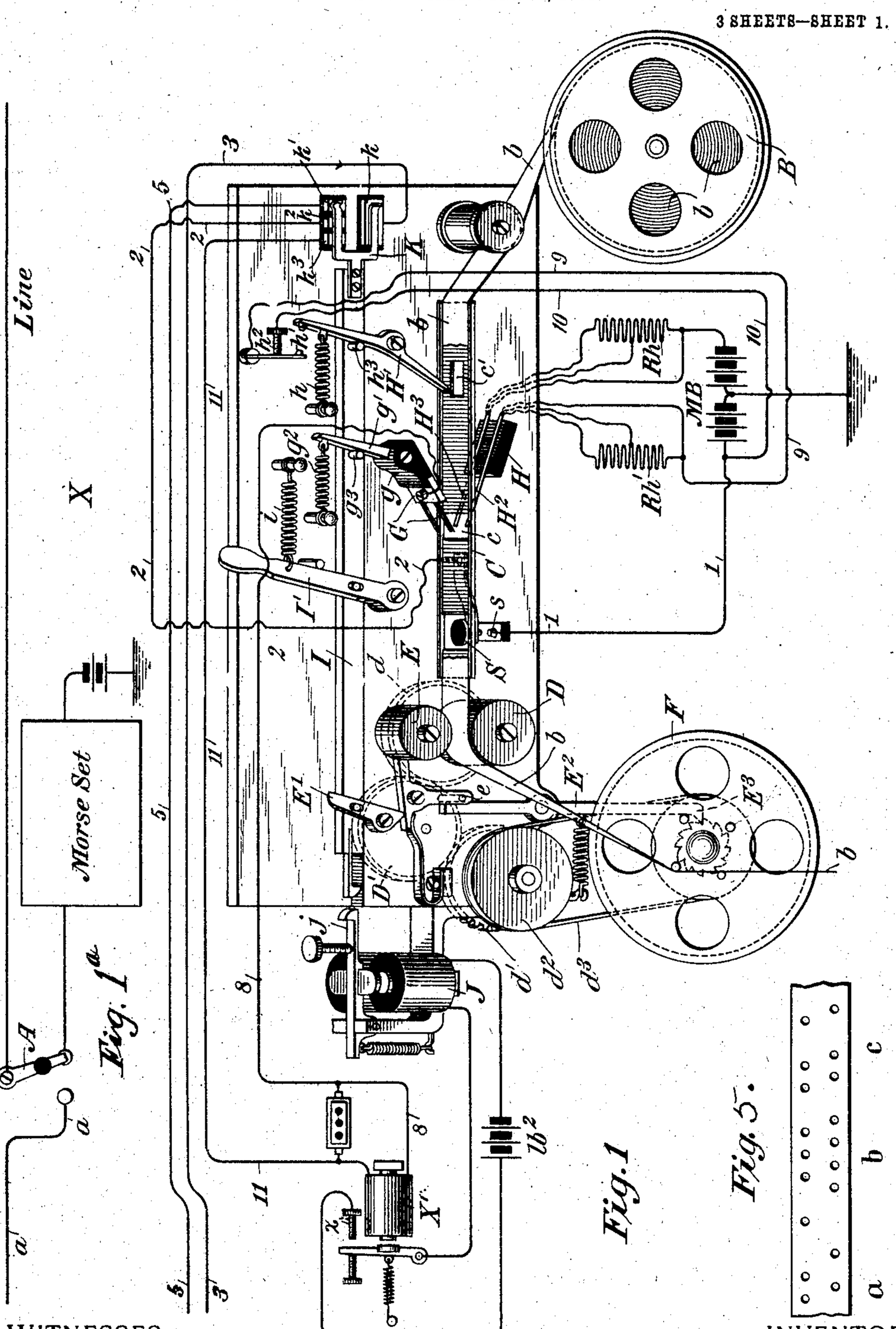
No. 790,193. PATENTED MAY 16, 1905.

P. B. DELANY.

TELEGRAPHY.

APPLICATION FILED JUNE 30, 1902.

