Sheet 1-3 Sheets.

R. Boyle.

Printing Telegraph.

No. 49,585. Patented Aug. 22, 1865.

Fig. 1.

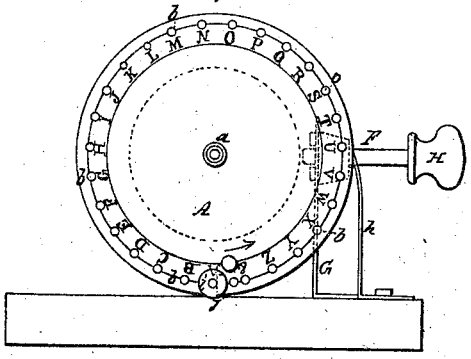


Fig. 2.

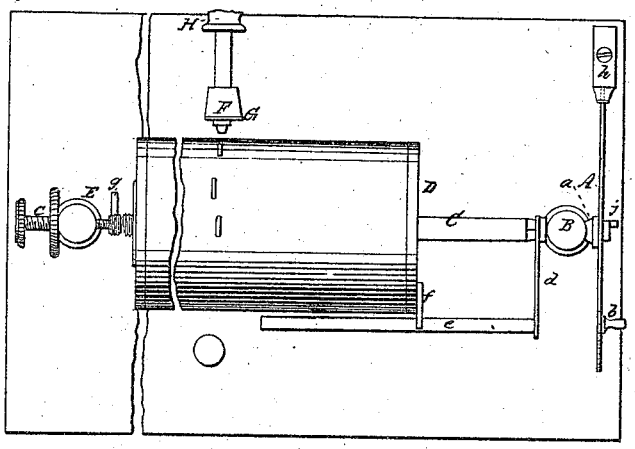


Fig. 7.

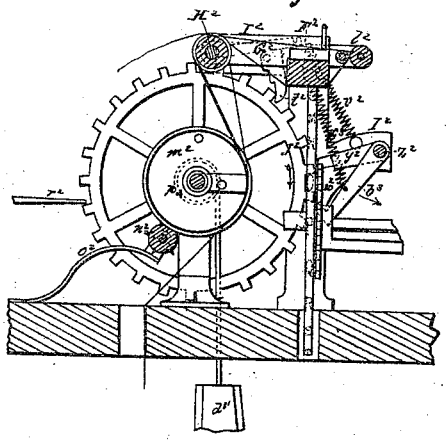


Fig. 8

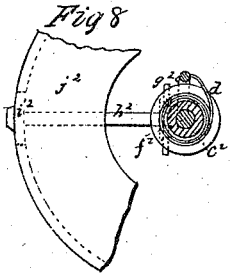


Fig. 9.

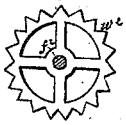
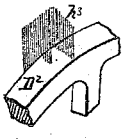


Fig. 10.



Witnesses
Wm. Freurn
Chas Tusch

Inventor
Robert Boyle

Sheet 2 - 3 Sheets.

R. Boyle.

Printing Telegraph.

No. 49,585. Patented Aug. 22, 1865.

Fig. 3.

