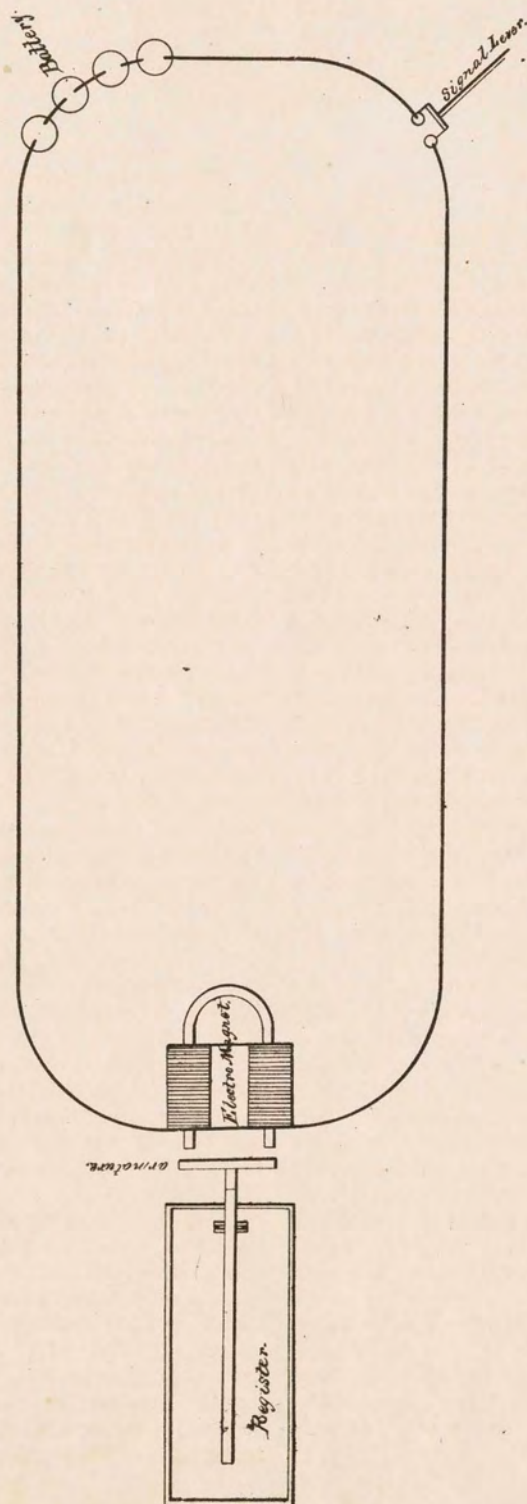
REISSUED JAN. 15, 1846.

MODE OF COMMUNICATING INFORMATION BY SIGNALS BY THE
APPLICATION OF ELECTROMAGNETISM.

NO MODEL.

4 SHEETS—SHEET 4.

Diagram. No 11.



UNITED STATES PATENT OFFICE.

SAML. F. B. MORSE, OF NEW YORK, N. Y.

IMPROVEMENT IN THE MODE OF COMMUNICATING INFORMATION BY SIGNALS BY THE APPLICATION OF ELECTRO-MAGNETISM.

Specification forming part of Letters Patent No. 1,647, dated June 20, 1840; Reissue No. 79, dated January 15, 1846.

To all whom it may concern:

Be it known that I, SAMUEL F. B. MORSE, of the city, county, and State of New York, have invented a new and useful apparatus for and system of transmitting intelligence between distant points by means of electro-magnets, which put in motion machinery for producing sounds or signs and recording said signs upon paper or other suitable material, which invention I denominate the "American Electro-Magnetic Telegraph;" and I do hereby declare that the following is a full, clear, and exact description of the principle or character thereof which distinguishes it from all other telegraphs previously known, and of the manner of making and constructing said apparatus and applying said system, reference being had to the accompanying drawings, making part of this specification, in which—

Example 1 is a sample of signs intended for numerals; Example 2, signs for compound numerals. Example 3 are signs for letters, and Examples 4, 5, and 6 are specimens of the form of types used. Example 7 is the type-rule; Example 8, apparatus for connecting and breaking the electrical or galvanic circuit. Example 9 is a modified apparatus for the same purpose. Example 10, Figure 1, is a perspective view of the registering apparatus; Fig. 2, a top plan; Fig. 3, a side elevation of the train of wheels for moving the paper and regulating its motion; Fig. 4, a sectional elevation of the registering-lever and parts appended thereto; Fig. 5, alarm apparatus; Example 11, a diagram showing the relative positions of the different parts of an approved form of apparatus.

It has heretofore been essayed to use the currents of electricity or galvanism for telegraphic purposes either by decomposition or the action or exercise of the deflective force of a current upon a magnetized bar or needle, which decomposition or deflection required to be noted by ocular inspection at the instant the sign was made.

By my invention the intelligence can be transmitted and imprinted on paper or other suitable substance without requiring the aid of any person at the station to which the communication is transmitted, so as to be read at any time thereafter.

The apparatus consists of two principal parts connected by wires, as shown in the Diagram No. 11, or other suitable galvanic or electric conductors to form a circuit, in which is placed any suitable generator of galvanism or electricity as the inducing power.

The first part of my telegraph is for communicating intelligence to the second, where it is recorded; and it consists of apparatus for making and breaking the circuit above named. At any convenient point in the circuit (generally near the generator) a break is made in the conductor, and the two ends thereof are immersed in mercury-cups, as shown in the drawings at E E, Fig. 1, Example 8. To correct the circuit I employ an inverted V-formed piece of metal or other proper conductor, A, suspended over the mercury-cups E E on the end of a horizontal lever, denominated in said drawing the "signal-lever," whose fulcrum is at *a*, so that when the connector A is dipped into the cups the circuit is completed. Between the fulcrum and connector A there is affixed to the under side of the lever, and projecting downward, a triangular tooth, *b*, which bears on the upper surface of the types about to be described, and is raised and lowered by them. The lever may be counterbalanced, as at C, to make it move easy. The types are composed of flat straight strips of metal, as shown in Examples 4 and 5 of the drawings, hereunto annexed, having their upper edges indented to suit the character to be represented, and which will be hereinafter more fully set forth in the description of the operation of the machine. The indentations are sufficiently deep to allow the connector A to be plunged into the mercury-cups, and the highest surface raises it from them. It is obvious that the forms of the upper surface of the types may be reversed and the cog *b* placed on the other side of the fulcrum, and the same effect be produced. The types are set up and confined in a rule to form any required sentences in one long line. This rule, which in the drawings, Example 8, is denominated a "type-rule," has on its under side a rack that gears into a pinion, *x*, on a shaft under the grooved railways D, of common construction, on which said rule slides, and is directed under the cog *b* on the lever. The types

are advanced at a regular speed by the application of any convenient power to the pinion x and bring notches in them successively under the cog.