3 SHEETS—SHEET 1.



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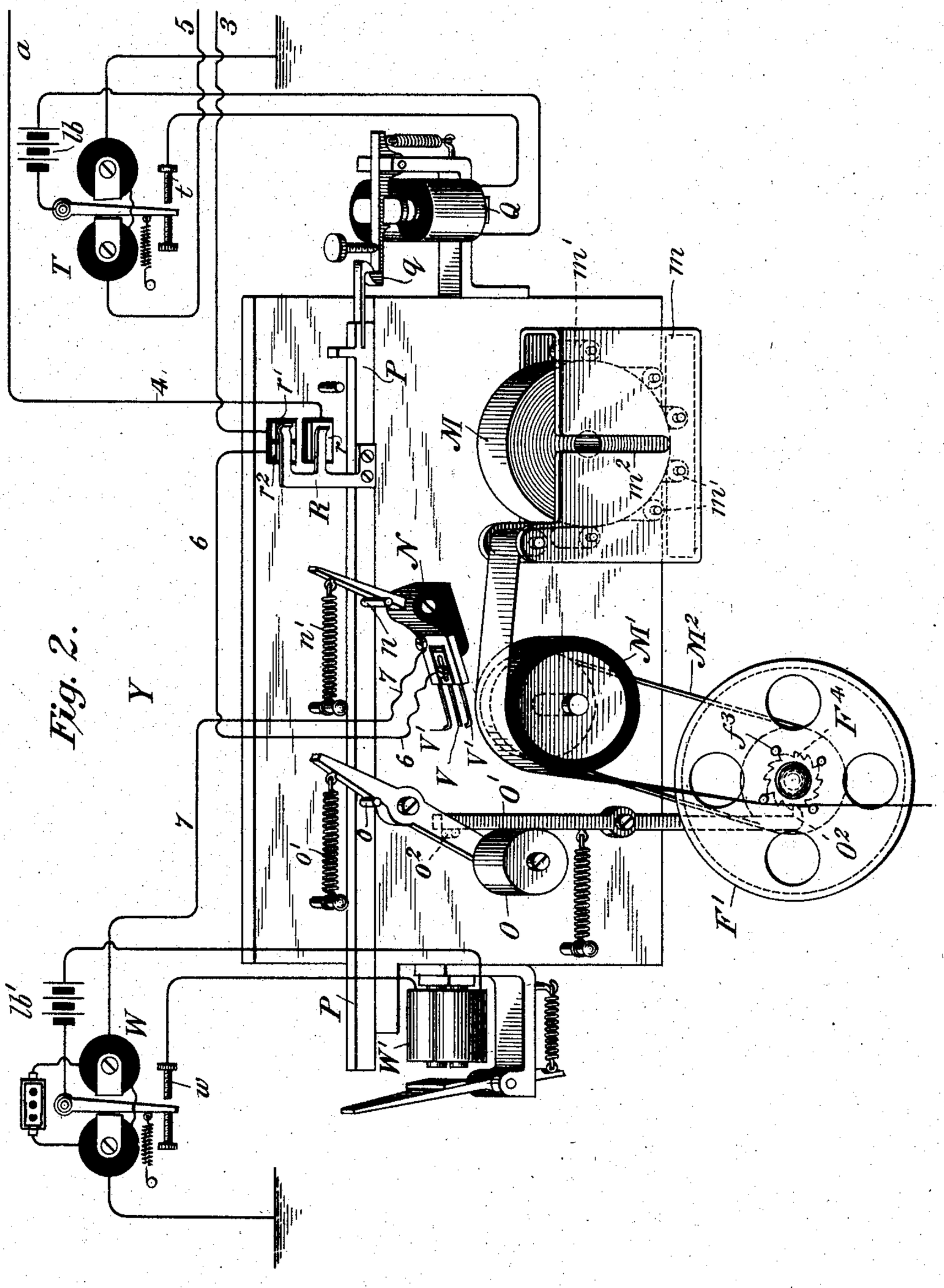

Fig. 2.

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3 SHEETS—SHEET 3.

Fig. 3.