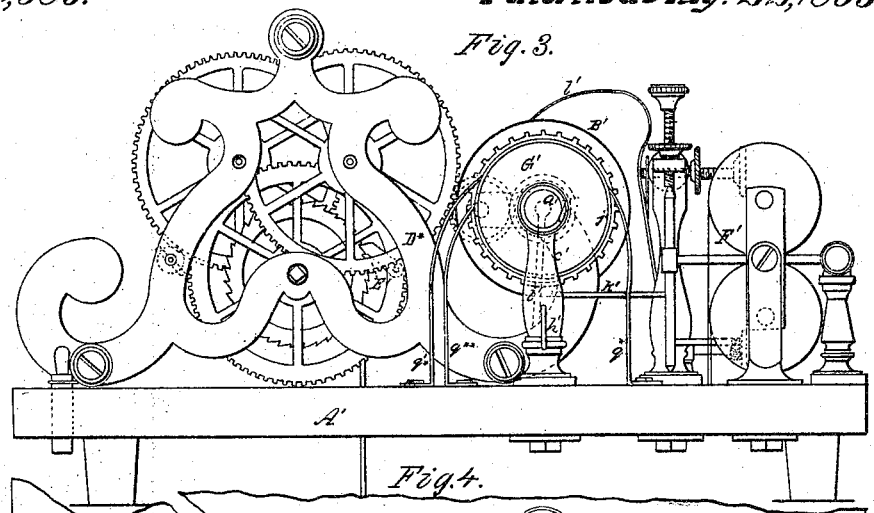
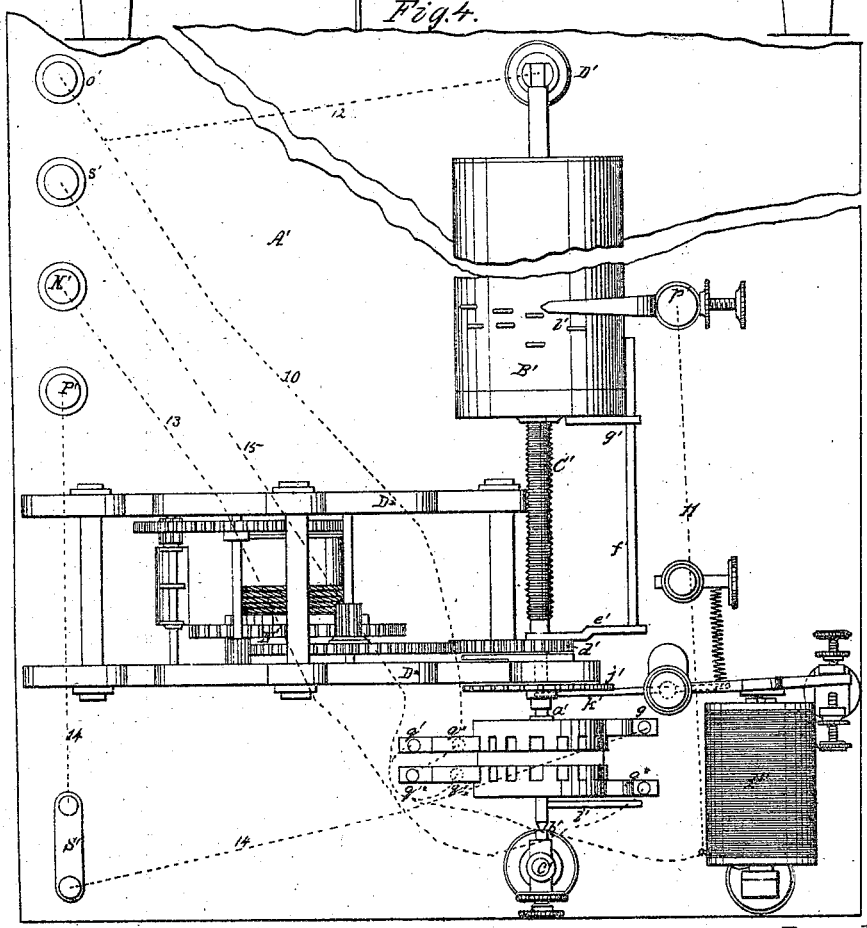


Fig. 4.



Witnesses
Wm. Freeman
Rhe Tusch

Inventor
Robert Boyle

R. Boyle.

Sheet 3-3 Sheets.

Printing Telegraph.

No. 49,585. Patented Aug. 22, 1865.

Fig. 5.