Other modifications of this apparatus can be made, some of which are shown in the drawings, Example 9, in which is represented what I denominate a "circular post-rule," in which the type are made to surround a disk, A, radially, the other parts of the apparatus being made to correspond. In this modification there may be a stationary hopper or type-feeder, E, into which the types are placed flatwise, one above another, as shown at Fig. 2, placed over the space that is to receive the types on the disk A, and as the disk revolves the types placed in the feeder fall successively into place on the disk and are carried past the signal-lever, where they act, and are then carried off from the disk by a guide, H, into a receiver, G. Many other devices have been suggested for effecting the same object—viz., making and breaking the circuit; but I believe these examples will illustrate the principle. The mercury-cups may be dispensed with and suitable metal plates substituted therefor.

The second part of my apparatus is for registering the signals or sentences communicated from the station where the apparatus heretofore described is situated; and it consists of an electro-magnet, which is in and connected with the above-described circuit, and clock-work for moving the paper or other registering medium, and an alarm may also be appended. The electro-magnet may be of any convenient construction, and will be charged every time the circuit is closed, as above, and discharged when it is broken. Opposite the bars of the electro-magnet (Example 10) C is placed an armature, f , suspended on the upright arm of a bent lever, A, the fulcrum of which is at a . This is most clearly represented in section, Fig. 4. To the end of the horizontal arm of this lever there is attached one or more pencils, fountain-pens, or other suitable marking-instruments, directly under which is placed a suitable cylinder, D, over which the paper passes on which the register is made. This cylinder turns on its axis, and is connected by a train of wheels and pinions with a barrel, m , of common construction, which is driven by a weight and cord wound thereon, and also with a fly, k , which regulates its motion. Near the cylinder D a reel or spool, d , is placed, on which a strip of paper is wound, the end of which is carried over the cylinder D, and is confined thereon by means of two tapes or endless bands, one at each edge, which pass around two pulleys, $b b$, one on each side of cylinder D. This is clearly represented in Figs. 2 and 4. By this arrangement it will be seen that when the electro-magnet is charged the marking-instrument will be brought down onto the paper, which is at the same time put in motion by removing a wire, g , which is so connected with the armature that it can be drawn back from

the fly k , and allow it to turn, (see Figs. 4 and 5,) and makes a mark, longer or shorter, according to the time the circuit is closed.

My system of characters consists of dots and lines, variously combined to form letters and other characters, a specimen of which is represented in Examples 1, 2, and 3. To make a dot a notch is required in the types, into which the cog on the signal-lever will fall and instantly rise from as the type moves on; and when a line is to be formed the notch in the type is extended, so that the lever will remain down for a space of time sufficient to make the line required.

The alarm-bell (shown at A, Example 10, Fig. 5) is struck by means of a hammer actuated by a supplementary electro-magnet placed in the same circuit as that first named. The machinery for this purpose may be variously modified, and therefore no particular description need be given.

Any convenient number of registering-stations may be connected with the same circuit, all constructed and operating as above described.

To extend more effectually the communication by my apparatus, I adopt the following arrangement, whereby I can use any number of additional batteries or generators of said current, and by which I can connect progressively any number of consecutive circuits, viz: I place at any point in the first circuit an electro-magnet, with an armature opposite, on a lever like that described for registering; but instead of the marking-instrument I attach to the end of the lever a conductor, such as is described on the first or signal lever. This connects the conductors of a new circuit, attached to another battery, and this might be continued on *ad infinitum*.

The conductors may be insulated in any convenient way, and may be extended above or below the surface of the earth, as shall be found most desirable, and sustained or inclosed by any suitable construction.

It will be observed that any vocabulary, system of signs, or secret writing by cipher can be conveniently used in communicating by this telegraph, and any mode of making or breaking the circuit can be adopted, the object being to do so at proper intervals.

Having thus fully described my invention, I wish it to be understood that I do not claim the use of the galvanic current or currents of electricity for the purpose of telegraphic communication; but

What I specially claim as my invention and improvement is—

1. Making use of the motive power of magnetism when developed by the action of such current or currents, as a means of operating or giving motion to machinery, which may be used to imprint signals upon paper or other suitable material or to produce sounds in any desired manner for the purpose of telegraphic communication. (The only ways in which the

galvanic current has heretofore been proposed to be used is by decomposition and the action or exercise of the deflective force of a current upon a magnetized bar or needle, and the decompositions and deflections thus produced were the subject of inspection, and had no power of recording the communication. I therefore characterize my invention as the first recording or printing telegraph by means of electro-magnetism. There are various known modes of producing motions by electro-magnetism, but none of these have hitherto been applied to actuate or give motion to printing or recording machinery, which is the chief point of my invention and improvement.)

2. The system of signs consisting of dots and lines, substantially as herein set forth and illustrated, in combination with the telegraph for recording signals.

3. The types and rule, in combination with the signal-levers, as herein described, for the

purpose of connecting and breaking the current of galvanism and electricity.

4. In combination with an electro-magnet used for telegraphic purposes, the train of clock-work actuated by a weight or spring for the purpose of carrying the material on which the record is to be made under the registering-pen, substantially in the manner specified.

5. The combination of two or more circuits of galvanism or electricity generated by independent batteries by means of electro-magnets, as above described.

In testimony whereof I have hereunto subscribed my name, this 27th day of December, 1845, to the above amended specification of the invention for which Letters Patent were granted to me on the 20th day of June, 1840.

SAML. F. B. MORSE.