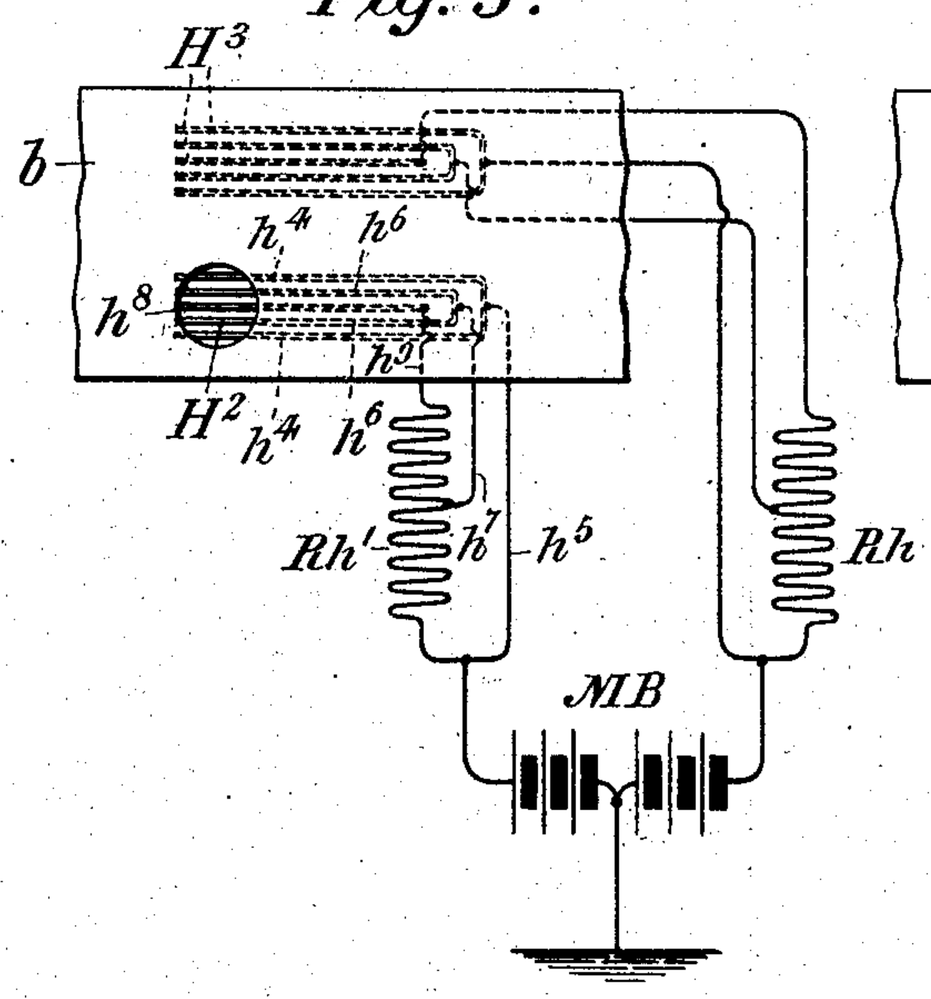
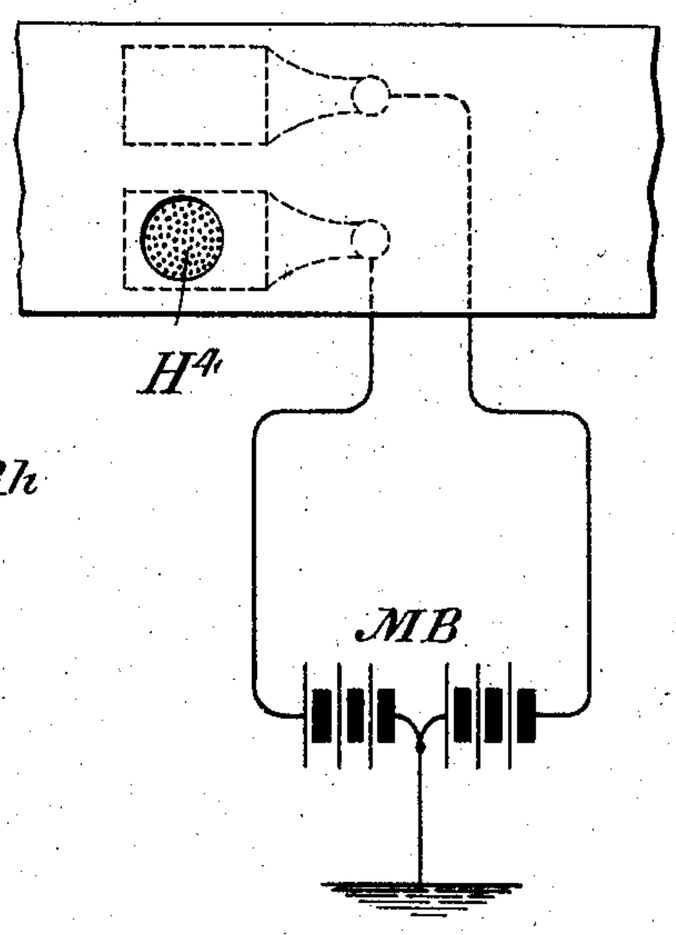


Fig. 4.