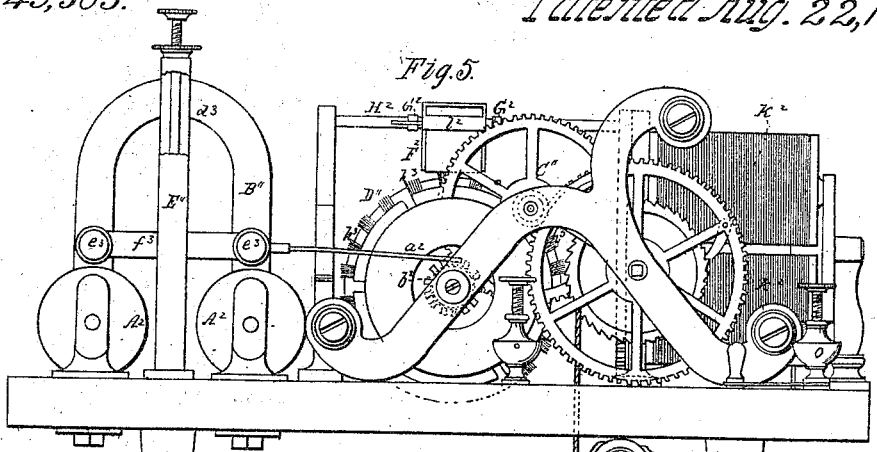
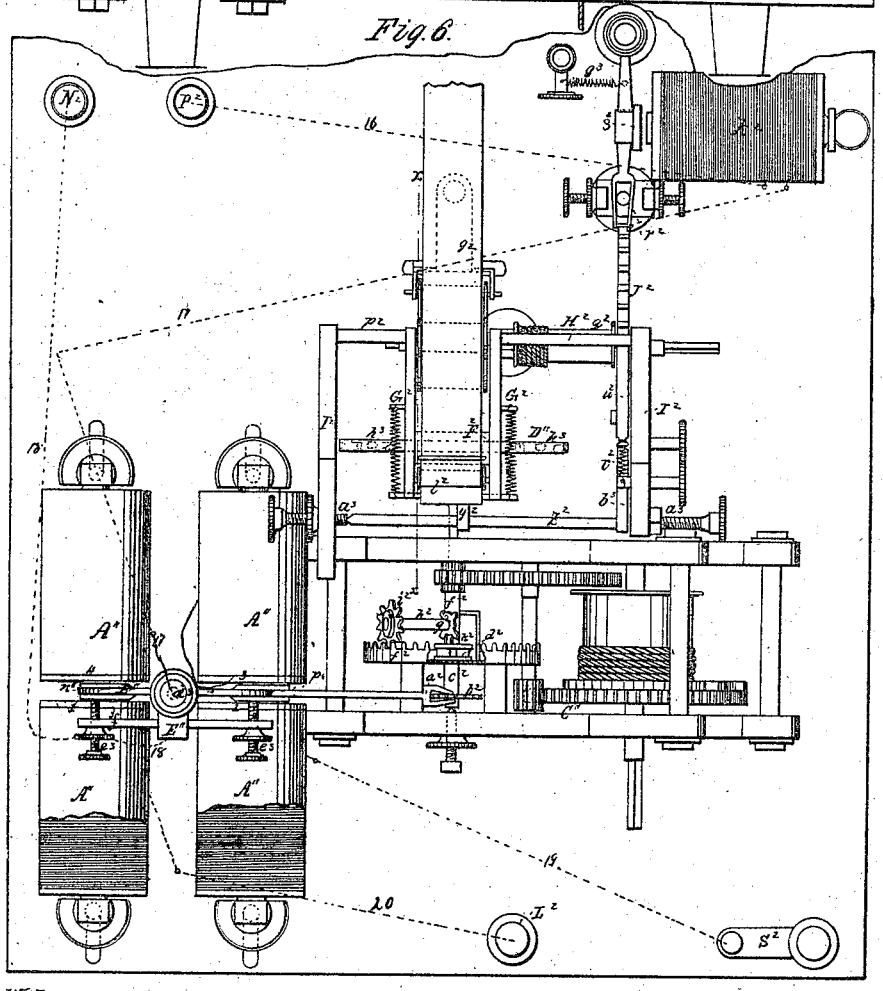


Fig. 6.



Witnesses
Wm. Frewin
Rec Tuscl.

Inventor
Robert Boyle

UNITED STATES PATENT OFFICE.

ROBERT BOYLE, OF NEW YORK, N. Y., ASSIGNOR TO HIMSELF AND GUISEPPE TAGLIABUE, OF SAME PLACE.

IMPROVEMENT IN ELECTRO-MAGNETIC TELEGRAPHS.

Specification forming part of Letters Patent No. **49,585**, dated August 22, 1865.

To all whom it may concern:

Be it known that I, ROBERT BOYLE, of No. 298 Pearl Street, in the city, county, and State of New York, have invented a new and useful Improvement in Electro-Magnetic Telegraphs; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to make and use the same, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 represents a face view of the punching-instrument. Fig. 2 is a plan or top view of the same. Fig. 3 is an end elevation of the transmitting part of the instrument. Fig. 4 is a plan or top view of the same. Fig. 5 is an end view of the receiving part of the instrument. Fig. 6 is a plan or top view of the same. Fig. 7 is detached sectional view of the printing mechanism, the line *x x*, Fig. 6, indicating the plane of section. Fig. 8 is a detached sectional view of the escapement of the printing mechanism, in a larger scale than the previous figures. Fig. 9 is a detached face view of the escapement-wheel. Fig. 10 is a detached sectional view of one of the types.

Similar letters of reference indicate like parts.

This invention relates to certain improvements in electro-magnetic telegraphs whereby any person desiring to send a message is enabled to prepare the same, send it to the telegraph-office, and have it transmitted and delivered without allowing any one to see or understand the same until it reaches the hands of the person to whom the communication is to be made.

The new instrument is composed of three distinct parts—viz., the punching-instrument, the transmitting-instrument, and the receiving-instrument.

The punching-instrument, which is represented in Figs. 1 and 2, consists of a plain disk, A, of metal or other suitable material, mounted on a horizontal shaft or spindle, *a*. This disk is perforated with twenty-eight holes, *b*, at equal distances apart, and all situated on a circle near its periphery. The holes *b* correspond to the twenty-six letters of the alphabet and to the sign "&," generally used for "and so forth," and one hole is left blank and forms the starting-point of the disk at the beginning of new words. The letters of the alphabet and the sign "&" are marked on the face of the disk opposite the holes, and a handle, *b**, placed opposite the blank hole, may be used to turn the disk. The shaft *a*, on which the disk is mounted, has its bearing in a standard, B, rising from the platform which supports the instrument, and it is hollow, to receive the end of the screw-spindle C, on which the spindle D is mounted. The screw-spindle has its bearing at one end in the hollow shaft *a*, and at its opposite end in a pointed screw, *c*, secured in the standard E, as clearly shown in the drawings.

