(No Model.) 2 Sheets—Sheet 1.

P. B. DELANY.

TELEGRAPHY.

No. 536,420. Patented Mar. 26, 1895.

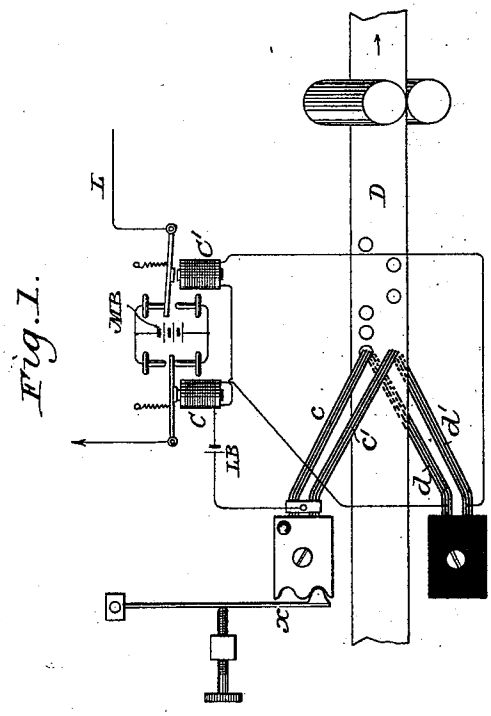

Fig. 1.

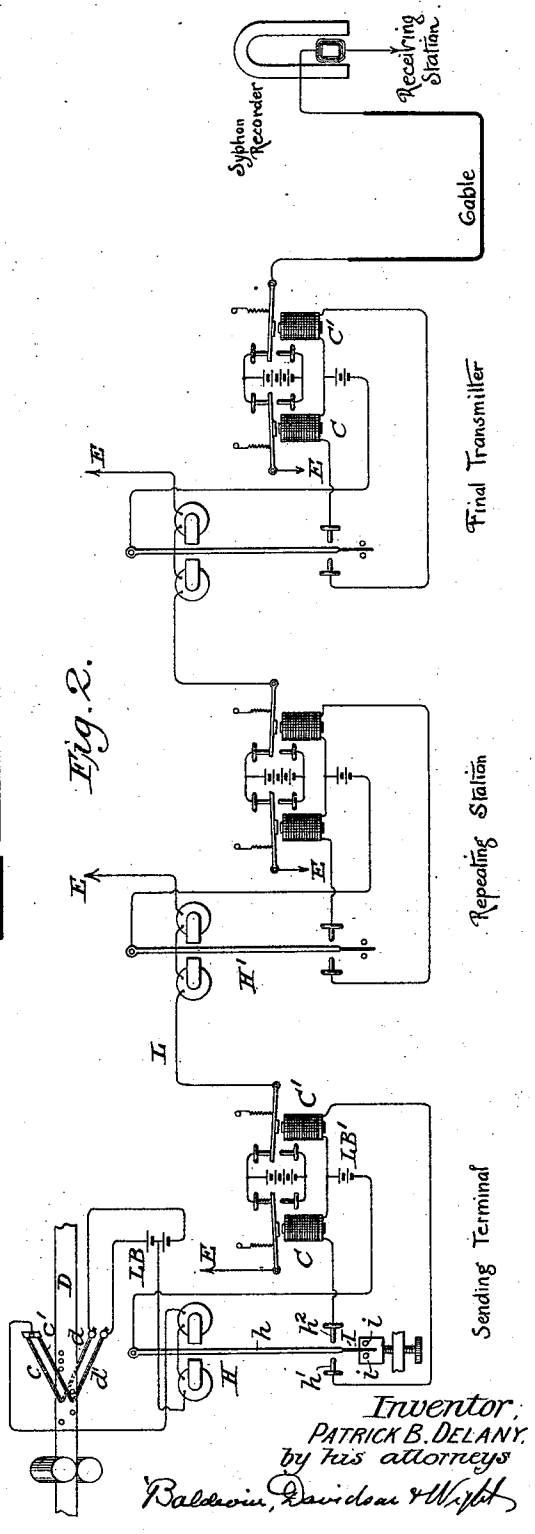

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

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TELEGRAPHY.

No. 536,420. Patented Mar. 26, 1895.

Fig. 3.