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TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 790,193, dated May 16, 1905.

Application filed June 30, 1902. Serial No. 113,779.

To all whom it may concern:

Be it known that I, PATRICK B. DELANY, a citizen of the United States, residing at South Orange, county of Essex, State of New Jersey, have invented certain new and useful Improvements in Telegraphy, of which the following is a specification.

This invention relates to machine or automatic telegraphy wherein the signals are recorded chemically. It involves various features hereinafter designated and particularly described.

In the accompanying drawings, Figures 1 and 2 are respectively diagrammatic illustrations of the transmitting and receiving apparatus at the same station. Fig. 1ª shows the Morse set and its circuit connections at the same station; Fig. 3, a diagrammatic view indicating an arrangement by which each current sent from a perforation of the transmitting-tape is caused to increase to a maximum and correspondingly decline, so that when impulses of alternating polarity are sent the line indicating them graphically would be sinusoidal; Fig. 4, a similar view indicating a modified arrangement of devices for accomplishing the same purpose. Fig. 5 shows a piece of perforated transmitting-tape that may be employed in this system.

Figs. 1 and 2 taken together show the equipment at one terminal of a line, X being the transmitter and Y the receiver. A switch A in one position connects a Morse set and its battery to line and in another position, through the circuit-wire *a*, connects either the transmitter or receiver to line, as will presently be described. At the transmitter, B indicates the reel carrying the transmitter-strip. *b* indicates the strip (which is broken away) shown as passing along a gutter or trough C between drawing-rolls D E to a receiving-reel F. In the trough C is an opening *c*, on opposite sides of which, respectively, are the upper signal-transmitting contact-fingers G and the lower ones, H^2. Those G are electrically connected and are shown as mounted in a pivoted block of insulating material *g*, having an upwardly-extending arm *g'*, to which is applied a spring g^2, that normally tends to throw the fingers down upon the tape. Above the trough is also mounted a pivoted lever H', to which is applied a spring *h*, the reaction of which normally tends to throw the lower end of the lever downwardly into an opening *c'* in the trough. Normally the lever is held up against the tension of the spring by the tape passing over the opening; but when at the completion of the transmission the tape finally passes from under the lever H' its upper end is permitted to strike the contact *h'* to lift it from the contact h^2, and thereby prevent short-circuiting of the transmitting-battery MB, as hereinafter described. A bar I, arranged longitudinally above the trough, is normally urged to the right by reaction of the spring *i*, applied to the lever I', and when in the right-hand position pins g^3 and h^3 thereon act to lift and hold out of action the upper contact-fingers G and the lever H', as well as, by means of the latch E', the spring-pressed drawing-roll E. The lower drawing-roll D may be continuously driven from a power-driven gear D' through a gear-wheel *d*, and the spindle on which the receiving-reel F is frictionally mounted may also be positively driven from the wheel D' by pulley d^2 and belt d^3. When the transmitter is in operation, the bar I is held in its left-hand position by a latch *j*, carried by the armature of a magnet J.

The general construction and arrangement of the transmitter thus far described form no part of the present invention.

A switch for controlling circuit connections at the transmitter is preferably arranged as follows and preferably actuated by the bar I. On the right-hand end of this bar is a two-armed switch-plate K, one arm of which sweeps an elongated contact *k* and the other arm three insulated contacts k' k^2 k^3, the circuit connections of which will presently be described.

At the receiver, M is the roll of chemically-prepared receiving-tape; M', the drum over which it passes and which may be continuously driven; F', the frictionally-mounted receiving-reel, the spindle of which may be continuously-driven from the shaft of the drum M' by a belt connection M^2.

N is the pivoted block, carrying recording-

fingers, and O the pressure-roll, coöperating with the drum in the feed of the receiving-strip. When the receiver is not in operation, both the members N O are held away from the drum by pins *o n* on a longitudinally-movable bar P, which is held in the right-hand position by a latch *q*, carried by the armature of the magnet Q, while the springs *o'* and *n'* normally tend to urge it to the left and to throw the recording-fingers and pressure-roll down upon the drum.

At the receiver there is a switch for controlling the circuit connections, which is preferably operated by the bar P and constructed and arranged as follows: A switch-plate R, attached to the bar, has two arms, one of which sweeps an elongated contact *r*, while the other coöperates with insulated contacts *r' r²*.

