(No Model.) 3 Sheets—Sheet 1.

P. B. DELANY.

PRIVATE LINE TELEGRAPHY.

No. 431,651. Patented July 8, 1890.

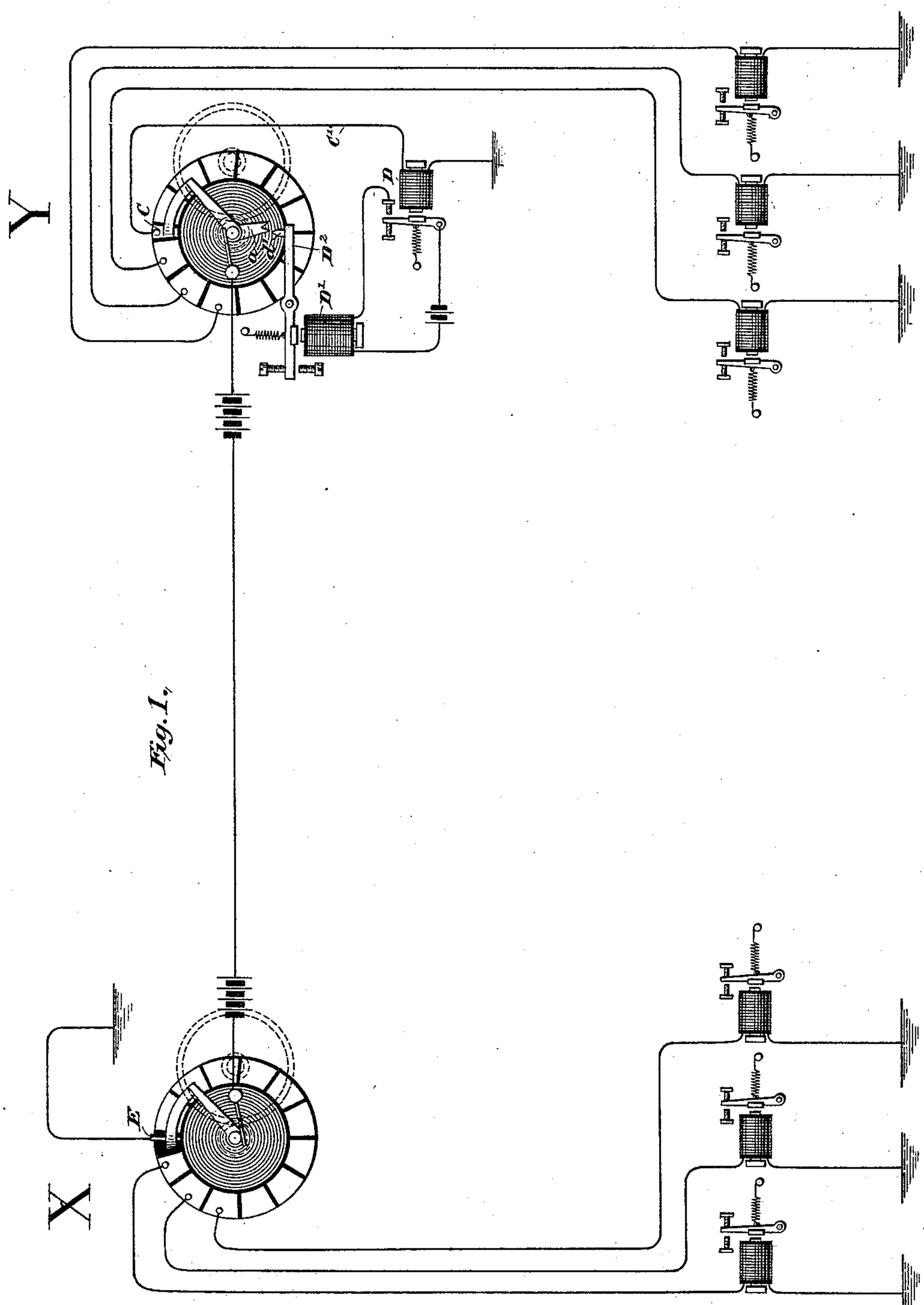

Fig. 1.

Witnesses
Geo. W. Breck
C. E. Ashley

Inventor
Patrick B. Delany
By his Attorneys
Baldwin, Davidson & Wright

(No Model.) 3 Sheets—Sheet 2.

P. B. DELANY.

PRIVATE LINE TELEGRAPHY.

No. 431,651. Patented July 8, 1890.