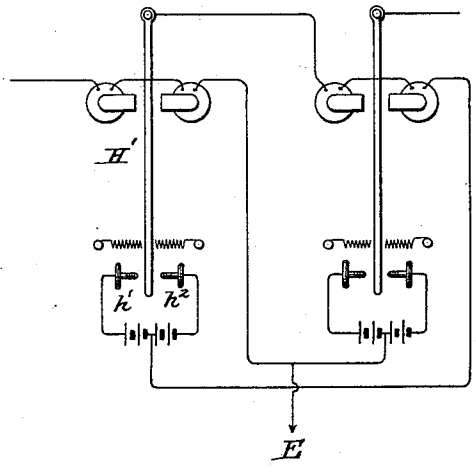


Fig. 4.

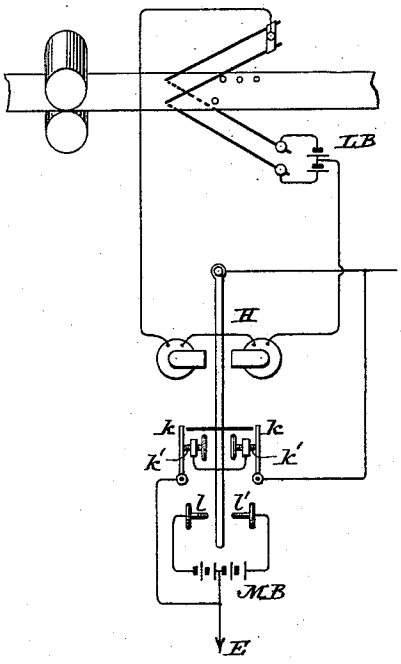
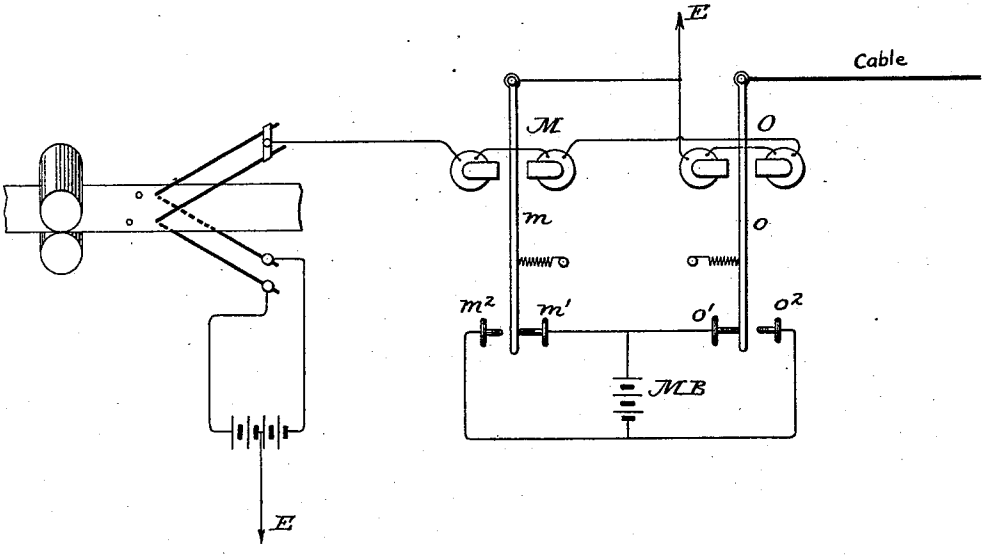


Fig. 5.



Witnesses.

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TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 536,420, dated March 26, 1895.

Application filed November 19, 1894. Serial No. 529,293. (No model.)

To all whom it may concern:

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

My invention relates to systems of telegraphy in which succeeding impulses of current of like and opposite polarity are sent into a line or in which the succeeding impulses are regularly alternated in polarity, and comprises transmitter devices for causing such impulses to be thrown upon the line (which devices are preferably of an automatic character or may be such as to be manually manipulated) and a polarized transmitter instrument, relay or repeater normally maintained in a neutral position or condition relatively to the contacts controlled thereby, and capable of being thrown into one active condition or position by a current of one polarity and into another active condition or position by a current of opposite polarity. Such an instrument is particularly adapted to cable systems in which successive currents of the same and opposite polarity are transmitted because the instrument locally controlled may be used to transmit at the sending terminal of a land line extending to the cable terminal, may be used as a repeater in said line and as a final transmitter to repeat into the submarine cable. I prefer that such polarized instrument shall have a single armature lever or contact controlling part normally maintained in a neutral or zero position from which it is moved by currents controlled by the transmitter devices successively in the same direction when such currents are of like polarity and successively in the opposite direction when such successive currents alternate in polarity or direction. Such a polarized normally neutrally maintained instrument may be located at the same station with the transmitting devices or at a distance therefrom to serve as a relay, and in the former case another such instrument may be placed at a point in the line to serve as a relay. The system is specially designed for working submarine cable lines. For such work it is desirable to transmit direct from a commercial center, such for instance as London, into the cable. In such a case I would prefer to place such an instrument at the transmitting London station, and at one or more relay stations, and at the station for final transmission into the cable. Such a neutrally maintained relay makes it possible to relay or repeat the signals of a cable system where succeeding impulses are of like or opposite polarity. I have found in actual cable practice that such a method of working is materially advantageous as regards speed and perfection of transmitted signals. The final receiver in my system may be of any appropriate character.

My invention comprises a special form of automatic transmitting devices worked in connection with the polarized neutrally maintained instrument, the essential feature of which devices consist in establishing local contact through the perforations of a transmitting tape by fingers or brushes bearing on opposite sides of the tape with their ends opposite each other, so that they press through the perforations into contact as the tape is drawn along and the perforations therein pass between the ends of the brushes.

The drawings are diagrammatic illustrations either of well known apparatus or of apparatus so simple in construction and mode of operation as to be readily comprehended.

Figure 1 shows my improved arrangement for automatic transmission in which contact fingers are arranged above and below, or on opposite sides of the perforated strip, and are pressed together through the perforations as the strip passes between them. Fig. 2 is a diagrammatic view illustrating a sending terminal, a repeating station, a final transmitter working into a submarine cable, or other long and difficult circuit, and a receiving station at the other end of the cable. Fig. 3 shows a modified arrangement that may be employed at the repeating station or at the initial or final transmitting station. Fig. 4 illustrates a modified organization for transmission into the line or cable from a perforated tape transmitter. Fig. 5 shows a modification in the construction and mode of operation of the neutrally maintained polarized instrument or relay.

Referring to Fig. 1, the automatic transmitter tape D shown has two parallel lines of

perforations and on opposite sides of the tape, or above and below it, are arranged yielding contact fingers whose ends are opposite each other and bear upon the tape. One pair of such fingers or brushes *c c'* is arranged above the ribbon, and the other pair *d d'* below it. As the tape is drawn between these brushes the ends of opposite brushes press into contact with each other through the perforations in the tape. This manner of making contact through the perforations is new with me so far as I am aware, and by it I obtain most excellent contacts and materially improve this style of automatic transmission. The paper strip traveling between the ends of the contact brushes or fingers scrapes or burnishes them and keeps them in good condition, and the absence of any rotary or cylindrical contact such as has ordinarily been employed in this class of apparatus not only permits of this rubbing or scraping on the ends of the fingers, but also removes from the circuit the moving contact that is present where a roller or cylinder is employed. I prefer to make each brush of several wires so that when the ends of opposite brushes press against each other through a perforation good electrical contact is unfailingly made as the wires of the engaging brushes interlock and insure perfect contact.

The electric circuits completed through the brushes for operating electro-magnetic transmitting devices may be as follows and as shown in Fig. 1: The two brushes of either pair may be electrically connected, that is to say, they both may be connected to one pole of a local battery L B, the pair *c c'* being shown connected in Fig. 1. The opposite pole of the local battery is connected through the coils of two transmitter magnets C C', the magnet C being connected with the brush *d* of the lower pair and the magnet C' with the brush *d'*.

M B indicate the main transmitter battery. The operation is obvious. The line L is normally to earth. Each time that the circuit of the magnet C is completed through the contact brushes *c d* an impulse of current of one polarity is sent to line, and each time that the circuit of the magnet C' is completed through the brushes *c' d'*, a current of opposite polarity from the battery M B is sent to line. As shown the upper pair of brushes *c c'* is supported in a pivoted block held in position by a spring catch *x* which admits of the block being turned to throw the brushes up when desired. This improved arrangement of contact brushes may be employed as shown in Fig. 1 to directly complete the circuits of the transmitter magnets C C' to throw impulses of current upon a main line or cable L, or the circuits completed by the contact brushes may operate a relay or intermediate instrument that controls the circuits of the transmitter magnet or magnets, as shown for instance in Figs. 2 and 3.