When the operator at the distant station wishes to transmit a message automatically from a prepared tape, he signals the receiving-operator on the Morse set which is normally connected with the line. The receiving operator indicates his readiness to receive the message and immediately throws the switch A to the circuit-wire *a*. The operator at the sending-station then presses the key S against its anvil *s* and pushes the lever I' to the left, where it is held by the latch *j*. This causes the switch K to pass from the contact *k'* to *k³*, and in doing so it momentarily completes a circuit through contact *k²*. This sends an impulse to line from one pole of the split main battery MB, the circuit being as follows: by wire 1 to key *s*S and wire 2 to switch-contact *k²*, thence by switch-plate K and contact *k* to wire 3, and thence to contact *r'* of the sending operator's receiver and by switch-plate R and contact *r* of that switch and wire 4 to circuit-wire *a*, which is connected with the line. This impulse arriving at the distant station, its course may be traced from Figs. 1 and 2 as follows: by wire *a* to contacts *r r'* of the switch R, thence by wire 3 to contacts *k k'* of switch K, thence by wire 5 through the windings of the polarized relay T to ground or return, throwing the relay-armature to its live contact *t*, and thereby completing the circuit of the local battery *bb*, through the coils of the magnet Q, which, attracting its armature, withdraws the latch *q* from the bar P, which then by the reaction of the springs *n' o'* is moved to the left and permits the recording-fingers and pressure-roll O to descend upon the continuously-driven drum M'. At the same time a pin *o²* on the lever carrying the roll O comes against a lever O' and forces the tooth or pawl O² at its lower end out of engagement with the ratchet-wheel forming part of the frictionally-mounted reel F' and permits its rotation. The distant receiver is now in operation, as is also the sending-transmitter, by reason of the fact that the movement of the bar I to the left has permitted the upper contact-fingers G and the upper feed-roll E to descend, and in the downward movement of the latter a pin *e* on the bell-crank lever in which it is mounted bears upon the upper end of a lever E² and moves the tooth or pawl E³ at its lower end out of engagement with the ratchet of the frictionally-mounted reel F, which is then revolved to draw the transmitting-tape through the trough C, under the lever H', and between the upper and lower contact-fingers G H², the latter fingers being connected to opposite poles of the transmitting-battery MB. The movement of the bar P to the left at the station where the message is now being received transfers the switch-plate R from the contact *r'* to the contact *r²*, thereby cutting out of circuit the wires 3 and 5 and relay T and introducing into the circuit of the main line the wire 6, connected to the recording-finger V, from which the circuit is completed through the chemically-prepared tape to the electrically-connected fingers V', thence by wire 7, through the coils of the polarized relay W, to ground or return. The relay W being connected in series with the recording or marking finger is shunted to reduce the self-induction of the relay and the resistance of the circuit so that signaling-currents will not affect it sufficiently to throw its armature, which will remain against its dead-stop, toward which a biasing-spring tends to draw it. At the same time this relay is sufficiently susceptible to respond to a somewhat-prolonged impulse of proper polarity sent from the distant station, as hereinafter described, after transmission is completed or at any time that the transmitting operator wishes to arrest the receiver. Any such impulse designed to stop or throw the receiver out of action will cause the armature of the relay W to pass to its live contact *w*, thereby completing circuit of the local battery *bb'*, including the winding of a magnet W', whose armature being attracted delivers a blow upon the end of the bar P and moving it to the right until it is engaged by the latch *q* throws the roll O and the recording-fingers upwardly and leaves the receiver out of action.

In the construction of the receiver thus far described the employment of a starting-relay which is replaced in the circuit by a stopping-relay is a feature of this invention, as is also the provision of switches such, for instance, as R and K of the companion receiver and transmitter, which afford the circuit connections for performing the operations which have been described.