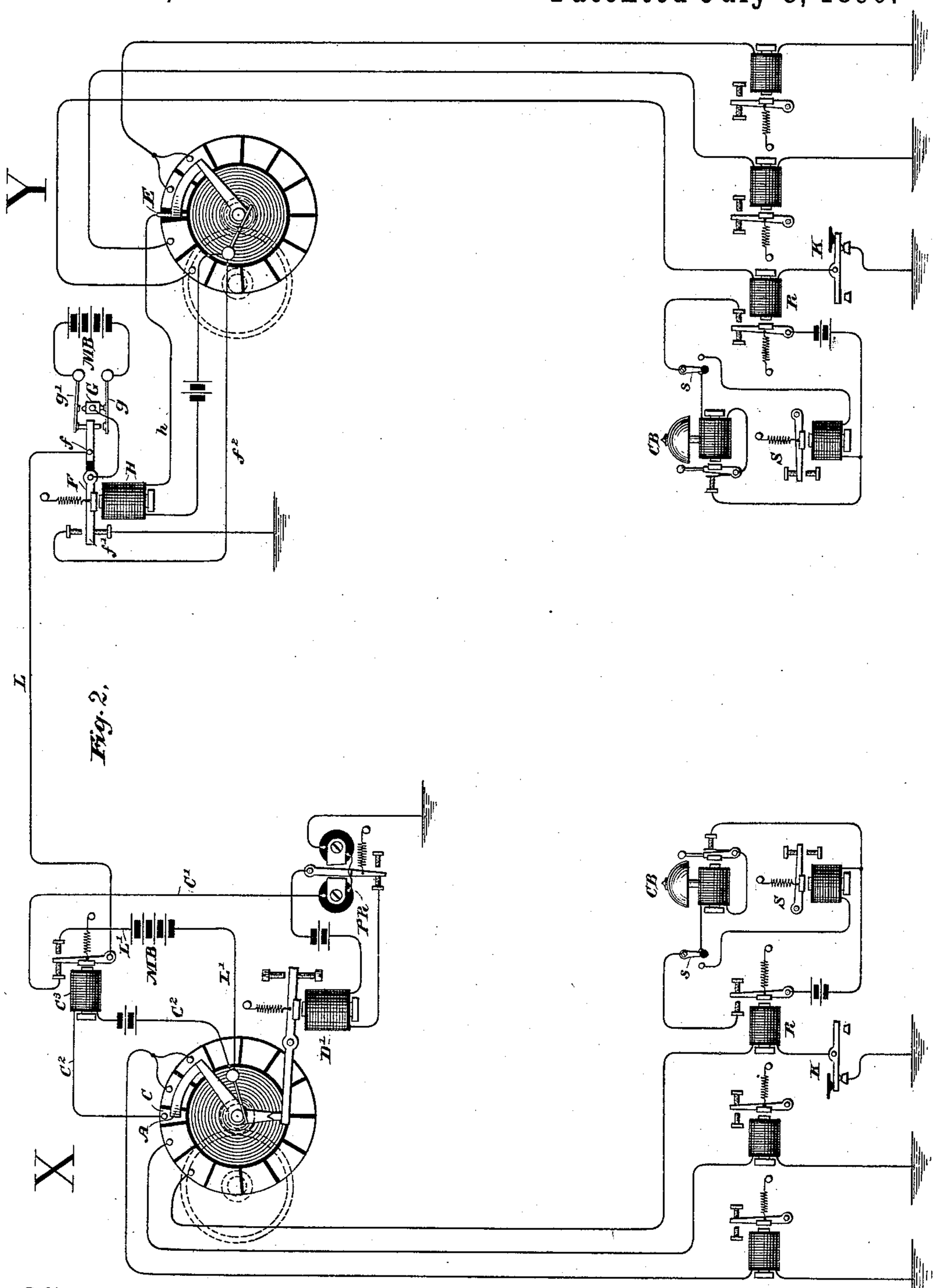

Fig. 2.

Witnesses
Geo. W. Breck
C. E. Ashley

Inventor
Patrick B. Delany
By his Attorneys
Baldwin, Davidson & Wright

(No Model.)

3 Sheets—Sheet 3.

P. B. DELANY.

PRIVATE LINE TELEGRAPHY.

No. 431,651. Patented July 8, 1890.