Having now described my improved devices for automatic transmission, I will now describe the general system of telegraphy which is illustrated in Fig. 2. In that figure, I have shown a sending terminal station which is so marked, a repeating station, a final transmitter for sending the message into a cable, and a receiving station at the other terminal of the cable equipped with a siphon recorder receiver. At the sending terminal, D indicates the perforated tape; *c c'*, the upper pair of brushes; *d d'*, the lower pair of brushes, and L B the split local battery. H indicates a polarized instrument or relay whose coils are included in the circuit of local battery L B, and whose armature lever *h* is normally held in a neutral position centrally between its opposite contact stops *h' h²*. This position may be maintained by means of limiting stops *i i*, between which is arranged a very light spring blade I projecting from the end of the armature lever. The same result may, however, be accomplished by means of springs acting in opposite directions upon the armature lever as shown in Fig. 3, or in any other suitable manner. This polarized relay or instrument having an armature normally occupying a neutral position and capable of movement therefrom in either direction constitutes a leading feature of my invention. At the sending station in Fig. 2, the neutral armature lever *h* is connected with one pole of a local battery L B', whose opposite pole is connected through the transmitter magnet C with the contact stop *h²* and through the transmitter magnet C' with the contact stop *h'*. The arrangement of main battery M B, magnets C C' and their armature levers is the same as illustrated in Fig. 1, and is well understood. Each time that the circuit of the local battery L B is completed through the coils of the polarized instrument H through the contacts *c d*, the armature lever *h* is moved from its neutral position, say to the right to complete the circuit of the local battery L B', through the coil of the magnet C, and send an impulse of one polarity into the line L; and each time that the local circuit of the battery L B is completed through the brushes *c' d'*, the armature lever of H moves in the opposite direction from its neutral position and the transmitter magnet C' is energized, and an impulse of opposite polarity from the main battery M B is sent into the line.

Succeeding impulses of current sent into the line L may be of like polarity, or of opposite polarity, according to the arrangement of the perforations in the transmitting tape. The line L running from the sending terminal might be a cable or other line into or over which the final transmission is sent, or it may be a line running to a final transmitter such as shown in this figure, and which transmits the signals into the cable. In Fig. 2, however, I have shown an intermediate or repeating station where a polarized relay or instrument H' is located and through the coils of which the line L is grounded. This instrument H' is of

the same character as the instrument H at the sending station, that is to say, it has an armature normally maintained in a neutral position between its contact stops, which armature controls the circuit of transmitter magnets exactly as illustrated at the sending station. At the final transmitter station, where the signals are to be sent into the cable, the organization is the same as that shown at the repeating station, and the transmitter magnets C C′ (or the polarized magnet, if such an arrangement as that shown in Fig. 3 is employed) transmit the signals or impulses of current into the cable. At the receiving end of the cable I have merely indicated a Thomson siphon recorder, which may be of any ordinary construction. Instead of the particular automatic transmitting devices, that is to say, the arrangement of contact fingers *c c′*, *d d′* and a perforated tape, shown at the sending terminal I may employ any suitable transmitter device, automatic or otherwise.

At the sending terminal the apparatus may be such as shown in Fig. 1, and in that event the impulses sent into the line by the magnets C C′ may directly operate the polarized instrument at the final transmitter, or one or more relays at repeating stations may be employed. So also at the sending terminal, relay stations and final transmitter, the transmitter magnets C C′ might be omitted and current be sent into the line or cable from the contact stops *h h′* of the polarized instrument; or instead of the transmitter magnets C C′ a second neutrally maintained polarized instrument may be used in the manner shown in Fig. 3.

The polarized relay or instrument H H′ as will now be seen and as has already been described is capable of having its armature lever moved successively from the neutral position in the same direction by succeeding impulses in its coils of the same polarity, the direction of movement being determined by the polarity, or of having its lever moved from the neutral position alternately in opposite directions when the succeeding impulses are of alternating polarity. The instrument is capable of being so constructed as to respond readily and with precision to relatively weak currents. Where the circuit is such as to permit, such instrument may be used as the final receiving relay, that is to say, it may be placed at the receiving terminal of the line or cable instead of the siphon recorder indicated in Fig. 2. From what has been said it is clear that this relay or instrument is of special applicability to systems, such as submarine cable systems, in which the polarity of the currents is reversed though succeeding impulses may be of like kind or polarity.