An arm, *d*, is firmly connected to the inner end of the shaft *a* and carries a horizontal rod, *e*, extending through a forked bracket, *f*, which is secured to the end of the cylinder. This arm transmits the rotary motion imparted to the shaft *a* and disk A to the cylinder D. This cylinder is made of wood or any other soft material, and it screws on the spindle C, so that when the cylinder is rotated while the spindle remains stationary, the screw-thread causes said cylinder to travel in a longitudinal direction, or in a direction parallel to its axis. A pin, *g*, which projects from the screw-spindle at right angles to the same, by coming in contact with a stud inserted in the standard E, retains the screw-spindle and prevents it from revolving with the cylinder.

The paper in which the message is to be punched is stretched on the cylinder D, and the perforations are produced by the action of a punch, F, which is fastened in a head secured to the loose end of a vertical spring or elastic standard, G, and operated by a handle, H.

A brake, *h*, bearing against the periphery of the disk, prevents the same from rotating spontaneously. When the instrument is in operation said disk is turned by a pin, *i*, inserted in one of the holes *b*, and a stop, *j*, rising from the platform, limits the motion of said disk.

At the beginning of the operation the cylinder is brought in such a position that the end farthest from the disk A is opposite the punch, and the disk is brought in its starting position by placing the pin *i* into the blank hole and turning in the direction of the arrow marked thereon in Fig. 1 until the same comes

in contact with the stop. In this position a hole is punched in the paper to correspond to the starting-point of the message. If it is desired, for instance, to punch the word "Boyle" in the paper on the cylinder the pin *i* is withdrawn from the blank hole and inserted in the hole opposite the letter "B," and the disk is turned with one hand in the direction of the arrow marked on it in Fig. 1 until the pin comes in contact with the stop. A blow given with the other hand to the handle of the punch produces the desired perforation. The pin *i* is then inserted into the hole opposite the letter "O," the disk is turned, and by striking the punch the second perforation is produced in the paper, and so on until every letter is represented by its perforation in the paper. At the end of each word the disk must be brought back to the starting-point and a hole punched in the paper to correspond to the blank.

When the entire message has thus been punched in the paper on the cylinder D said paper is removed and carried to the telegraph-office, where the operator applies it to the paper-cylinder of the transmitting-instrument. This part of the instrument is mounted on a platform, A′, of wood or any other bad conductor of electricity, and it is provided with a paper-cylinder, B′, of metal or other good conductor of electricity. The diameter of this cylinder is precisely equal to the paper-cylinder of the punching-instrument, and said cylinder is provided with a suitable mark to enable the operator to bring the perforated paper in the correct position by placing the first perforation in the paper opposite to said mark.

The cylinder B′ is mounted on a screw-spindle, C′, the screw-thread of which is precisely of the same pitch as that of the spindle C, and which is made flat at one end to fit into the forked end of a standard, D′, rising from the platform A′, so as to prevent it from turning round with the cylinder. The other end of said spindle is insulated by a piece of ivory, E^{15}, fitted to it, and it is supported by the inner pointed end of a shaft, *a′*, which has its bearing in an arm, D**, extending from the frame D* of a clock-movement, whereas the outer end of said shaft is supported by a screw, *b′*, secured in a standard, *c′*, that rises from the platform A′.

On the inner end of the shaft *a′* is mounted a pinion, *d′*, from which extends an arm, *e′*, carrying a horizontal rod, *f′*, that extends through a forked bracket, *g′*, secured to the end of the cylinder B′. When the shaft *a′* revolves, therefore, a rotary motion is imparted to the cylinder B′, and by the action of the screw-spindle, which remains stationary, the revolving cylinder is caused to traverse in a direction parallel to its axis for the distance of one thread for each revolution precisely in the same manner as the paper-cylinder of the punching-instrument.

The revolving motion of the shaft *a′* is produced by the clock-movement E′, which is driven by a weight or spring, and the speed of which is regulated by a fan, or in any other suitable manner, and when the instrument is not used the motion of said shaft is stopped by a key, *h′*, which passes through the standard *c′* and comes in contact with an arm, *i′*, projecting from said shaft, as shown in Fig. 4. As soon as the key is drawn out the motion of the shaft and paper-cylinder commences, provided the clock-movement is wound up.