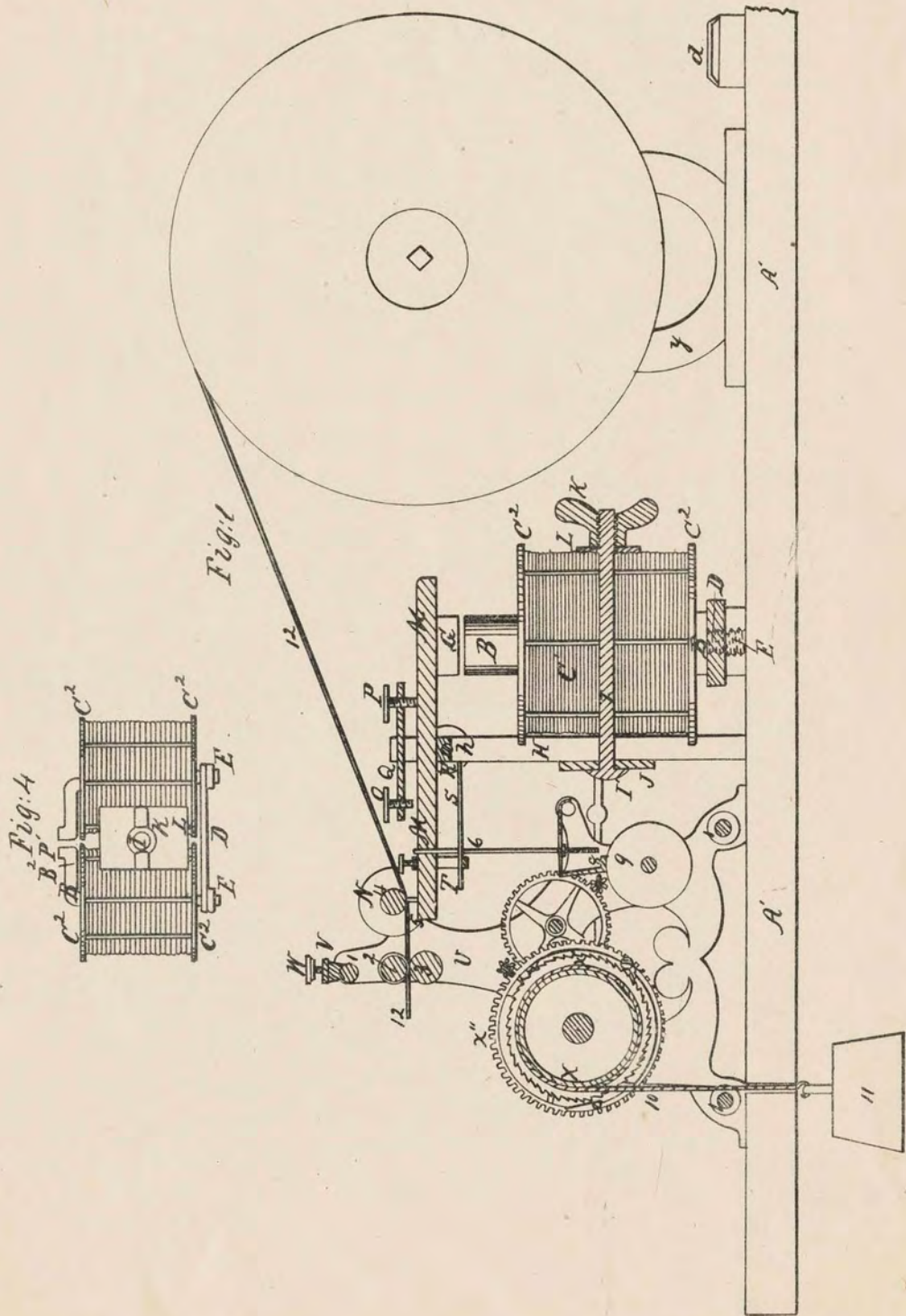
Witnesses:

JAMES MACGREGOR, Jr.,
A. P. BROWNE.

S. F. B. Morse.
Telegraph.

N^o 4453

Patented Apr. 11, 1846.

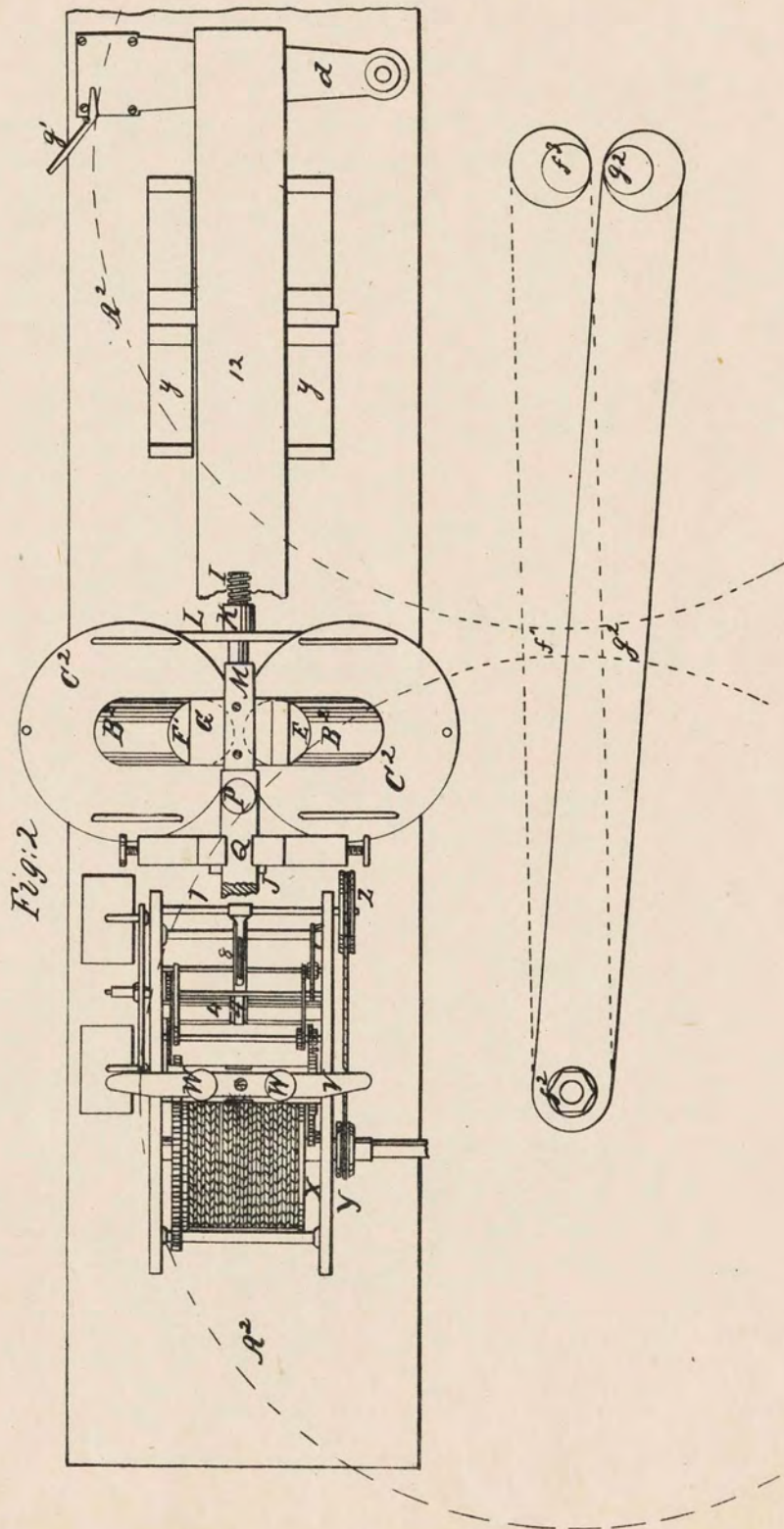


S. F. B. Morse.

Telegraph.

N^o 4453.

Patented Apr. 11, 1846.



UNITED STATES PATENT OFFICE.

SAMUEL F. B. MORSE, OF NEW YORK, N. Y.