It is new, so far as I am aware, to employ such a neutrally maintained relay as a repeater placed between a sending terminal of a line and the final station where signals are transmitted into the main line or cable. It is also new, so far as I am aware in the general organization shown, to employ a neutrally maintained polarized relay whose armature lever is capable of being actuated successively in either direction from its neutral or zero position to transmit succeeding impulses of current of like or opposite polarity into a line or circuit whether such instrument be used as an initial transmitter, a repeater, or a final transmitter. The stops *i i*, as seen in Fig. 2 at "sending terminal" are mounted on an adjustable base capable of being moved toward or from the pivot of the armature lever to apply the stops nearer to or farther from the free end of the spring, I, and thus in effect adjust its tension.

Referring to Fig. 2, the sending station may be London, the one or more repeating stations may be located at any desired points and the final transmitter may be at the sending terminal of a transatlantic cable.

In Fig. 3 I have shown the polarized instrument H or H′ with its lever held normally in a neutral position by oppositely acting delicate coiled springs, and working against contacts *h′ h²* to control a precisely similar instrument whose neutral armature lever plays between the main battery contacts and transmits to line succeeding impulses of like or opposite polarity as the case may be. The figure illustrates the apparatus arranged at a repeating station. It might be the apparatus of an initial or final transmission station.

In Fig. 4, I have shown the perforated tape and opposite brushes or contact fingers controlling the circuits of a split battery L B, in which are included the coils of a polarized instrument H, whose armature lever is normally maintained in a neutral or zero position by very light spring plates *k k*, bearing against the contact stops *k′ k′* through which the line is grounded normally and between impulses of current sent into it. A cross pin K on the armature is acted upon by these spring plates to hold the armature normally in the neutral position. The line L is connected with the armature lever which when moved from its neutral position comes against the contact *l* or *l′* and a current from battery M B is sent to line. Such transmitted currents will be successively of like or opposite polarity as is determined by the perforations in the transmitting tape. I prefer to use the style of neutrally maintained polarized instrument or relay shown in Figs. 2 and 3.

In Fig. 5 I have shown a modified construction or arrangement of the neutrally maintained polarized instrument. I have here indicated the automatic transmitter devices as before. The polarized instrument or apparatus however is shown as consisting of two ordinary biased polar relays M and O. The local transmitter circuit or line circuit, as the case may be, passes successively through the coils of both relays M and O. The armature levers *m o* are respectively biased by springs and normally bear against corresponding con-

tacts m' o' connected with one pole of the battery M B. The other pole is connected with the other contact stops m^2 o^2 of the armature levers. The line or cable is connected with the armature lever of O and the armature lever of M is grounded. A current of one polarity in the coils of M and O causes one armature lever to bear more strongly against its contact stop m' or o' and the other passes to its contact m^2 or o^2. A current of opposite polarity in the coils reverses this condition. It will be seen, therefore, that the polarized apparatus normally occupies a neutral position with the line or cable to earth and that the polarity of the current sent into the line or cable from battery M B, depends upon the polarity of the current in the coils of M and O. This apparatus has the same capacities as the polarized instrument above described.

I claim as my invention—

1. The combination, substantially as set forth, of a single circuit extending from a terminal station to a final transmitting station, transmitting devices for sending over such circuit successive impulses of current of like or opposite polarity, a polarized instrument located at the final transmitting station through the coils of which said circuit is completed, the armature lever or contact controlling part of said polarized instrument normally maintained in a neutral position and capable of movement in either direction therefrom as the impulses of current in its coils are of one or another polarity, a main line or cable circuit extending from the final transmitting station to a distant receiver, a transmitting battery located at the final transmitting station, transmitting devices interposed in the circuit of the cable and battery and controlled by the normally neutrally maintained armature lever of the polarized instrument, whereby successive impulses of current of like or opposite polarity are transmitted into the cable from said battery.

