THE HOUSE PRINTING TELEGRAPH.

CHAPTER XXX.

Early History of the House Telegraph—The Composing and Printing Apparatuses—The Axial Magnet—The Air Valve and Piston—The Manipulation—The Patented Claim.

EARLY HISTORY OF THE HOUSE TELEGRAPH.

The printing telegraph invented and patented by Royal E. House is one of the most remarkable blendings of the arts and sciences accomplished by the genius of man.

In the perfection and introduction of his telegraph, Mr. House had to contend with the most extraordinary difficulties. Before him were the earlier patented systems, and it required wonderful powers to devise mechanical contrivances to act conjunctive with the known discoveries in the sciences. He obtained a patent from the United States government in 1848, dated from April 18th, 1846. This patent, however, was defective in the protection of a complete system. Early in 1847, Mr. Henry O'Reilly, the indomitable pioneer in telegraphing, became interested in the House Printing Telegraph, and he rendered invaluable aid in the perfection of the apparatus. This energetic and sterling telegrapher furnished the necessary means for new instruments, and had them applied to his line between Cincinnati and Louisville, in the fall of 1847. The first dispatch ever transmitted over a telegraph line with a printing system was by Mr. O'Reilly, from Cincinnati to Jeffersonville, opposite Louisville, 150 miles.

For a long time the friends of the House telegraph struggled against competing interests. Finally, in March, 1849, the first line using the House system was put in operation, from Philadelphia to New York. Under the able and enterprising administration of Messrs. Hiram Sibly, Francis A. Morris, R. W. Russell, and others, the House telegraph was rapidly and successfully extended to different parts of the country.

The mechanism of the apparatus operated with the most

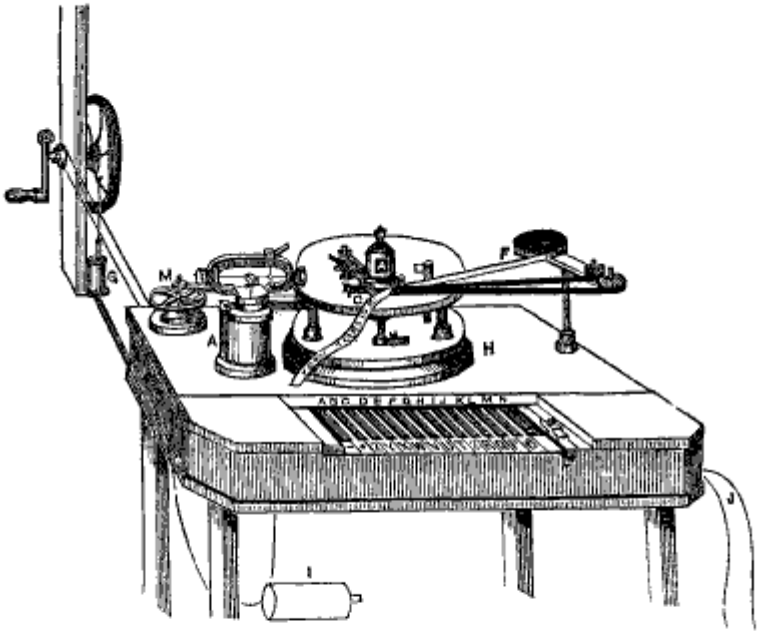
perfect accuracy, and many of the instruments have operated for years with but little repair. I have recently seen one of them that had been used to so great an extent, that the fingers of the operator had worn away the ivory on the keys.

The main constituents of his telegraph are, the composing machine, the printing machine, a compound axial magnet, a manual power which sets the two machines in motion, and a letter-wheel or tell-tale, from which messages can be read, should the printing machine get out of order.

THE COMPOSING AND PRINTING APPARATUS.

A composing and printing machine are both required at every station; the printing apparatus is entirely distinct from the circuit, but all the composing machines are included in and form part of it: the circuit commences in the voltaic

Fig. 1.

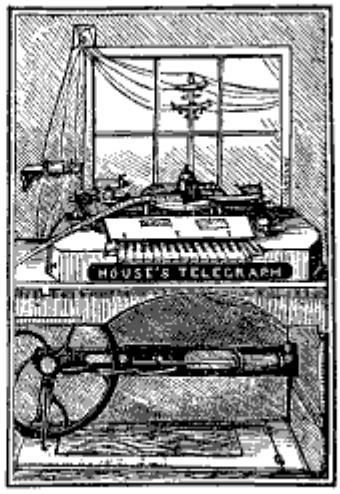


battery of one station, passes along the conductor to another station, through the coil of the axial magnet to an insulated iron frame of the composing machine, thence to a circuit wheel revolving in this frame; it then enters a spring that rubs on the edge of this circuit wheel, and has a connection

with the return wire, along which the electricity goes through another battery back to the station from which it started, to pursue the same course through the composing machine and magnet there, and all others upon the line; thus the circuit is confined to the composing machines, axial magnets, conducting wires, and batteries.