In order that the receiving operator may at will arrest the distant transmitting instrument, the following arrangement is provided: An electromagnet X', shunted by an adjustable resistance, has one terminal of its winding connected by wire 8 with the electrically-connected upper contact-fingers G, from

whence the circuit is completed through perforations of the transmitting-tape to the lower contact-fingers H^2, one set or group of which is connected through resistance Rh with one pole of the main battery MB and the other group or set of which is connected through resistance Rh' to wire 9, thence through the normally closed contacts h' h^2 and wire 10 to the opposite pole of the battery, which is grounded at its middle. The other side of the winding of magnet X′ is connected by wire 11 with switch-contact k^3, from whence the circuit passes by switch-contact k and wire 3 to the companion receiver-switch contacts r' and r and by wire 4, a, and the switch A to line. The magnet X′ is so adjusted that the message impulses from the battery MB passing in its winding will not be sufficient to attract its armature to its front stop x. The operator at the distant receiver may arrest the transmitting instrument by throwing a current of either polarity upon the line which, reinforcing the current impulse from one of the sections of the main battery MB, will be sufficient to cause the magnet X′ to attract its armature to the front stop x, thereby closing a local circuit of the battery $l b^2$ which includes the winding of the magnet J and which on being so energized attracts its armature and releases the latch j from the bar I, which is then thrown to the right by spring i, thereby causing the elevation of the drawing-roll E, transmitting-fingers G, and lever H′. The distant receiving operator may conveniently send such an impulse by moving the switch A to connect his Morse instruments and battery in circuit with the line and then depressing his Morse key. The inclusion of the transmitter-arresting magnet X′ in the line-circuit in series with the transmitting-fingers is a feature of this invention.

The transmitting operator may arrest the receiving instrument at any time by sending an impulse over the line of proper polarity to actuate the polarized relay W. This may be done by throwing his switch A to his Morse set and closing the Morse key.

The distant receiver is automatically arrested when the transmitting-tape b has run out by a prolonged impulse from one-half of the main battery MB to line through the transmitting-fingers, which then press into contact through the opening c in the trough C, and at the same time the transmitter is arrested by action of magnet X′. The running out of the tape also permits the lower end of the lever H′ to fall, thereby causing its upper end to strike the spring-contact h', which being lifted from the contact h^2 opens the circuit of the wires 9 10, that serve to connect one group of the lower transmitting-fingers through the resistance Rh' to one pole of the main battery, thereby preventing short-circuiting of the battery.

In Fig. 1 the upper and lower transmitting-fingers have not been completely illustrated, because of the difficulties of completely showing them with their circuit connections. The upper transmitting-fingers are equal in number to and are arranged respectively opposite the lower ones, so that opposite fingers will press into contact through the tape-perforations, as set out in my United States Patent No. 536,420, dated March 26, 1895. The lower contact-fingers are shown diagrammatically in detail in Fig. 3. The upper transmitting-fingers may be arranged in two groups, but all electrically connected, as in Fig. 1, one group being for one line of perforations in the tape and the other group for the other line. Since, however, the upper transmitting-fingers are electrically one, they may be of any appropriate character, although in Fig. 1 I have indicated that each set is composed of several wires. Whatever the character of the upper fingers or transmitting contact devices they should be such as to bridge the perforations in both rows. Below each line of perforations is arranged a group of contact-fingers which are marked H^2 H^3. Each group is composed of several metallic pieces or wires electrically insulated from each other and arranged and connected in Fig. 3, as follows: There are two outer fingers h^4, electrically connected together and by wire h^5 with one pole of the divided battery MB. Just within these outer fingers are two others, h^6 h^6, electrically joined and connected by wire h^7 with the middle of a resistance-coil Rh, (or Rh',) and finally there is a central finger h^8, connected by wire h^9 with the upper terminal of the resistance-coil, the lower terminal thereof being directly connected to the battery MB. This arrangement thus specifically described has been shown by experience to be a practical and efficient one; but I do not intend to restrict myself to this particular style or kind of fingers and connections for accomplishing the object sought—namely, a rise in intensity of the signal impulse and a corresponding decline. As a perforation passes between the transmitting-fingers the central one, h^8, will first enter the perforation and press into the contact with the upper finger or contact device, thereby initially completing the circuit for the signaling impulse through the total resistance Rh. Next the fingers h^6 h^6 on opposite sides of the center one will drop or press into the perforation, and so establish another or branch circuit for the signal impulse through but one-half of the resistance Rh, and, finally, the outer fingers h^4 will establish a branch circuit to the battery around the resistance. There is therefore in this construction a rise in current intensity by three stages to a maximum at the middle part of the impulse. As the tape passes there will be a corresponding decline in intensity of the impulse, the outer fingers h^4 be-

ing first cut out of circuit, next the adjoining ones, h^6, and, finally, the middle one, h^8. In Fig. 4 is shown a modification for effecting a like result. Here the lower contact device opposite each row of perforations in the tape is a block of material H^4 of relatively low conductivity, such as carbon, and is connected directly with the battery. In this case the upper contact-fingers, all electrically connected, may be arranged in a flat series like the contact-fingers H^2. (Shown in Fig. 3.) At first the central one would be in contact with the block H^4, and then two adjoining ones, and finally the outer ones, when the maximum current would be delivered and then the outer ones would pass out of contact with the block next the two adjoining them, and finally the central one. This mode of operation constitutes a prominent feature of this invention. With circular perforations I find that the ends of the fingers may all lie in the same transverse line perpendicular to the tape. Of course they might be otherwise arranged, and would necessarily be, if the perforations were, for instance, square instead of circular.