IMPROVEMENT IN ELECTRO-MAGNETIC TELEGRAPHS.

Specification forming part of Letters Patent No. 4,453, dated April 11, 1846.

To all whom it may concern:

Be it known that I, S. F. B. MORSE, of New York, in the county of New York and State of New York, have invented a new and useful Improvement in the Electro-Magnetic Telegraph; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation thereof, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical longitudinal view through the machine. Fig. 2 is a top plan. Fig. 3 is a side elevation.

The construction of my apparatus is as follows: In the section Fig. 1, A represents the base, which is an oblong plank to which all of the other parts are affixed. Near one end of said base are two upright standards. (Shown in the figures and lettered *y*.) These standards are represented by harp-shaped castings, which are placed a little distance apart and support the journals of a short cylinder near their top, around which a strip of paper, 12, is wound, of any length, and from it is supplied to the machine, as hereinafter described.

Near the center of the base A is situated the electro-magnet of the register, which is constructed as follows: Two round bars of soft iron are each placed in a coil of insulated copper wire, C, the lower ends of said bars B' being connected by a cross-bar, D, extending from one to the other, through which they pass, and to which they are secured by screws, which are screwed onto them. The upper ends of these bars above the coils curve inward toward each other, coming nearly together without touching, as shown at B², Fig. 4, and the extreme ends are turned upward, as shown at F', same figure.

Just in front of the coils C, above named, there is affixed to the base an upright standard, H, through which a bolt, I, is put horizontally, with its head against a plate, J, between it and standard H. This bolt passes through between the two coils C, and also through a cross-bar, L, that extends from one coil to the other. On its end a screw is cut, on which a nut, K, is screwed, which secures the two coils and the soft-iron bars firmly in their places. Each of the coils of wire have wooden heads

or cheeks above and below, with binding-wires extending from one to the other, for the purpose of keeping the wire together.

On the top of the standard H there is a cross-bar, Q, permanently attached to said standard, and having in each end a thumb-screw, (lettered O and P,) the ends of which extend down nearly to a lever, M M, directly under said bar Q, which I denominate the "pen-lever." One arm of this lever projects over the soft bars above named, where an armature, G, of soft iron is attached to it, that extends over the surface of the ends of both bars B² of the electro-magnet, as shown in the plan, Fig. 2. To the other end of the lever three, more or less, points, 5, are affixed, that project upward toward a steel roller, 4, directly under the center thereof, as hereinafter described.

The extent of the vibration of the lever M is regulated by the thumb-screws O and P, above named, its pivot *h* being in the standard H. The screw O is for limiting the upward motion of the pen or points 5, and P their downward motion, a spring, *s*, being used to draw them down.

A suitable frame is secured to the same base A as the other parts above described, which contains the clock-work for supplying the paper from the roll. Said clock is composed of a cylinder or barrel, *x*, on which a cord, 10, is wound, to which a weight, 11, is suspended. On this barrel, at one end, is a ratchet-wheel, *x'*, and on the same shaft as the barrel there is a spur-wheel, *x''*, with a spring-click, similar to a common clock. This wheel connects, by means of a multiplying-gearing, with the cylinder 3, upon which is pressed a cylinder, 2, by means of a spring, V, which passes over the top of the frame, its ends turning down and resting on the journals of cylinder 2, Figs. 2 and 3, and holds down the upper roller. The pressure of this is regulated by screws W on top. These cylinders draw the strip of paper 12 between them, after it has passed under a cylinder, 4, placed over the pens above described, in which cylinder are grooves 4', cut directly opposite the points.

In addition to the above-described machine, there is what I denominate a "receiving-magnet," of the following construction and use. It is

represented in Figs. 2 and 3, and consists of a bar of soft iron, f' , the two ends $f^2 f^3$ of which are turned up at right angles, and said ends are made larger in diameter than the lower horizontal part, f' , which may be flat. On the upper end of one of the uprights, f^2 , is bolted a horizontal bar, g^2 , that extends out to a point just beside the other upright, f^3 , (more clearly shown in the outline Fig. 2,) and its end turns up at the same distance from f^2 as the end of f^3 . The upper end of the upright f^3 and bar g^2 are on a level with each other, and they are chamfered off on the sides from each other, so as to have the face of the upper ends smaller than the body of the bars and adjacent to each other. Around each of the uprights $f^2 f^3$ there is a large flat coil of wire consisting of a wire of considerable length, say one mile, more or less, in each coil. These coils connect with a battery, c , Fig. 3, at the other station by a wire from one of the coils, and with the ground as a conductor to the other, as hereinafter described. The circuit can be broken or closed by an apparatus consisting of a straight lever or key, d , Figs. 2 and 3, to one end of which one wire, g' , Fig. 3, is connected, and a boss of metal, e , composing the anvil, is attached to the other wire, e' , forming the rest of the circuit. When the hammer on the lever d is brought down on the anvil it closes the circuit, by which the bar $f^2 f^3$ of the receiving-magnet at the opposite station is magnetized. This attracts a keeper or armature, d'' , on the short arm of a straight metal lever, d' , suspended on metal standards d^1 above it, which causes the long arm of said lever to rise and come in contact with a brass adjusting-screw, h , placed above and near its end, to which is attached the wire leading to one pole of the local battery k . The wire $i' i''$ from the other pole of said battery is connected with the metal standards d^1 that support the journal of lever d' , and thus completes the circuit which has the electro-magnet B in it for writing, by which any amount of power can be obtained that is required to enable the said magnet to draw down the armature G above described, which causes the points 5 to mark on the paper 12. (See Fig. 1.)

To the arm M of the pens a break, S , which is a common plain lever, is attached by means of a connecting-rod, 6 , so as to be raised from a friction-pulley when the pen is made to mark and let off the clock-work attached thereto, which puts the paper in motion. This break S is attached to the shaft 7 placed a little above the friction-pulley 9 that is connected with the clock-work on which said break acts. On the same shaft 7 with the break there is a pulley, z , connected by an endless band with a smaller pulley on the shaft of the barrel on which the weight-cord is wound. This causes the break, when raised by the lever M , slowly to descend till it strikes the friction-pulley 9 and stops the clock-work, after a sufficient quantity of paper has been run off by its action to form the spaces for the longest rests between the

motions of the pen-lever M , and thus keeping the break up till the writing ceases, after which it gradually descends and the machine is stopped.

The red and black lines, Fig. 3, show the relative positions of the apparatus in connection with a circuit of wire.

a is a copper plate buried in the ground, from which a wire, b , ascends to a battery, c . This I denominate the "main battery." From thence the wire extends to a receiving-magnet, f , described in a former section, and represented at f , Figs. 1 and 3. From thence a wire, e' , is continued to the opposite station, and is there connected with the anvil e of the key d , as above described, and thence to another plate of copper, g , in the ground. Connecting this circuit by means of the key d , magnetizes the receiving-magnet and causes the lever d' to move, which closes the circuit of wire i connected with a local battery, k , and magnetizes the soft bars B of Fig. 3, acting on the pen-lever, which causes it to mark on the paper.