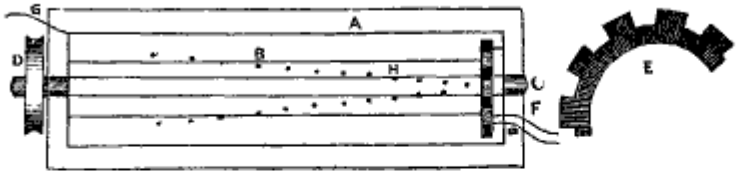
The composing machine, fig. 1, is arranged within a mahogany frame H, three feet in length, two in width, and six or ten inches deep; the various parts of the printing machine are seen on the top of the same case; both are propelled by the same manual power, which is distinct from the electric current; it is simply a crank, with a pulley carrying a band to drive the machine, and a balance-wheel to give stable motion; one of the spokes of the balance-wheel has fixed to it an axis for the end of a vertical shaft to revolve on, that moves the piston of an air condenser G, fastened to the floor; the air is compressed in the chamber I, fourteen inches long, and six in diameter, lying beneath the mahogany case H; it is furnished with a safety-valve, to permit the escape of redundant air not needed in the economy of the machine.

Fig. 2.



The composing system has an insulated iron frame, A, fig. 3, placed immediately below the keys, parallel with the long diameter of the case; this has within it a revolving shaft

Fig. 3.



C; the shaft is enclosed for the greater part of its length by the iron cylinder B; it is made to revolve by a band playing over the pulley D, fixed to the left extremity of it. The cylinder B, fig. 3, is detached from the shaft, but made to

revolve with it by a friction contrivance, consisting of a brass flange fastened permanently to the revolving shaft; the face of the flange and the inner face of the circuit wheel are in contact with a piece of cloth or leather interposed, moistened with oil; the friction is regulated by a spring pressing against the end of the revolving shaft C.

The object of this friction apparatus is to allow the shaft to revolve while the cylinder can be arrested.

On the right end of the cylinder is fixed the brass wheel E, fig. 3, four or five inches in diameter, called the circuit wheel, or break; the outer edge of it is divided into 28 equal spaces, each alternate space being cut away to the depth of one fourth of an inch, leaving fourteen teeth or segments, and fourteen spaces, Fig. 3, E; the revolving shaft and cylinder form part of the electric circuit; one point of the connection being where the shaft rests on the frame, the other through a spring F, having connection with the other end of the circuit, pressing on the periphery of the break-wheel E, fig. 3; G, the other part of the circuit, coming from the axial magnet to the frame A; when the shaft, cylinder, and circuit wheel revolve, the spring will alternately strike a tooth and pass into an open space; in the former case, the circuit is closed, in the latter it is broken.

For the purpose of arresting the motion of the circuit wheel and cylinder, the latter has two spiral lines of teeth H, fig. 3, extending along its opposite sides, having fourteen in each line, making 28, one for each tooth, and one for each space on the circuit wheel; the cylinder extends the whole width of the key-board above it; the latter is like that of a pianoforte, containing twenty-eight keys that correspond with the twenty-eight projections on the cylinder, and have marked on them in order, the alphabet, a dot, and dash, fig. 1; they are kept in a horizontal position by springs; there is a cam or stop fixed to the under surface of each key; directly over one of the projections on the cylinder; these stops do not meet the teeth unless the key is pressed down, which being done the motion of the cylinder is stopped by their contact; by making the circuit wheel revolve, the circuit is rapidly broken and closed, which continues until a key is depressed; that key being released, the revolution continues until the depression of another key, and so on; the depression of a key either keeps the circuit broken or closed; as it may happen to be at the time, so that the operator does not break and close the circuit, but merely keeps it stationary for a moment; from one to twenty-eight openings and closings of the circuit take place