As illustrated in Fig. 2, the roll of chemically-prepared tape M is deposited in a box m and rests upon a curved series of rollers m', having bearings in opposite walls of the box. Opposite the center of the roll of tape the box is slotted, as indicated at m^2, and the bottom of the box beneath the lowermost rollers therein is open. This arrangement is designed to afford a free delivery of the tape with a small resistance to the draft exerted by the drawing-rolls and by means of the slots m^2 to afford a ready means of lifting the roll of tape from the box, and finally the core or circular block upon which the tape is wound, if such be used, will, when the tape is all withdrawn, drop through the open bottom.

Heretofore the drums over which the chemically-prepared receiving-tape is drawn and against which it is pressed by the recording finger or fingers has been provided with a metallic face. In some cases this metallic face serves as a part of the circuit, being generally connected to earth, and where both line and earth contact fingers have been applied on the top of the tape a metallic face of the drum has served as a conductor, which together with the tape itself completes the circuit between the two fingers I have found that where the line and earth contacts are used on the same side of the tape it is much safer to use a drum with a non-metallic or non-conducting surface for the reason that should the receiving-tape break or run out, permitting the line and earth contacts to connect electrically through the metal surface of the drum, their ends are liable to be injured by the current, the usual result being the formation of a hard point on the marking or recording finger, which scratches the tape and fails adequately to respond to the electrolytic action of the current. As seen in Fig. 2, the drum M′ has a non-conducting surface and the recording-finger v and the earth or return connecting finger V′ of non-corrosive metal, such as silver or platinum, both bear upon the upper surface of the tape. I have found by experience that the best results are obtained when the non-marking or earth-connected finger or electrode is forked, so as to bear upon the tape on each side of the marking-finger. This arrangement causes an even corrosion of the latter finger by passage of current in opposite directions to the forked non-marking or earth-connected finger. I have also found that by making the ends of the non-marking finger comparatively flat and bending them upwardly or away from the tape the resistance of the circuit is less than if the non-marking finger or fingers had the same surface contact as the recording-finger, and, furthermore, these two flat non-marking fingers serve to keep the tape in proper position on the drum.

I claim as my invention—

1. In an automatic telegraph system, the combination with a receiver apparatus adapted to be started and stopped automatically by current from the distant station, a starting-relay connected in the line when the receiver is prepared to be automatically started, a stopping-relay normally disconnected from the line, and switch devices and circuit connections controlled by the receiver by which when the receiver is thrown into operation the starting-relay is cut out of, and the stopping-relay included in, the line-circuit.

2. In an automatic telegraph system, a transmitter adapted to be automatically arrested by current impulse from the distant station and comprising an arresting-magnet included in the line-circuit in series with the signal-current-transmitting devices, combined with means at the distant or receiving end of the line for sending a current to arrest the operation of the transmitter.

3. In an automatic telegraph system, a transmitting device adapted to coöperate with a transmitting-tape and respectively connected with the line and with sources of current of opposite polarity, and an arresting-magnet connected in series with the signaling-current-transmitting devices and irresponsive to such signal-currents, combined with means at the distant or receiving end of the line for transmitting a current that supplements the signal-current to cause the actuation of the arresting-magnet armature and thereby automatically stop the transmitter.

4. In an automatic telegraph, an organization at one station comprising the combination of a receiver adapted to be automatically thrown into operation and having an electro-

magnetic starting device adapted to be actuated by current received from a distant station, a transmitter adapted to be automatically arrested and having an electromagnetic arresting device adapted to be operated by a current received from the distant station, a switch controlled by the receiver, a switch controlled by the transmitter, local-circuit connections between the switches whereby when the transmitter is inoperative and the receiver is ready for reception, the line-circuit is completed by the switches through the electromagnetic device starting the receiver, and when the receiver is out of operation and the transmitter transmitting, the line-circuit is completed by the switches through the electromagnetic device for automatically arresting the transmitter.