On the shaft *a′* is mounted a cog-wheel, *j′*, and an oscillating pawl, *k′*, attached to the armature of an electro-magnet, F′, is arranged in such a position that when said armature is drawn back from the core of the electro-magnet by the action of its springs the wheel *j′* and shaft *a′* are allowed to revolve without obstruction; but as soon as the circuit through said electro-magnet is closed and the armature is attracted the pawl engages with the teeth of the wheel *j′* and the motion of the paper-cylinder stops.

The closing of the circuit is effected by the action of a metallic spring or finger, *l′*, the point of which bears down upon the surface of the paper on the paper-cylinder. Whenever one of the perforations in the paper comes under the point of said spring, causing the same to come in contact with the metallic surface of the paper-cylinder, the circuit through the helix of the electro-magnet F′ is closed and the armature of the same is attracted. The pawl *k′* engages with the teeth of the cog-wheel *j′* and the motion of the paper-cylinder stops; but it continues long enough to carry the point of the spring *l′* beyond the perforation, so that the circuit is immediately opened, and the stoppage of the motion of the shaft *a′* is only momentary. The object of this momentary stoppage is to obtain time for the printing of each letter, as will be explained in describing the receiving-instrument.

In order to bring the electro-magnet F′ in the circuit, one end of its helix connects by a wire, 15, with the stud *s′*, which represents the earth-line, and the other end of the helix connects by a wire, 11, with the standard *p′*, from which extends the spring *l′*. A wire, 12, also extends from a forked standard, D′, to a wire, 10, leading from the main-line stud *o′* to springs *q″ q′**, the object of which will be presently explained. These springs are in metallic connection with the main battery and with the wire 15, and by referring to the several wires in Fig. 4 it will be readily seen that the circuit is open while the spring touches the paper; but so soon as the point of the spring, dropping into one of the perforations of the paper, comes in contact with the metal surface of the paper-cylinder the circuit is closed and the armature of the electro-magnet is attracted, as previously described.

The cog-wheel *j′* is provided with twenty-eight cogs, and the positions of these cogs correspond to the twenty-eight letters on the disk of the punching-instrument and to the perfo-

rations produced thereby in the paper. If the twenty-eight letters and the blank are punched out in consecutive order, and the transmitting-instrument is set in motion, the wheel j' will stop once for every letter or sign, giving time to print the same, as will be presently explained.

On the shaft a' is also mounted the division-wheel G', which is made of a cylindrical body of hard gutta-percha, india-rubber, or other good non-conductor of electricity, inlaid with two toothed metal rings, each of which is provided with fourteen teeth or divisions, thus dividing the circumference of the wheel in twenty-eight spaces, one half of which presents a metallic surface, and the other half a surface of rubber or other non-conductor. Three sets of springs, $q\ q^*$, $q'\ q'^*$, $q''\ q''^*$, bear on the surface of the division-wheel, one set on one side, and the other two sets on the opposite side. The springs $q\ q^*$, which are situated between the division-wheel and the helix, bear on the solid metallic rims of the same, and the springs $q'\ q'^*\ q''\ q''^*$, which are situated on the opposite side of said wheel, bear on the divisions, and they are so arranged that when the springs $q'\ q'^*$ bear on a metallic division the springs $q''\ q''^*$ bear on an intermediate insulating division, and vice versa. By this arrangement, and by the peculiar connection with the battery and with the earth and main lines, an alternate positive and negative current is passed from the transmitting to the receiving station.

The connections of the springs $q\ q^*\ q'\ q'^*\ q''\ q''^*$ with the main battery and with the earth and main line are as follows: A wire, 13, extends from one of the springs q^* to the negative-pole N' of the main battery, and another wire, 14, connects the other spring, q, with the switch S', and through it with the positive pole P' of the main battery. The springs $q''\ q'^*$ connect by the wire 10 with the main-line stud o', and a wire, 15, connects the springs $q'\ q''^*$ with the earth-line stud s'. From this explanation it will be seen when the springs $q'\ q'^*$ are in metallic contact with the division-wheel G' a negative current will pass through the wire 13, spring q^*, division-wheel G', spring q'^*, wire 10, and main-line stud o', and back through the earth-line stud s', wire 15, spring q', division-wheel G', spring g, and wire 14, to the positive-pole of the battery. The springs $q''\ q''^*$ are in metallic contact with the division-wheel. A positive current passes from the pole P', through the wire 14, spring q, division-wheel G', spring q'', wire 10, and stud o' to the main line, and back through the earth-line springs $q''^*\ q^*$, and wire 13, to the negative pole of the battery. The duration of these currents depends upon the speed and diameter of the division-wheel and upon the number of divisions which, as previously stated, amounts to twenty-eight, equal to the number of holes in the disk of the punching-instrument.

