American Electromagnetic Telegraph —A Classic Invention

Electricity

IMPROVEMENT IN THE MODE OF COMMUNICATING INFORMATION BY SIGNALS BY THE APPLICATION OF ELECTROMAGNETISM. Samuel F. B. Morse, of New York, N. Y. Specification forming part of Letters Patent No. 1,647, dated June 20, 1840. U. S. Patent Office.

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 electromagnetism, 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 specifications for the original Morse telegraph bring to mind the latest automatic self-printing telegraph instruments just now coming into use. The chief problem to the inventor seems not to have been to get his code of dots and dashes over the electric circuit, but to send it as exactly as possible and to get it into written form at the other end. For this purpose it was actually set up in a special kind of type at the sending instrument, and the jagged edges of the type run under the key, so that the make-and-break of the current occurred with machine precision. Most of the patent is taken up with minute specifications for these outmoded accessories and for a now familiar recording device for the receiving instrument. The earliest telegraph instruments were provided with these devices, and the operators were themselves surprised to find that they soon learned the rhythmical dot-dash language so thoroughly that they translated as they listened, and the recording pen merely slowed up telegraphic communication.

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. . . .

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

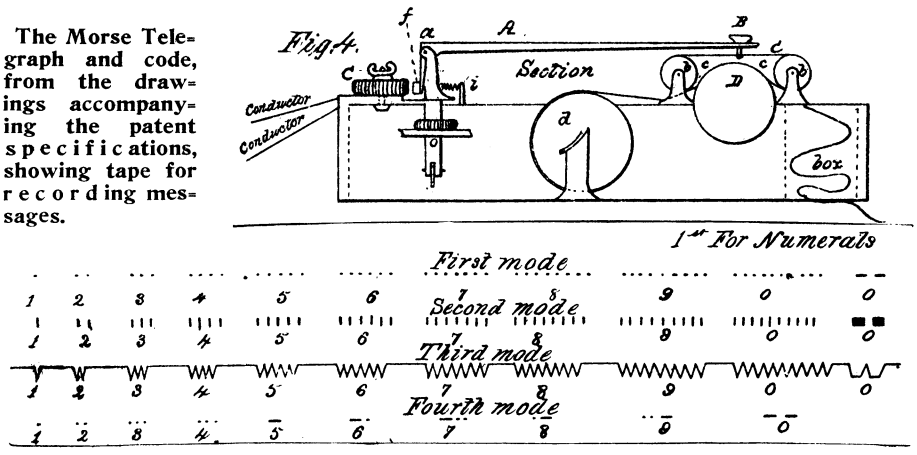
Signs of numerals consist, thirdly, of characters drawn at measured distances in the shape of the teeth of a common saw by the use of a pencil or any instrument for marking. The points corresponding to the teeth of a saw are in number to correspond with the numeral desired to be represented, as in the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

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. . . .

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

The type for producing the signs of numerals consists, 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. . . .



The Morse Telegraph and code, from the drawings accompanying the patent specifications, showing tape for recording messages.

The Instrument

The signal-lever consists, first, for use with the straight port-rule, 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 in 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. 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 proceeds 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 ends, 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 wire attached to said lever, may be substituted, if preferred, for said cups of mercury. . . .

The Register

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. . . . 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. . . .

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. 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. . . . 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.

The Wire Circuit

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.