The economy of the galvanic power by the introduction of the receiving-magnet is obvious. When the extent of the telegraphic line is very great the resistance to the passage of the galvanic current is proportionably increased, and an enormous battery would be required to operate the pen by means of the register or local magnet, which is of small dimensions and has a comparatively short extent of wire around it; but I have discovered that by using a very long coil of wire, as in the receiving-magnet, there is a sufficiently powerful magnet produced (notwithstanding the length of the telegraphic line may be very great) by means of a small galvanic battery. The same extent of galvanic battery that would produce no available magnetism in the register-magnets charges the receiving-magnet to such an extent as to enable me to produce motion, and thus at pleasure to make and break the circuit of the small local battery, which, being on the spot and charging the register-magnet, gives me perfect control over it and the apparatus connected with it. Thus I resort to two magnets and two batteries, of such relative characters as I have described, to effect a communication through any distance desired without increasing to any considerable degree the size of the main galvanic battery, which is in itself a great source of expense.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The receiving-magnet, or a magnet having a similar character, that sustains such a relation to the register-magnet, or other magnetic contrivances for registering, and the length of current or telegraphic line as will enable me to accomplish, with the aid of a main galvanic battery and the introduction of a local battery, such motion or power for registering as could not be obtained otherwise without the use of a much larger galvanic battery.

2. The use of a local battery and magnet, in combination with a battery and magnet connected with the main line or lines of conductors, for the purpose above specified.

3. The combination of the apparatus connected with the clock-work for setting off the paper and stopping it with the pen-lever M.

4. The combination of the points affixed in the pen-lever with the grooved roller N for marking on paper, as above described.

SAM. F. B. MORSE.

Witnesses:

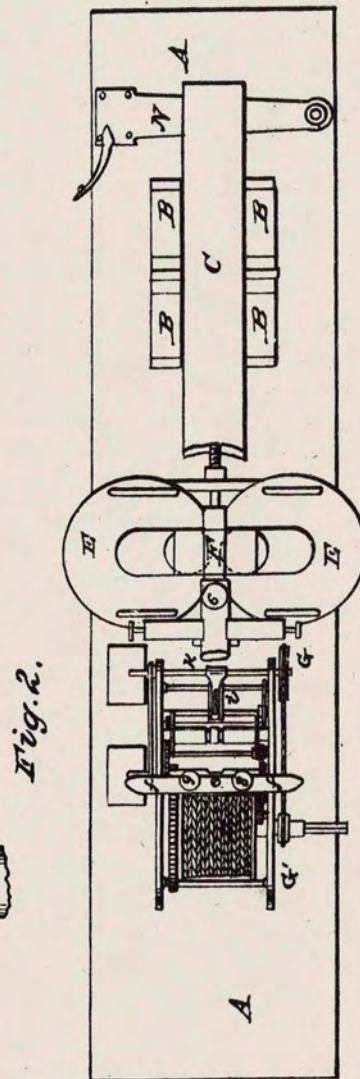
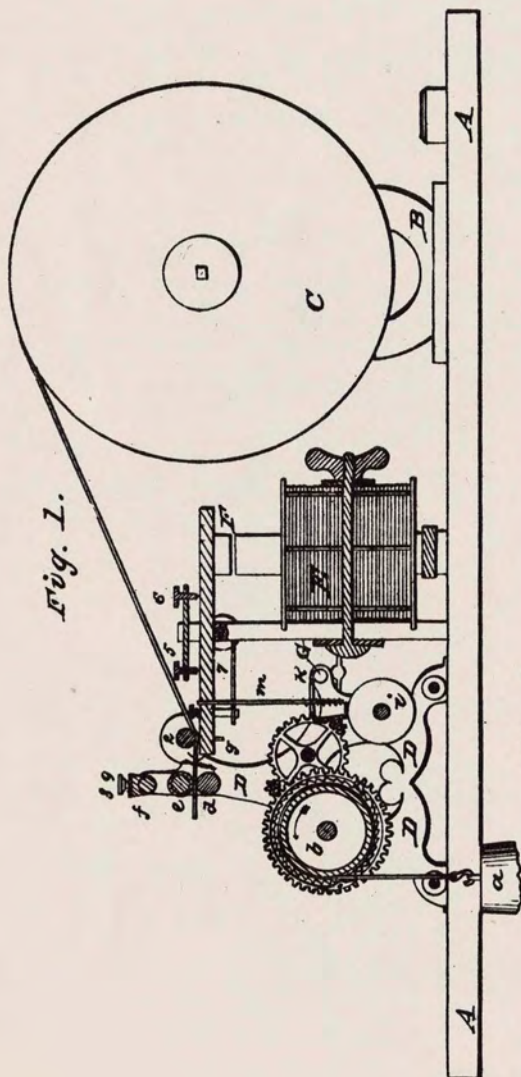
ALFRED VAIL,
J. J. GREENOUGH.

S. F. B. MORSE.
Telegraph.

4 Sheets—Sheet 1.

No. 118.

Reissued June 13, 1848.