Each revolution of the division-wheel and of the paper-cylinder produces fourteen positive and fourteen negative currents, which control the mechanism of the receiving-instrument. This part of my invention is represented in Figs. 5 and 6. It consists, principally, of a set of four intensity-coils, A'', and a vibrating horseshoe-magnet, B'', which controls the motion of a clock-movement, C'', and through it that of the type-wheel D'', as will be presently explained. The cores of the intensity-coils are not connected, and the connection of their helices with the main line is such that their poles are reversed, bringing a north pole opposite to a south, and vice versa. The horseshoe-magnet is secured to a standard, E'', which rises from the platform supporting the entire mechanism, and it is so arranged that it is allowed to vibrate between the poles of the intensity-coils A'' without being permitted, however, to come in contact with them. If 1 2 3 4 represent the poles of the intensity-coils and $n''\ p''$ the south and north pole of the horseshoe-magnet, and the current passing through the coils is of such a nature that the poles 1 and 2 are negative and the poles 3 and 4 positive, the poles $n''\ p''$ of the horseshoe-magnet will be attracted by the opposite poles, 4 and 2, and repulsed by the corresponding poles, 1 and 3, and if the current through the coils is reversed, so as to make the poles 1 and 2 positive and the poles 3 and 4 negative, the poles $n''\ p''$ of the horseshoe-magnet will be attracted by the poles 1 and 3 and repulsed by the poles 4 and 2. Every change in the nature of the current passing through the coils A'' produces an oscillation of the horseshoe-magnet, and since the change of the current depends upon the division-wheel G' in the transmitting-instrument, as previously described, each revolution of said division-wheel produces twenty-eight oscillations of the horseshoe magnet.

From the horseshoe-magnet extends a horizontal arm, a^2, the forked end of which straddles an escapement-wheel, b^2, with fourteen teeth. One prong of the fork a^2 is longer than the other, and said fork is so adjusted in relation to the escapement-wheel that for each oscillation of the horseshoe-magnet the escapement-wheel is allowed to revolve half a tooth, and consequently twenty-eight oscillations of the magnet are required to produce a complete revolution of the escapement-wheel. Said escapement-wheel is mounted on a sleeve, c^2, which turns loosely on the shaft f^2 of the type-wheel D'', being connected to it by means of a hair-spring, d^2, which extends from it to an arm, e^2, which is rigidly attached to the shaft f^2. As the shaft rotates by the action of the clock-movement C'', the spring is wound up and the escapement-wheel turns whenever the fork a^2 releases its teeth.

In order to prevent the hair-spring being wound up any more than necessary to impart motion to the escapement-wheel, and to allow the type-wheel to catch up if from some cause

its motion should be retarded, a toothed wheel, g^2, is employed, which is mounted on a tubular shaft, h^2, that has its bearing on a pin extending from the shaft f^2, as shown in Fig. 6.

Secured to the outer end of the tubular shaft h^2 is a pinion, i^2, which gears in a stationary toothed rim or crown-wheel, j^2, that is firmly secured to the frame of the clock-movement C″. As the shaft f^2 rotates, the pinion i^2 is carried round on the toothed ring j^2, and a revolving motion is imparted to it and to the wheel g^2. The teeth of this wheel come in contact with a stop, k^2, which projects from the end of the sleeve c^2. As long as the escapement-wheel b^2 is not permitted to revolve, the shaft f^2 rotates until one of the teeth of the wheel g^2 strikes the stop k^2, and by this motion the hair-spring is wound up sufficient to impart motion to the escapement-wheel. As soon as the fork a^2 releases the escapement-wheel, the sleeve c^2 rotates and the stop k^2 advances, thus allowing the wheel g^2 to make a quarter-revolution. The resistance to be overcome by the fork a^2 is only that of the hair-spring, which is very weak, and at the same time the full power of the clock-movement is exerted to turn the type-wheel shaft. The teeth of the wheel g^2 are so adjusted that for each motion of said wheel the type-wheel advances one type or space, and the number of types or characters being equal to that of the characters on the disk A of the punching-machine, it will be readily understood how, by the mechanism above described, the motion of the type-wheel is made to conform to the motion of the paper-cylinder, the motion of said type-wheel being governed by the division-wheel G′ and the oscillations of the horseshoe-magnet B″. The type-wheel D″ revolves under a block, F^2, which is secured between two arms, G^2, extending from a horizontal shaft, H^2, which has its bearings in two standards, I^2, rising from the platform which supports the receiving mechanism.

In front of the printing-block F^2 are small rollers l^2, which serve to convey the paper, and after the paper has been printed it passes off to a take-up roller, m^2, on which it is wound, together with a secondary strip, as shown in Fig. 7. The course of these two strips is shown in red lines in said figure, the main strip being passed in from above and the secondary strip from below.