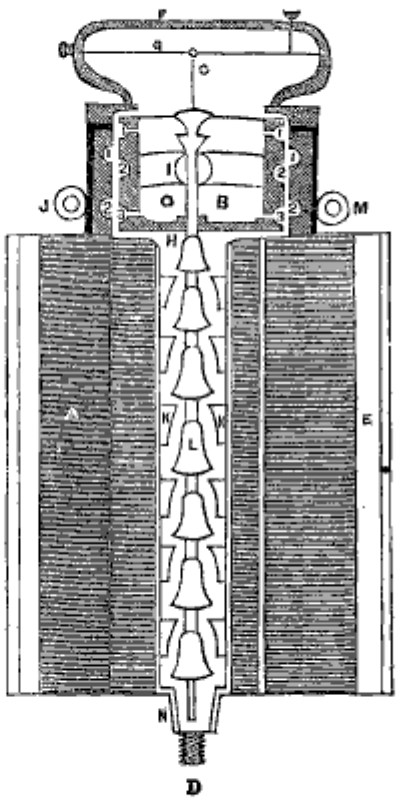
between the depression of two different keys or the repetition of the depression of the same one; the object of the composing machine is to rapidly break and close the circuit as many times as there are spaces from any given letter to the next one which it is desired to transmit, counting in alphabetical order.

THE AXIAL MAGNET.

The rapid electrical pulsations are transmitted by the circuit of conductors to the magnet and printing machine at another station, through the wire J, fig. 1. The helix of this magnet is an intensity coil contained in the steel cylinder A, fig. 1, on the upper surface of the mahogany case; its axis is vertical.

A, fig. 4, is a brass tube, eight or ten inches long, placed within the helix, and fastened at the bottom by the screw D. To the inner surface of this tube are soldered six or eight soft iron tubes, separated from each other at regular intervals. Above the iron cylinder is an elliptical ring F, through the axis of which is extended an elastic wire, G; two screws are attached to the wire, by which it is made lax or tense, to suit the intensity of the electric current. From this is suspended the brass rod C, that passes down within the small iron tubes before mentioned, and has strung on it six or eight small iron tubes L; these are fastened at equal intervals, and have their lower extremity expanded into a bell-like flanch; the surrounding fixed ones have their upper ends

Fig. 4.



enlarged inwardly in the same manner. The tubes L, and the wire to which they are fastened, are movable, so as to come in contact with the small exterior iron tubes K, fig. 4, but are kept separate by the elastic spring above. At E, is the brass covering. On the transmission of an electric current through the helix, the tubes become magnetic. Such is the arrangement of their polarities, that they act by attraction and repulsion, overcome the elasticity of the spring, and bring the movable magnets down to the fixed ones—the current being broken, the spring separates them. The two flanches do not come in direct contact, though the movable one acts responsive to magnetic influence. Most of the magnetism exists at the flanches, and the order is such that the lower end of the inner tube has south polarity, the surrounding one above, the same, which repels it, while the top of the surrounding one below has north polarity, and attracts it; this movement is through a space of only one sixty-fourth part of an inch.

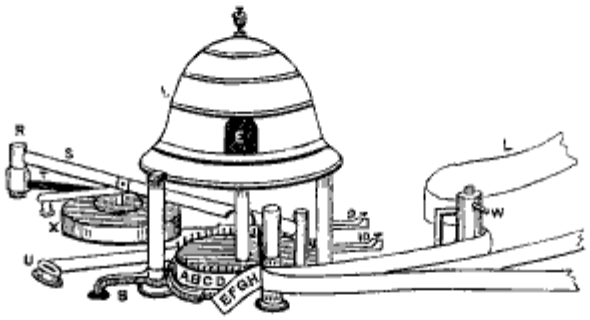
THE AIR VALVE AND PISTON.

On the same rod, above the movable magnets, is fixed a hollow cylindrical valve, having on its outer circumference the grooves 1, 2, 3, fig. 4. The plate represents a longitudinal half section of the valve, magnets, and helix. The valve slides in an air chamber H, which has two grooves, 1, 2, on its inner surface. Air is admitted through the orifice 1, by means of a pipe from the air chamber beneath the case into the middle groove of the valve. The grooves of the chamber open into the side passages J and M, which connect at right angles with a second chamber, in which a piston moves. The movement of the magnets changes the apposition of the grooves in the first chamber, by which air enters from the supply pipe, through one of the side passages, into the second chamber, at the same time that air on the other side of the piston in the second chamber escapes back into the grooves 1 and 2 of the valve, through the other side passage, and from them into the atmosphere. This causes the piston to slide backward and forward with every upward and downward motion of the valve.