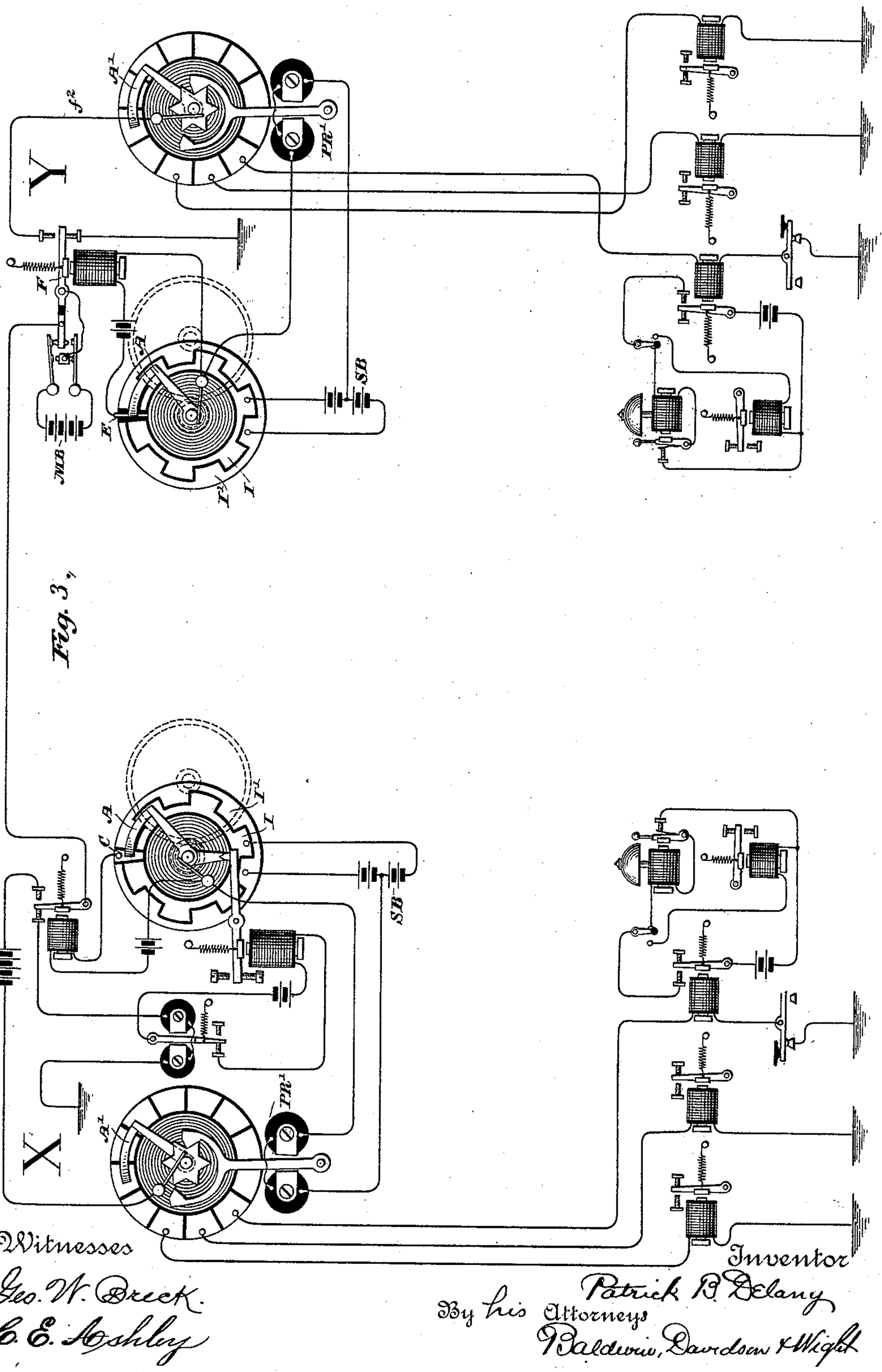

Fig. 3.

Witnesses
Geo. W. Breck.
C. E. Ashley

Inventor
Patrick B. Delany
By his Attorneys
Baldwin, Davidson & Wright

UNITED STATES PATENT OFFICE.

PATRICK B. DELANY, OF SOUTH ORANGE, NEW JERSEY.

PRIVATE-LINE TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 431,651, dated July 8, 1890.

Application filed February 21, 1890. Serial No. 341,303. (No model.)

To all whom it may concern:

Be it known that I, PATRICK B. DELANY, a citizen of the United States, residing at South Orange, in the State of New Jersey, have invented a certain new and Improved Private-Line System for Electric Communication, of which the following is a specification.