A small roller, n^2, provided with a series of fine points, is mounted on the end of a spring, o^2, and pressed against the surface of the paper on the take-up roller, and, as this roller revolves, the points of the roller n^2 pierce the two strips of paper and cause them to adhere together, so that the message printed on the first strip is covered by the secondary strip, and cannot be read until the two strips are separated.

To prevent the strips of paper becoming separated when they are taken off, I connect the ends by a small quantity of paste. When this is done the strips can be taken off from the roller endwise in the form of a ring.

The take-up roller m^2 is mounted on a shaft, p^2, which carries a drum, q^2, from which a weight is suspended to impart to said roller the requisite rotary motion. This motion is regulated by an escapement-wheel, J^2, which is mounted on the shaft p^2, and which is provided with teeth of such a pitch that the paper is fed along the requisite distance after every letter is printed on it. A forked arm, r^2, which extends from the armature s^2 of an electro-magnet, K^2, engages with the teeth of the wheel J^2 and arrests the same until the armature of the electro-magnet is attracted. In that case one prong of the fork relieves the tooth with which it had been in contact, and said wheel revolves half a tooth, and when the armature is drawn back again the wheel J^2 is set free to revolve half a tooth. If the armature of the electro-magnet K^2 is not attracted, the teeth of the wheel J^2 press on a dog, t^2, which is pivoted to one of the standards I^2, as shown in Fig. 7 of the drawings, and the back of this dog acts on an arm, u^2, which extends from the shaft H^2 and is subjected to the action of a spring, v^2. This spring has a tendency to draw the printing-block down on the surface of the types; but its power is overcome by the action of the dog t^2, which raises the arm u^2 and throws the printing-block off from the type-wheel. The type-wheel is thus allowed to revolve freely until that letter which is to be printed arrives under the printing-block. At that moment the type-wheel stops a short time, the armature s^2 of the electro-magnet K^2 is attracted, and the wheel J^2 advances half a tooth. By this motion the dog t^2 is released suddenly, and the spring v^2, acting on the arm u^2, causes the printing-block to come down with considerable force.

In order to hold the type-wheel in the correct position while the printing-block descends, and to prevent the same from turning one way or the other during the printing operation, a wheel, w^2, is mounted on the shaft f^2 of the type-wheel. This wheel is provided with triangular teeth, as shown in Fig. 9, and an arm, y^2, by dropping between said teeth retains the same, together with the type-wheel, in the desired position. The arm y^2 is secured to a rock-shaft, z^2, which has its bearings on the pointed ends of screws a^3 secured in the frame I^2, and a dog, b^3, extending from said shaft engages with the cogs of the escapement-wheel J^2, being held in contact therewith by a spring, c^3, as clearly shown in Fig. 7 of the drawings. By the action of the weight d^3 the wheel J^2 has a tendency to revolve in the direction of the arrow marked on it in said figure; but it is prevented doing so by the fork r^2, and when the wheel is held by the fork the dog b^3 rests against one of the teeth of said wheel, and the arm y^2 is clear of the teeth of the wheel w^2; but as soon as the fork r^2 releases the wheel J^2 the dog b^3 is forced back in the direction of the arrow marked near

it in Fig. 7, and the point of the arm y^2 is thrown in gear with the wheel w^2, causing the same, together with the type-wheel, to stop in the desired position.

The motion of the fork r^2, and of the printing apparatus which is controlled by the electro-magnet K^2, is effected in the following manner: One end of the helix of said electro-magnet connects by a wire, 16, with one—say, the positive—pole P^2 of a local battery, and its other end connects by a wire, 17, with the pivot d^3, on which the horseshoe-magnet B″ oscillates, and another wire, 18, extends from the negative pole N^2 of the local battery to the standard E″, which forms the bearings for the pivot d^3. Said pivot is insulated by lining the sockets in which it is stepped with ivory or other suitable non-conductor, and the metallic connection between it and the frame is effected whenever the horseshoe-magnet touches one of the screws e^3 which limit its oscillations, these screws being inserted into an arm, f^3, extending from the frame E″, as clearly shown in Fig. 6.