This piston moves horizontally, and is connected with the lever 8, fig. 5, of an escapement, the pallets of which alternately rest on the teeth of an escapement wheel of the printing machine A, fig. 5. This part of the apparatus is arranged on a circular iron plate, twelve or fourteen inches in diameter, supported by standards on th mahogany frame H, fig. 1. The escapement wheel revolves on a vertical shaft that passes

through the iron plate, and has fixed on it there a hollow pulley. This pulley contains within it a friction apparatus,

Fig. 5.



consisting of an ordinary spiral clock spring—the inner end of which is fastened to the shaft, and the outer pressing against the inner side of the case. Thus the spring is always about the same strength, and acts upon the escapement wheel, causing it to revolve uniformly when released by the escapement. The pulley revolves constantly, while the shaft and escapement wheel may be stopped. The escapement wheel has fourteen teeth, each one of which causes two motions of the escapement, which will make twenty-eight for a single revolution of the wheel, which is shown in fig. 7.

Fig. 6.

When in operation, the piston to which the escapement arm 8, fig. 5, is attached, is subjected, on one side or the other, to a pressure of condensed air; therefore the piston and escapement will only be moved by the escapement wheel when the air is removed from one side or the other of the piston. The position of the valve, fig. 4, attached to the magnet, regulates the pressure of air on either side of the piston, by opening one or the other of the side passages into the second chamber. By breaking and closing the circuit, therefore, the piston and escapement move backward and forward; thus a single revolution of the circuit wheel at one station opens and closes the circuit twenty-eight times, causing an equal number of movements of the magnets in another station; they carry the valve which alternately changes the air on either side of the piston. This permits the

Fig. 7.

escapement wheel to move the escapement and piston twenty-eight times, and allows one revolution of the escapement wheel for one of the circuit wheel at the transmitting station.

A steel type wheel, fig. 5, A, B, C, D, two inches in diameter, is fixed above and revolves on the same shaft with the escapement wheel; it has on its circumference twenty-eight equi-distant projections, on which are engraved in order the alphabet, a dot, and a dash. The fourteen notches of the escapement wheel cause twenty-eight vibrations of the escapement in a revolution, that correspond to the characters on the type wheel. Every vibration of the escapement, therefore, makes the type wheel advance one letter; these letters correspond to those on the keys of the composing machine. If any desired letter on the type wheel is placed in a certain position, and a corresponding key in the composing machine is depressed, by raising that key, and again depressing it, the circuit wheel at one station, and the escapement and type wheels at the other station, all make a single revolution, which brings that letter to its former position. Any other letter is brought to this position by pressing down its key in the composing machine, the circuit being broken and closed as many times as there are letters from the last one taken to the letter desired.

THE MANIPULATION.

To form the letters into words, it is necessary that the printing and composing machines should correspond, and for this purpose a small break and thumb screw, 9 and 10, fig. 5, can be made to stop the type wheel at any letter. In sending messages, they usually commence at the dash or space; if, by accident, the type wheel ceases to coincide with the distant composing machine, the printing becomes confused, the operator stops the type wheel, sets it at the dash, and the printing goes on as before.

Above the type wheel, on the same shaft, is the letter wheel E, fig. 5, on the circumference of which the letters are painted in the same order with those on the type wheel below. It is incased in a steel hood, having an aperture in it directly over where the letters are printed, so that when the type wheel stops to print a letter, the same letter is made stationary for a moment at the aperture, and is readily distinguished; hence messages can be read, thus making it a visual telegraph.

The type wheel has twenty-eight teeth arranged on the outer edge of its upper surface; near it, on the opposite side from where the printing is done, is the shaft T, fig. 5.

lving in an opposite direction. A steel cap x, fig. 5, two inches in diameter, is so attached to the top of this shaft that friction carries it along with it, but it can be moved in the opposite direction; it has a small steel arm, three fourths of an inch long, projecting from its side, and playing against the teeth on the type wheel; while the latter is revolving, its teeth strike this arm, and give the cap a contrary motion to its shaft. There is a pulley on this shaft, below the plate, connected by a band to M, fig. 1; its speed is less than that of the type wheel. When the type wheel comes to rest, the arm falls between the teeth, but it has not time to do so when they are in motion. On the opposite side of the cap to where the arm is attached are two raised edges, called detent pins, against which the detent arm v, fig. 5, alternately rests, as the position of the cap is altered by the small arm that plays on the teeth of the type wheel.

Between the type wheel and cap is a small lever and thumb-screw, 9, fig. 5, which acts as a break on the cap; its motion can be stopped by it, while the type wheel revolves; it is used merely to arrest the printing, though the message may be read from the letter wheel.