5. In an automatic telegraph, an organization at one station comprising the combination of a receiver adapted to be automatically started and stopped by current received from a distant station and having an electromagnetic starting device and an electromagnetic stopping device, a transmitter, a switch controlled by the receiver, a switch controlled by the transmitter, local-circuit connections between the switches and a circuit connection between the receiver-switch and the receiver-stopping device, whereby when the transmitter is inoperative the line-circuit is completed by the switches through the electromagnetic starting device of the receiver to start the receiver, which, when thrown into operation, operates its switch to cut the starting device out of and include the stopping device in the line-circuit.

6. In an automatic telegraph, an organization at one station comprising a receiver adapted to be automatically started and stopped by currents received from a distant station and having an electromagnetic starting device and an electromagnetic stopping device, a transmitter adapted to be automatically arrested by current received from the distant station and having an electromagnetic arresting device, a switch controlled by the receiver, a switch controlled by the transmitter, local-circuit connections between the switches including the receiver-starting device and a circuit connection between the receiver-switch and the receiver-stopping device whereby, when the transmitter is inoperative, the line-circuit is completed by the switches through the receiver-starting device and, when the receiver is thrown into operation, the starting device is cut out of and the stopping device included in the line-circuit; and, when the receiver is inactive and the transmitter is in operation, the line-circuit is completed by the switches through the transmitter-arresting device.

7. In an automatic telegraph, a recording-receiver adapted to be automatically started and stopped by current received from a distant station and comprising the combination of recording devices, an electromagnetic starting device included in the normal circuit of the line, an electromagnetic stopping device normally disconnected from the line-circuit, and a switch and circuit connections which, when the receiver is started, operate to cut the starting device out of and introduce the stopping device into the line-circuit in series with the recording devices.

8. In an automatic telegraph, a chemical receiver adapted to be automatically started and stopped by current received from a distant station and comprising the combination of a recording or marking finger, means for drawing the chemically-prepared tape past the finger in contact therewith, a starting-magnet included in the normal circuit of the line, a stopping-magnet included in the circuit connection in series with the recording-finger, and a switch controlled by the receiver, whereby, when the receiver is thrown into operation, the starting-magnet is disconnected from the line and the recording-finger and stopping-magnet are connected in the line-circuit.

9. In an automatic telegraph, a chemical receiver comprising the combination of a non-metallic surface over and in contact with which the prepared receiving-tape passes, a recording-finger and non-marking finger which bear upon the tape passing over said surface.

10. In an automatic telegraph, a chemical receiver comprising the combination of a non-metallic surface over and in contact with which the prepared tape passes, a recording-finger bearing on the tape and non-marking fingers arranged on both sides of the recording-finger and also bearing upon the tape.

11. In an automatic telegraph, a chemical receiver comprising the combination of a metallic surface over and in contact with which the prepared tape passes, a recording-finger bearing upon the tape and non-marking fingers bearing upon the tape on each side of the recording-finger and having rounded or upturned ends for the purpose set forth.

12. In an automatic telegraph employing a perforated transmitting-tape, the insulated transmitting-fingers, a battery and circuit connections of different resistance connecting the battery and respective transmitting-fingers.

13. In an automatic telegraph employing a perforated transmitting-tape, a transmitting-generator, transmitting devices operating through the perforations of the tape, and means whereby a transmitted impulse increases to a maximum and then declines.

14. In an automatic telegraph, a transmitter employing a transmitting-tape perforated in two rows, signal-transmitting devices arranged on opposite sides of the tape and adapted to make contact through the perfora-

tions in both rows, those on one side of the tape being connected to the line and those on the other side of the tape respectively opposite the two rows of perforations being respectively connected to sources of electricity of opposite polarity and means whereby current transmitted from a perforation in either row is caused to increase in strength to a maximum and then decline.

15. In an automatic telegraph, the combination of a transmitter employing a perforated tape and a chemical receiver connected by a main line including a transmitting-battery and each having an arresting-magnet in the line-circuit, and the transmitter having means for sending a prolonged impulse of current when traverse of the tape through the transmitter is completed to energize both said magnets and arrest both instruments.

In testimony whereof I have hereunto subscribed my name.

PATRICK B. DELANY.

Witnesses:
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GEO. H. RUDOLPH.