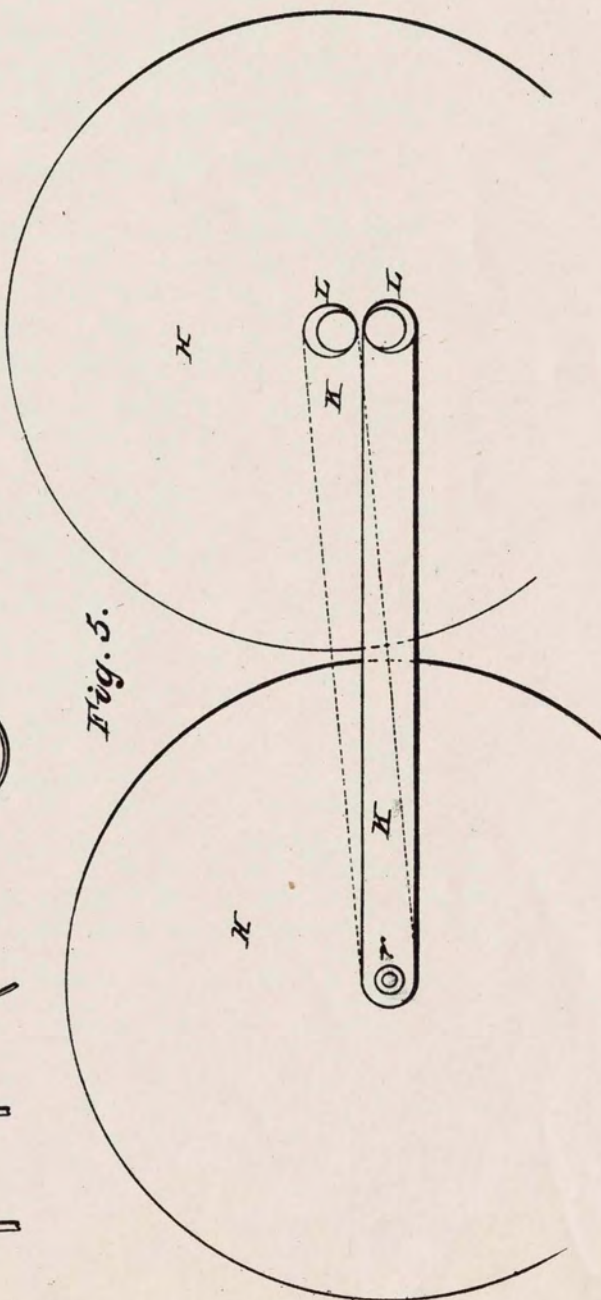
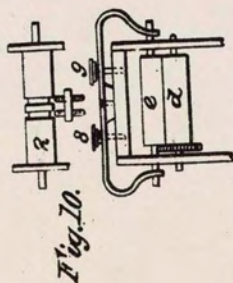
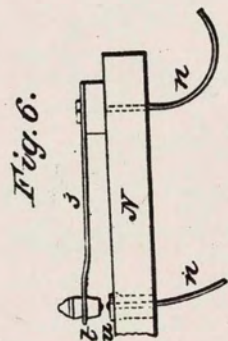
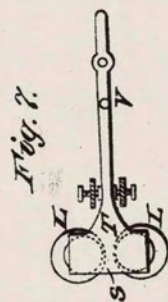
S. F. B. MORSE.

4 Sheets—Sheet 3.

Telegraph.

No. 118.

Reissued June 13, 1848.



S. F. B. MORSE.

Telegraph.

No. 118.

Reissued June 13, 1848.

Fig. 8.

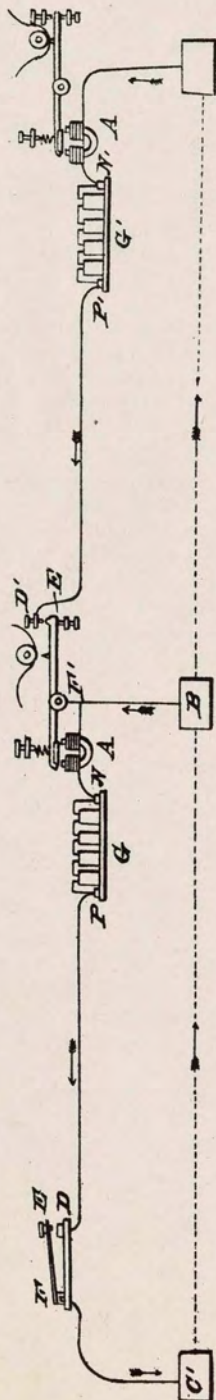
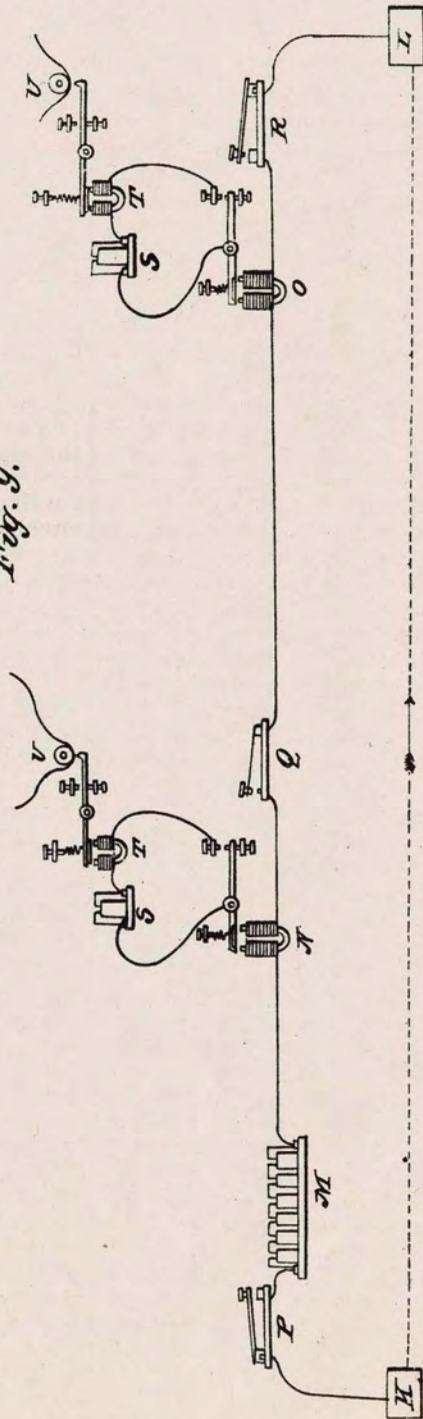


Fig. 9.



UNITED STATES PATENT OFFICE.

SAML. F. B. MORSE, OF POUGHKEEPSIE, NEW YORK.

IMPROVEMENT IN ELECTRO-MAGNETIC TELEGRAPHS.

Specification forming part of Letters Patent No. 4,453, dated April 11, 1846; Reissue No. 118, dated June 13, 1848.

To all whom it may concern:

Be it known that I, SAMUEL F. B. MORSE, now of Poughkeepsie, in Dutchess county, in the State of New York, have invented a new and useful Improvement in the Electro-Magnetic Telegraphs; and I do hereby declare that the following is a full, clear, and exact description of the object, construction, and operation thereof, reference being had to the accompanying drawings, and making part of the same.

The original and final object of all telegraphing is the communication of intelligence at a distance by signs or signals.

Various modes of telegraphing or making signs or signals at a distance have for ages been in use. The signs employed heretofore have had one quality in common. They are evanescent, shown or heard a moment, and leaving no trace of their having existed. The various modes of these evanescent signs have been by beacon-fires of different characters, by flags, by balls, and reports of fire-arms, by bells heard from a distant position, by movable arms from posts, &c. I do not therefore claim to be the inventor of telegraphs generally. The electric telegraph is a more recent kind of telegraph proposed within the last century; but no practical plan was devised until about sixteen years ago. Its distinguishing feature is the employment of electricity to effect the same general result of communicating intelligence at a distance by signs or signals. The various modes of accomplishing this end by electricity have been the employment of common or machine electricity as early as 1787 to show an evanescent sign by the divergence of pith-balls; the employment of common or machine electricity in 1794 to show an evanescent sign by the electric spark; the employment of voltaic electricity in 1809 to show an evanescent sign by the evolution of gas-bubbles decomposed from a solution in a vessel of transparent glass; the employment of voltaic electricity in the production of temporary magnetism in 1820 to show an evanescent sign by deflecting a magnet or compass-needle. The result contemplated from all these electric telegraphs was the production of evanescent signs or signals only. I do not therefore claim to have first applied electricity to telegraphing for the purpose of showing evanescent signs or signals.