With the growth of business enterprises and development of means for rapid transportation and communication a demand has grown up for a private-line service, either by means of telephony or telegraphy, between business houses located in different cities. Ordinarily, however, the expense of a private line between cities, even if they be comparatively close to each other—as, for instance, as between Washington and Philadelphia, Philadelphia and New York, and New York and Boston—is excessive, and unless the demands of business call for the constant use of a line the cost of such a service is not justified, even if not prohibited.

With many business houses, who require or desire a private-line service, all the demands of business could be provided for by the use of a private line during a portion of the day only and at stated intervals of a given number of minutes in every hour. For instance, a private-line service at the disposition of a business man for five minutes, or ten, or fifteen during every hour of the business day would, if properly utilized, be entirely sufficient for his purpose. Obviously, if a line may thus be divided up or apportioned among different subscribers, so that each shall have the use of it for a limited time during each hour, the cost to each subscriber may be made relatively small and proportionate to the length of time during which the wire is assigned to him. Thus twelve subscribers could have the use of a main line between New York and Boston five minutes during each hour. On such a line telephonic messages may be sent, or the ordinary Morse telegraph used, or printing-instruments that do not require skilled operators may be employed.

The object of my invention is to provide for such a system, in which is employed a single main circuit, either an independent wire or the leg of a duplex or quadruplex circuit, or of a multiplex telegraph system—such, for instance, as the "Delany synchronous multiplex telegraph." This object I attain by locating at each terminal of the main circuit a time mechanism, or time-controlled mechanism, which successively places the main line in communication for limited periods of time with corresponding multiple or branch circuits. This may be accomplished by connecting the branch or subscribers' circuits at each end of the line with insulated contacts, over which moving trailers connected to the main line pass.

With this general reference to the purpose, utility, and manner of carrying out my invention, I will now describe several organizations of circuits and apparatus by which the invention may be practiced.

In the accompanying drawings, Figures 1, 2, and 3 are all diagrammatic views illustrating different ways of carrying out my invention.

In Fig. 1, L is a main line, in which are placed two main batteries M B—one at each end of the line—though a single battery might be used. The lines are connected at each end with a trailer A, driven by a clock-train, which may be represented by the dotted circle B. The trailer traverses a circle of insulated segments, numbered from 1 to 12. The arbor of the trailer corresponds with or may be that of the minute-hand of the clock-train. Corresponding subscribers' branch lines are connected with corresponding segments. For instance, a subscriber's line (marked 4′) is connected at each station with segment marked 4. When, therefore, the trailers are both traversing the segment marked 4, there will be a complete private circuit from the operator at one terminal of the line 4′ to the operator at the other terminal of line 4′. If the trailers occupy one hour in traversing the circuit, they will dwell five minutes upon each segment. One of the trailers and circle of segments, which I will call the "distributers," may be assumed to be located in New York and the other in Boston. Any subscriber's circuit may be given two adjoining segments, so that the circuit may be used for ten consecutive minutes in every hour; or any subscriber's circuit may be connected with one segment at one point in the circle and another segment at another point in the circle, so as to have the

line for five minutes in each half-hour, or any other arrangement may obviously be adopted, according to the needs of the different subscribers. In the arrangement shown in this figure no impulses are sent over the line to correct the time-pieces. I provide for the sending once in each hour of a correction-impulse over the line, so that the distant time-piece is brought into exact unison with the time-piece at the station from which the impulse is sent. This is accomplished in the following manner: At station Y, in addition to the subscribers' segments, there is a correction-receiving segment C, and from this segment a line C′ runs through the coils of a neutral relay D to earth. The local of this relay, which is normally open, includes the coils of a magnet D′, whose pivoted armature-lever D^2 carries a wedge-shaped post *d*, that works in a correspondingly-shaped notch in an arm *a*, fast upon the spindle or arbor of the trailer. At the other station X, I may devote an equal space in the circle to correction, but it is largely of insulating material, and contains only a narrow conducting blade or segment E, electrically connected to earth. The insulation to the left of the blade E is preferably wider than to the right, to give a proper margin for the correcting-impulses. If the trailer at Y rests upon the segment C while the trailer at X is upon the insulation, no current passes through the line C′; but when the trailer at X reaches the blade E, then, if the trailer at Y is upon the segments C, an impulse of electricity passes to earth through the line C′, the relay D attracts its armature to its front post, closes its local, the magnet D attracts its armature, and the wedge entering the notch in the arm *a* throws the trailer either backward or forward, as the case may be, and brings it into exact unison with the trailer at X. Of course this arrangement does not contemplate such a variation of the time-pieces as would carry the notch in the arm *a* out of range of the wedge *d*.