2. The combination, substantially as set forth, of transmitting devices for sending successive currents of like or opposite polarity from a sending terminal into a single line circuit extending through the coils of a polarized instrument located at an intermediate repeating station, a transmitting battery at the repeating station, the armature lever or contact controller of such polarized instrument normally maintained in a neutral position and capable of movement therefrom in either direction according as the impulses of current in its coils are of one or another polarity, contacts and current transmitting devices controlled by said neutrally maintained part by means of which successive impulses of current of like or opposite polarity are sent from the battery at the repeating station into a line extending therefrom through the coils of a polarized instrument located at a final transmitting station and having an armature normally maintained in a neutral position and capable of movement therefrom in either direction according as the impulses of current in its coils are of one or another polarity, contacts and current transmitting devices controlled thereby, a battery located at the final transmitting station, and the main line or cable into which successive impulses of current of like or opposite polarity are sent by said current-transmitting devices from the battery at the final transmitting station.

3. The combination, substantially as set forth, of a single line circuit extending from a terminal station to a relay station, transmitting devices at the sending station for transmitting over the line circuit succeeding currents of like or opposite polarity, a polarized relay at the relay station through whose coils said line circuit is completed, the armature lever of the relay normally maintained in a neutral position and adapted to be moved in either direction therefrom as the received impulses are of one or another polarity, a battery at the relay station, a second circuit extending from the relay station, and transmitting devices interposed with the battery in said second circuit and controlled by the normally neutrally maintained relay armature.

4. The combination, substantially as set forth, of an automatic perforated tape transmitter for sending into a line succeeding currents of like or opposite polarity, which transmitter consists of a transmitting tape having therein two lines of perforations, one line for the transmission of currents of one polarity, and the other line for the transmission of currents of the other polarity, contact devices operating through such perforations, transmitting devices and a battery controlled thereby, a polarized relay through the coils of which the line circuit is completed, the armature of said relay normally maintained in a neutral position and capable of movement therefrom in either direction, according to the polarity of the current passing in its coils, a second line circuit extending from the relay, a battery at the relay station, and transmitting devices controlled by the relay whereby currents may be transmitted into the second line circuit representing signals corresponding with those sent from the automatic transmitter.

5. An automatic transmitter comprising a tape having two lines of perforations therein, contact devices operating through each line of perforations, a split battery, a local circuit controlled thereby, a polarized relay in said local circuit whose armature is normally maintained in a neutral position and is capable of movement therefrom in either direction, according to the polarity of the current in its coils, transmitting devices controlled by the armature of the polarized instrument, in combination with a line circuit and a battery from which successive currents of electricity are sent into the line, the polarity of such cur-

rents being determined by the direction of movement of the normally neutrally maintained armature lever.

6. The combination, substantially as set forth, of an automatic tape transmitter having a tape so formed in two parallel lines as to transmit currents of one polarity from one of said lines and currents of another polarity from the other of said lines, a polarized relay or transmitter instrument having circuit contacts arranged on each side thereof, the armature lever or contact controlling part of said instrument normally maintained in a neutral position between said contacts and out of contact with either of them and capable of movement in either direction from said neutral position according as the instrument is influenced by currents of one polarity or another, a line circuit and a battery from which successive currents of like or opposite polarity are sent into the line as the neutrally maintained part of said instrument is moved in one direction or the other.

7. The combination, substantially as set forth, of a circuit, means for sending therethrough succeeding impulses of currents of like or opposite polarity, a polarized instrument in said circuit normally maintained in a neutral position or condition, but capable of being thrown into one active position or condition by a current of one polarity and into another active condition or position by a current of the opposite polarity, a single line circuit extending from said instrument and a battery, whereby succeeding currents of like or opposite polarity are sent into the line circuit from said battery, according as the said instrument is thrown into one active condition or position or another.

8. In an automatic transmitter, the combination of a pair of contact brushes, each consisting of a yielding strip or finger, arranged in opposition so that their ends tend to press into contact with each other, a perforated tape traveling between the ends of the brushes and rubbing or scraping against the ends thereof, the organization being such that the ends of the brushes thus rubbed or burnished by the traveling strip press into contact with each other through the perforations as the tape passes between them, substantially as set forth.

9. In an automatic perforated tape transmitter, elastic or yielding contact brushes each consisting of a bunch of wires arranged on opposite sides of the tape with their contact making ends opposite each other, the organization being such that the brushes press into contact with each other through the perforations as the tape passes between them, substantially as set forth.

In testimony whereof I have hereunto subscribed my name.

PATRICK B. DELANY.

Witnesses:
ALFRED NUTTING,
THOMAS P. ROGERS.