The detent arm revolves in a horizontal direction about the vertical shaft, which is also driven by a pulley beneath the steel plate; when the type wheel is at rest, the detent arm rests on one of the detent pins, but when it moves, the teeth on its upper surface give the arm and cap a reverse direction to its shaft, which alters the position of the detent points, so that the detent arm is liberated from this first pin, and falls upon the second, where it remains until the escapement and type wheels again come to rest; when this happens, the arm falls between two of the teeth, the cap resumes its first position, the detent is let loose, makes a revolution, and stops again on the first pin.

The shaft that carries the detent arm has an eccentric wheel, K, fig. 5, on it, above the arm; an eccentric wheel is one that has its axis of motion nearer one side than the other, and, while revolving, operates like a crank; from this eccentric is a connecting rod, s, which draws a toothed wheel against the type; this toothed wheel is supported in an elastic steel arm (shut out of view by the coloring band), on the opposite side of the type wheel from that of the eccentric, and revolves in a vertical direction; the band E, fig. 1, carrying the coloring matter to print with, passes between this and the type; the dots seen represent small teeth that catch the paper and draw it along, as the wheel revolves, between itself and a steel clasp,

operated by a spring that presses the paper against the teeth and keeps it smooth; the clasp is perforated in such a manner that the type print through it; there are two rows of teeth, one above, the other below the orifice.

The vertical wheel, fig. 5, is embraced in a ring by the connecting shaft s, and a rotary motion is imparted to it by a ratchet fixed to its lower surface, moving with it, and catching against two poles fastened to the steel plate below it; the poles are pressed against the ratchet by springs, as shown in fig. 8; the wheel is octagonal, and every revolution of the eccentric turns it through one eighth of a revolution, and therefore presents a firm, flat surface to push the paper against the type, and advances sufficient for every letter, one being printed each time the detent arm revolves.

Fig. 8.

When the type wheel stops, the detent arm revolves, that carries with it the eccentric, which, through the connecting rod, draws the toothed wheel having the paper and coloring band before it against the type, and an impression is made on the paper; a letter is printed if the circuit remains broken or closed longer than one tenth of a second; three hundred letters, in the form of Roman capitals, can be accurately printed per minute; the roll of paper L, fig. 5, is supported on a loose revolving wire framework; on the same standard is a small pulley w, around which one end of the coloring band runs.

In transmitting a message, the machine is set in motion, a signal is given (which is simply the movement of the magnet), and then with the communication before him, the operator commences to play like a pianist on his key-board, touching, in rapid succession, those keys which are marked with the consecutive letters of the information to be transmitted; on hearing the signal, the operator at the receiving station sets his machine in motion; then setting his type at the dash, sends back signal that he is ready, and the communication is transmitted; he can leave his machine, and it will print in his absence; when the printing is finished, he tears off the strip which contains it, folds it in an envelope ready to send to any place desired.

The function of the electric current in this machine, together with the condensed air, is to preserve equal time in the printing and composing machine, that the letters in one may correspond with the other. The electrical pulsations determine the number of spaces or letters which the type wheel is per-

mitted to advance; they must be at least twenty-five per second to prevent the printing machine from acting; the intervals of time the electric currents are allowed to flow unbroken are equal, and the number of magnetic pulsations necessary to indicate a different succession of letters are exceedingly unequal; from A to B will require one twenty-eighth of a revolution of the type wheel, and one magnetic pulsation; from A to A will require an entire revolution of the type wheel and twenty-eight magnetic pulsations.

THE PATENTED CLAIM.

On the 28th December, 1852, Royal E. House obtained the following patent for various improvements on the original machine: "I claim, First. The employment of electro-magnetic force, in combination with the force of a current of air, or other fluid, so that the action of the former governs or controls the action of the latter, for the purpose described. Second. I claim the construction of the electro-magnet, as described; that is to say, a series of fixed magnets, in combination with a series of moveable magnets, arranged upon a central axis, which axis plays between or through the line of fixed magnets, so as to effect a vibratory movement of said axis by a force multiplied by the number of magnets of both kinds. Third. I claim the combination of the electro-magnet with the valve, for regulating and directing the force of a current of air, or other fluid, acting as a motive power upon the piston, or other analogous device for producing a vibratory motion, as described. Fourth. I claim the endless band, in combination with the cylinder, as an inking machine, for conveying and applying the coloring matter to the paper, at the moment of receiving the impression from the types, as described. Fifth. I claim the combination of the regulating bar with the type wheel, for the purpose of regulating the proper position said wheel should have, in connection with a given position of the key shaft, at the moment of printing any letters or characters."