In Fig. 2 I have shown a somewhat analogous arrangement, except that the correcting-relay is polarized, its armature being biased by a spring, and pole-changing devices are employed. As in Fig. 1, there is a correction-segment C, and from it a wire C^2, including a local battery and coil of a relay C^3, runs to the hub of the trailer or its arbor. When, therefore, the trailer at X rests upon the segment C, as shown in the drawings, the armature of the relay C^3 is attracted against its front post, and the line L, being connected to said armature, is grounded through a wire C′, connected through the coils of a polarized relay P R to earth. This relay, being attracted against the force of its biasing-spring, closes its local circuit, including the coils of the magnet D′, which attracts its armature and corrects or trues the position of the trailer, precisely as described in connection with Fig. 1. This operation, however, never occurs until pole-changing mechanism is actuated at the distant station Y, as presently described. Normally at station X the armature-lever of the magnet C^3 rests against its back-stop, so that in this normal working condition of the line there is a circuit from line L through said armature-lever, line L′, and main battery M B to the trailer A, traversing the subscribers' segments. At station Y the line runs to the insulated end *f* of a pivoted armature-lever F, which, being normally retracted, bears upon a pole-changing spring *g*, pressing it out of contact with the central conducting-block G, the main-line circuit being therefore through the spring *g*, battery M B opposite pole-changing spring *g′*, central block G, conducting end *f′* of the armature-lever F, its upper stop and line f^2 to the trailer, the various segments, and subscribers' branch lines to earth. When the trailers reach the correcting-segments C E, the following operation takes place: At station Y the contact of the trailer with the segment E completes a local circuit *h*, including the coils of a magnet H. The armature F is attracted and the main battery is reversed. This is the position indicated in the drawings. At the same time at station X the trailer, coming upon segment C, completes the local circuit C^2 and the magnet C^3 attracts its armature, sending the current from the battery M B at station Y through the coils of the polarized relay P R to earth. The relay draws its armature to the left, as viewed in the drawings, completes its local, and corrects the position of the trailer, as before described. Thus once in each hour the time-pieces are brought into exact accord and the accurate running of the system is insured. In this figure I have shown operator's instruments in connection with one of the circuits. A subscriber's line is normally closed through the relay R and key K. The local of the relay is branched, one branch including a sounder S and the other a call-bell C B. The local is completed through the call-bell or sounder by switch *s*. When, therefore, the trailers come upon the segments devoted to this particular sub-circuit, the relays at both ends of the line attract their armatures, the locals are completed, and the call-bells announce to the operators that the line is at their service. The bells will continue to ring until the switches *s* are moved to throw the sounder into circuit, when the line is ready for business. Of course any instruments for electrical communication may be connected in the lines.

I now come to a description of Fig. 3, which shows what I consider the most perfect organization of my system. In this diagram the trailers controlled by the time-pieces are not in the line, but the corrections are applied to the trailers in precisely the manner indicated in Fig. 2, and no repetition of that description is necessary. At station X the line from the battery M B, instead of running to the trailer A, that is actuated directly by the time-piece, runs to a second trailer A′,

that traverses a series of twelve segments, with which the subscribers' branch lines are connected. At station Y the upper stop of the armature-lever F is likewise connected by the line f^2 to the corresponding trailer A'. In this organization the trailer A traverses alternate segments I and I'. All segments I are connected with one pole of a split battery S B, and all segments I' are connected with the opposite pole of said battery, while the middle of the battery is connected through the coils of the polarized relay P R' with the trailer A. As this trailer revolves, therefore, each time that the trailer passes onto a segment I or I' the battery S B is reversed, and the armature of the polarized relay is thrown to the right or left, thereby advancing the trailer A' one step by means of the star-wheel-and-pallet arrangement shown and transferring it to the next segment. With this arrangement the trailer A' is at rest upon each segment for five minutes, and is then quickly transferred to the next segment. This plan I prefer because it insures a better contact, and where telephones are used it has the further advantage of doing away with a moving contact, which might produce noises in the instruments. Of course the segments I and I', over which the trailers A pass, may be of unequal number to the segments over which the trailers A' traverse. With this organization the time-pieces are corrected once in each revolution of the trailers A, and every five minutes the trailers A' are transferred to adjoining segments.