The original and final object of my telegraph is to imprint characters at any distance as signals for intelligence. Its object is to mark or impress them in a permanent manner. To attain this end I have applied electricity in two distinct ways: First, I have applied by a novel process the motive power of electro-magnetism, or magnetism produced by electricity, to operate machinery for printing signals at any distance; second, I have applied the chemical effects of electricity to print signals at any distance.

The apparatus or machine with which I mark or imprint signs or letters for telegraphic purposes at a distance I thus describe, viz.: first, the machinery at the transmitting terminus; second, the machinery at the receiving or recording terminus; third, the arrangement of circuits or conductors consisting of the main circuit and local circuit or circuits connecting the machinery of both termini.

First, the machinery at the transmitting terminus consists of the key or correspondent N. (See Sheet III, Fig. 6.) The part N is of wood or some convenient non-conducting substance. 3 is a spring or lever of metal, fastened upon N at one end and terminating at the other in a knob or hammer, *t*, faced with platinum. *u* is a metallic anvil, also faced with platinum. Parts of the electric conductor terminate at the key, the one part at the anvil *u* and the other at the hammer *t*, in such a way that the only part broken of the entire circuit is between the points *u* and *t*. The object of the key is to close and break the circuit.

Second, the machinery at the receiving terminus consists of the receiving-magnet. (See Fig. 4, Sheet II.) H H are the coils or helices of the magnet, being part of the main circuit of conductors. K K (see Figs. 4 and 5, Sheets II and III) represent the iron of the electro-magnet in a form to enable me to enlarge the coils or helices without separating to an inconvenient distance the poles L L from each other. K K represent the upper and lower portions of the magnet, which are without the coils, and one of which unites the two portions of the magnet within the coils, forming one piece with them. The other bar is united at one end to this piece by a screw at *r*, and runs divergent from the position of the other bar in such a manner as to bring the two poles

L L near each other, but not in contact. This arrangement admits of coils of any desired size to form the helices of a magnet without requiring any increase in the size of the armature, thus allowing to the armature a quicker vibration and a more delicate adjustment. The special object of the receiving-magnet is to close and break at a distance another circuit, called a "local circuit," in which local circuit is a magnet and battery or their equivalents for the production of the power necessary to mark or imprint characters.

s is the armature of the receiving-magnet, affixed to the metallic lever T, supported by the metal standard P, which is attached to a wooden frame or other non-conducting substance, M. *j* is a spring so attached to the lever T as to withdraw the armature *s* from the poles L L of the magnet when the magnetic force is withdrawn, the other extremity of the spring being so attached to a thumb-screw, *q*, as to be adjusted to any desired degree of strength or delicacy. *z* is a stop (being a screw with a head) to regulate, in connection with another metallic screw, *y*, the limits of motion of the lever T. The screw *y* has its end, *w*, faced with platinum in order to form better contact with the platinum point or surface *v* on the lever T. On the proper adjustment of these two screws *l* and *y* depends the efficiency of the receiving-magnet. The limits of motion should be such that when the magnet is charged the point *v* should come in contact with the point *w*, but the surface of the armature should not touch the surface of the poles of the magnet, and when the magnet is not charged the armature should not be withdrawn by the spring *j* beyond the sphere of the magnet's attraction.

The register consists of a series of wheels and pinions, and its object is to regulate the movement of paper or other material upon which to imprint telegraphic characters.

A A, &c., Sheets III, Figs. 1 and 3, represent the platform, of wood or other convenient material, upon which is to be imprinted the telegraphic characters; D, one form of the arrangement of the wheels and pinions of the register; *d e*, rollers for drawing the paper in contact with the pen or marking-roller 2. (Seen also on Sheet III, Fig. 10.)

Sheet II, Fig. 3: E represents the helices or coils and magnet of the register; F, the pen-lever and armature of the magnet attached. 5 6 are stops, being thumb-screws attached to some convenient fixed part of the machinery, for limiting the motion of lever F, to which is affixed both the armature of the magnet E and the pen point or points *g*. The stop 5 arrests the movement of the armature as it moves toward and stop 6 as it recedes from (by the action of the spring 7) the poles of the magnet, according as magnetism exists or ceases. The spring 7 so operates on the lever F as to be antagonistic to the attractive power of the electro-magnet E—not so strong as successfully to resist the magnetic power when excited,

but strong enough when the magnetic power ceases to bring the armature back quickly. The armature in its movements should not be allowed to touch the face of the magnet, nor should the point or points *g* (of which there may be one or more at pleasure) be allowed to touch the bottom of the groove or grooves of the roller 2. The pen point or points, if they are screws, aid in an exact adjustment of the pen-lever.

The frame D contains the train of wheels whose motion is caused by the weight *a* or its equivalent. Connected with this train of wheels is the self-stopping apparatus G G', which consists of a friction-wheel or brake-wheel, *i i*, of any suitable material, as wood, cork, &c., which should be fixed upon any convenient part of the fly-wheel shaft, or the swiftest or one of the swiftest in the train. Another shaft, G, has at one extremity a pulley-wheel connected by a small cord with another pulley-wheel, G', fixed upon the shaft of the barrel *b*. The diameter of the pulley-wheel G is greater than that of G'. Attached to and forming a part of the shaft of G is a small arm or brake, *k*, of metal or other suitable material, so formed as to come in contact with the friction-wheel *i i*. A light rod of wire, *m*, secured at one extremity to and dropped from the pen-lever F, has the other extremity with a screw-thread cut upon it, which rod passes freely through an opening in the brake *k*. A nut fitting the screw keeps the rod from passing back through the opening, and at the same time serves to adjust and regulate the movement of the brake. The object of the self-stopping apparatus is to enable the operator to put in action or to arrest at pleasure the movement of the distant register.

The paper-rollers *d*, *e*, and 2, Fig. 10, Sheet III, are so connected with the train of wheels that the paper drawn from the reels, by passing between *d* and *e*, is made to be in contact with the grooved cylinder 2. The roller *e* is kept in contact with *d* by the forked spring in Fig. 10 bearing upon the ends of the journals, and regulated in its strength by the thumb-screws 8 and 9. The bearing or sockets for the ends of the shafts of *e* are not circular, but are slots to allow of a slight movement in a direction with and against the force of the spring, so that the spring shall act with proper power tending to keep the cylinder *e* in contact with *d*.