By following the wires 16, 17, and 18 it will be seen that the circuit through the helix of the electro-magnet K^2 is closed whenever the horseshoe-magnet comes in contact with one of the screws e^3, and as this magnet oscillates continually by the action of the alternate positive and negative currents passing from the transmitting-instruments through the helices of the electro-magnets A″, the circuit through the helix of the electro-magnet K^2 is continually closed and opened. The oscillations of the horseshoe-magnet, however, are so rapid that the electro-magnet K^2 has no time to attract its armature s^2, which is retained by an adjustable spring, g^3. The type-wheel D″ therefore continues to revolve from one type to the other for every oscillation of the horseshoe-magnet, and it is not arrested until the spring l' of the transmitting-instrument comes in contact with the paper-cylinder B′. At that moment the circuit through the helix of the electro-magnet F′ is closed and its armature is attracted, causing the pawl k' to catch in the teeth of the cog-wheel j', and to arrest momentarily the revolving motion of the division-wheel G′. The current, be it negative or positive, transmitted at that moment through the main line to the receiving-instrument continues for a little longer than ordinarily, and the horseshoe-magnet remains in contact with one of the screw e^3 long enough to allow the electro-magnet K^2 to overcome the force of the spring g^3, and to attract the armature S^2. When this takes place the fork r^2 releases the wheel J^2, and the printing mechanism is caused to operate. At the same time the motion of the type-wheel is arrested by the action of the fork a^2 on the escapement-wheel b^2 long enough to allow time for the printing.

The types h^3 are made of a series of sharp points, as shown in Fig. 10, so that they readily perforate the paper which is thrust against them by the action of the printing-block F^2. Said types are either made out of separate pieces of steel and secured to the rim of the type-wheel by solder or other suitable means, or the type-wheel may be made entirely out of steel and the types produced by engraving.

The connection between the helices of the electro-magnets A″ and the transmitting-instrument is effected by wires 19 and 20, the wire 19 being made to connect through the switch S^2 with the main line, and the wire 20 through the stud L^2 with the earth-line.

The transmitting-instrument represents the operator; but by a slight change in the construction the receiving-instrument can be so arranged that it will record a message transmitted by the action of the hand of an operator on a key or other suitable mechanism.

I claim as new and desire to secure by Letters Patent—

1. The alphabet-disk A, in combination with the revolving traversing paper-cylinder D and punch F, constructed and operating substantially as and for the purpose described.

2. So arranging the perforations in the paper that each of them, by its peculiar position in relation to the perforation representing the starting-point of the message, and to the preceding and succeeding perforations, which position is governed by the revolving and traversing motion of the paper-cylinder or by any other equivalent means, represents a specific letter or sign, substantially as and for the purposes set forth.

3. The combination of the screw-spindle C′ and spring C, with the revolving metallic cylinder B′ and perforated paper containing the message to be transmitted, substantially as and for the purpose specified.

4. The electro-magnet F′ and stop-pawl k', in combination with the cylinder B′, carrying the perforated paper, and with the spring l', constructed and operating substantially as and for the purpose set forth.

5. The division-wheel G′, constructed as described, in combination with springs q q^* q' q'^* q'' q''^*, paper-cylinder B′, electro-magnets A″, and horseshoe-magnet B″, constructed and operating substantially as and for the purpose specified.

6. The combination of the electro-magnets A″ and horseshoe-magnet B″ with the clock-movement of the receiving-instrument, constructed and operating substantially as and for the purposes herein specified.

7. The forked arm a^2 and escapement-wheel b^2, in combination with the oscillating horseshoe-magnet B″, type-wheel D″, and clock-movement C″, constructed and operating substantially as and for the purpose set forth.

8. The sleeve c^2, carrying the escapement-wheel b^2 and hair-spring d^2, in combination with type-wheel shaft f^2, wheel g^2, pinion i^2, crown-wheel j^2, and oscillating fork a^2, constructed and operating substantially as and for the purpose described.

9. The method substantially as herein de-

scribed of regulating the motion of the type-wheel by means of a clock-work and of an escapement-wheel, to which motion is imparted by a hair-spring, substantially as set forth.

10. The combination of the sharp-pointed types with the type-wheel D″ and with the printing mechanism, constructed and operating substantially as and for the purpose set forth.

11. The escapement-wheel J^2 and electro-magnet K^2, in combination with the dog t^2, arm u^2, spring v^2, and printing-block F^2, constructed and operating substantially as and for the purpose set forth.

12. The combination of the oscillating horse-shoe-magnet B″, electro-magnet K^2, escapement-wheel J^2, type-wheel D″, and printing-block F^2, constructed and operating substantially as and for the purpose described.

13. Covering up the strip of paper containing the message immediately after printing the same, substantially as and for the purpose specified.

14. The roller n^2, carrying a series of points and applied in combination with the take-up roller m^2, substantially as and for the purpose described.

15. The oscillating shaft c^2, carrying the dog b^3 and arm y^2, in combination with the wheel w^2, escapement-wheel J^2, and type-wheel D″, constructed and operating substantially as and for the purpose set forth.

16. The stop-pawl k', electro-magnet F′, and perforated strip of paper containing the message, in combination with the oscillating horse-shoe-magnet B″, electro-magnet K^2, and printing mechanism, constructed and operating substantially as and for the purpose specified.

ROBERT BOYLE.

Witnesses:

M. M. LIVINGSTON,

C. L. TOPLIFF.