As illustrative of the practical operation and advantages of this system, I may say that if six firms having branch houses in New York and Philadelphia should each have a circuit between those cities for five minutes in every half-hour they would have facilities equal to at least one message per minute, and the capacity of the circuit would be, of course, greatly increased by reason of the fact that dates, addresses, signatures, and other formalities, which often outnumber the words in the body of the telegram, may be omitted. During the time that the operator is not engaged in transmitting or receiving messages he can be attending to clerical or other duties, and thus the expense of a line-operator is practically obviated. If the periodic facilities thus afforded for five minutes in every half-hour were properly utilized, ten messages per hour might readily be sent, and for eight hours of the business-day eighty messages could therefore be transmitted between each pair of subscribers. This would be sufficient for the transaction of the business of many firms who now require and pay for a private line. At the same time such a number of messages, if sent over the lines of any of the telegraph companies, would prove a heavy tax, aside from the disadvantage of delays and the importance often of receiving immediate answers to inquiries.

The distributer apparatus would, of course, be located at a central office in each city, and the branch lines radiating therefrom could be run to any points desired, and the operators at the offices to which the branch lines run would have nothing whatever to do in connection with the periodic transferrence of the main circuit from one subscriber to another.

I claim as my invention—

1. The combination, substantially as set forth, of a main circuit, distributers at each terminal thereof, actuated by time mechanism in correspondence with the hours of the day, subscribers' branch lines connected with the segments of said distributers, whereby corresponding branch lines are periodically and for determined times of sufficient duration for transmission or reception of messages placed in communication, means for correcting the position of the time-controlled distributer at one end of the line, and means for periodically transmitting impulses of electricity over the line to correct the time mechanism.

2. The combination, substantially as set forth, of a main circuit, a distributer at each end thereof, each consisting of a time-actuated trailer, and a circle of segments over which it travels, subscribers' branch lines connected with said segments, a polarized relay, and devices actuated thereby to correct the position of one of said trailers, pole-changing device at the distant station to transmit a current of reversed polarity over the line and through said polarized relay to correct the position of the trailer, and local circuits at each end of the line, including the trailer, a correcting-segment, an electro-magnet, and a source of electrical energy, these parts serving at one station to throw the polarized correcting-relay into circuit and at the other station to operate the pole-changing devices.

3. The combination, substantially as set forth, of a main circuit and source of electrical energy, time-controlled trailers located at each station, segments over which said trailers pass, a local circuit, including said segments and trailer at each station, electro-magnetic devices in said local circuit, a second trailer normally connected with the main circuit, segments over which the second trailer traverses, subscribers' branch lines connected with said segments, and means by which the electro-magnet devices in said local circuit periodically transfer the second trailer from one segment to another.

4. The combination, substantially as set forth, of a main circuit, a source of electrical energy, time-controlled trailers at each terminal of the circuit, means for sending correcting-impulses from one end of the line to the other and periodically bringing both time-controlled trailers to unison, a second trailer at each station normally connected with the main circuit, segments over which said trailer travels, subscribers' branch lines connected with said segments, and means whereby the time-controlled trailer periodically transfers

the second trailer from one segment to another, whereby the main circuit is periodically during a given time connected successively with the independent subscribers' branch circuits for private-line communication.

5. The combination, substantially as set forth, of a main circuit, a source of electrical energy, time-controlled trailers at each terminal of the circuit, means for correcting the position of one of said trailers to maintain the two trailers in the same relative positions, a second trailer or distributer connected with each end of the main circuit, segments over which it is moved, subscribers' branch lines connected with said segments, and mechanism controlled by the first trailer for periodically transferring the second trailer from one segment to another.

6. The combination, substantially as set forth, of a main circuit and source of electrical energy, time-actuated trailers at each terminal of the circuit, series of segments over which the trailers pass, subscribers' branch lines connected with said segments, whereby corresponding subscribers' lines are periodically connected during a sufficient period of time to permit of the transmission or reception of messages, a correction-impulse-sending segment in one series of segments and a correction-receiving segment in the other, the former segment being narrower than the latter for the purpose of allowing a proper margin for correction, and trailer-correcting devices electrically connected with said receiving-segment.

In testimony whereof I have hereunto subscribed my name.

PATRICK B. DELANY.

Witnesses:
CHAS. C. ZUKSCHWERDT,
EDWARD C. DAVIDSON.