The circuits of conductors.—A circuit is a continuous connection by a good conductor between and uniting the two poles of a battery or any generator of electricity. I use in my arrangement for imprinting signals two combinations of circuits in connection with the receiving-magnet or its equivalent:

The first combination consists of two or more single circuits consecutively arranged, each having a battery and receiving-magnet or their equivalents, the second circuit being dependent on the first circuit, and the third on the second, and the fourth on the third and so on *ad infinitum*, like links of a chain. In this combination of circuits the entire line is de-

combination of circuits the entire line is dependent on the entirety of each single circuit of the whole series.

The second combination consists of one main single circuit containing in it any number of receiving-magnets or their equivalents, the helices of which are successively and continuously connected. Each receiving-magnet or its equivalent closes and breaks an independent second circuit, which is no part of the main line, nor is the main line influenced in its action by the derangement of any one or all of the local or secondary circuits. Both combinations of circuits may be insulated upon posts, or otherwise, to any distances throughout a country.

These two combinations of circuits are illustrated by Figs. 8 and 9, Sheet IV.

Example 1.—The first link has a battery, G. From the pole P the circuit connects the anvil D of a key or correspondent where it terminates. From E it again commences, and, passing through F, continues to the plate C in the earth, thence through the earth to plate B, and then through the helices of the magnet A, terminating at the other pole, N, of the battery. At the key F E D is the only part of the circuit broken—to wit, between E and D. When E is pressed down so as to touch D the circuit is closed, and, the magnetic influence from the battery G operating on A, the lever F' E' D' of the second link is brought down. D' and E' are connected, (the only broken parts of the second circuit similarly arranged as the first,) and the battery G' operates the helices of the magnet A', connected with another lever, and so on to a third link indefinitely.

Example 2, Fig. 9.—From one pole of the main battery M the conductor proceeds to the key P, where it is interrupted, (as in the key F E D of the previous example,) and thence proceeds to the plate K in the earth, passing through the earth to the plate L at the other terminus. From L it passes to a similar key, R, thence through the helices of receiving-magnet O to an intermediate key, Q, thence through the helices of receiving-magnet N, and so completing the circuit at the other pole of the battery M. The local circuits are without the main line. When not in use the keys P, Q, and R are kept closed, so that wherever there is a key upon the line an operator can command the whole line by breaking and closing circuit with the key at his station. Each key operates every receiving-magnet on the line. N and O both operate when either of the keys P, Q, or R is made to close and break the circuit. When the main circuit is closed the magnetism at N and O operates the local lever or key which connects the local circuit, having the local battery S and the register-magnet T in the local circuit, causing the lever operated by T to mark the characters on the paper at U.

In the Example 1 the receiving-magnet propagates the magnetic impulse from circuit to circuit on consecutive and mutually-depend-

ent circuits. In Example 2 it is propagated from a main circuit simultaneously to independent circuits.

Connection of the other parts of the machinery with the circuits.—O, Sheet II, Fig. 3, is the main battery, from one pole of which the main conductor *n* proceeds to the plate Q' in the earth. From thence it passes in the direction of the arrow to the plate Q, thence to the key N, where it terminates at *t*. Commencing again at *u*, it proceeds to the helices of the magnet K K and back to the other pole of the battery O.

R is the local battery, from one pole of which the conductor X X X of the local circuit proceeds to the screw *y* and to the point *w*, where it terminates. Commencing at *v* on the lever T, it passes through the metal standard P to the screw *z*, from thence through the helices of the register-magnet E, and thence back to the other pole of the battery R.

Having thus described the object and construction of my invention, and the connection of the different parts of the machinery with each other, I will now describe the operation of the system combined as a whole.

The register D is at rest and the weight prevented from acting and moving the clock-work by the pressure or friction of the brake *k* upon the brake-wheel *i*, the brake being kept in contact with the brake-wheel by the power of the weight itself. Now, when the key or correspondent N is pressed down, so that the metallic hammer *t* shall strike the anvil *u*, this being the only part of the main circuit that is interrupted or broken, the circuit of conductors from the two poles of the main battery O are by this act connected, and the electricity from the battery freely passes through the entire circuit *n n n*, imparting magnetic power to the helices H H of the receiving-magnet K K. The armature S on the metallic lever T is now attracted by the poles L L and *v w*. The only part of the local circuit broken are brought together, closing the local circuit *x x x* of the local battery R, which instantly imparts magnetic power to the register-magnet E, to strike the point or pen *g* against the paper. The rising of the lever F has suddenly raised the brake *k*, by means of the rod *m*, from the brake-wheel *i*, so that now the weight *a* is permitted to move the whole train. The rollers *d e* commence drawing the paper in regular time from the paper-reel C. If the key which has been pressed down is now released and the circuit broken, the lever F falls, the power being gone that held it; but when it falls the lower end of the brake-rod, having free play through the opening in the brake-lever, does not, in its descent, take down the brake, but leaves it to the action of the clock-work gradually to bring it down into contact again with the brake-wheel. While closing and breaking the circuit, therefore, for imprinting the characters, the machine keeps in movement, for every rising of the lever F, in the act of writing or imprinting, prevents the

brake-lever from descending and coming in contact with the brake-wheel, for the cord which connects G with G' slips upon the smallest wheel G', from the quickness of the action of the lever; but when the circuit remains broken for a short time, the lever F having fallen, there is now no more obstacle to the brake lever *k* in slowly descending by the action of the machinery till it comes in contact with the brake-wheel *i*, and thus arrests all motion.

In this manner, by the apparatus or machine or combination of machinery above described, I am enabled, standing at any one station, to mark or imprint signs or signals at any other station, however distant, and by a combination of these machines, by means of electromagnetism, all being in order, I can at the same instant, by pressure upon one key, mark or imprint the same signs or signals at any number of points throughout the American continent. This machinery I call the "American electro-magnetic telegraph."

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The employment, in a main telegraphic circuit, of a device or contrivance called the "receiving magnet," in combination with a short local independent circuit or circuits, each having a register and register-magnet, or other magnetic contrivances for registering and sus-

taining such a relation to the register-magnet or other magnetic contrivances for registering, and to the length of circuit of telegraphic line, as will enable me to obtain, with the aid of a main galvanic battery and circuit and the intervention of a local battery and local circuit, such motion or power for registering as could not be obtained otherwise without the use of a much larger galvanic battery, if at all.

2. The combination of the apparatus called "the self-stopping apparatus," connected with the clock-work of the register, for setting said register in action and stopping it, with the pen-lever F, as herein described.

3. The combination of the point or points of the pen and pen-lever or its equivalent with the grooved roller or other equivalent device over which the paper or other material suitable for marking upon may be made to pass for the purpose of receiving the impression of the characters, by which means I am enabled to mark or print signs or signals upon paper or other fabric by indentation, thus dispensing with the use of coloring-matter for marking, as specified in my Letters Patent of January 15th, 1846.

SAML. F. B. MORSE.

Witnesses:

GEO. WOOD,
J. THOMAS CLARK.