(No Model.)

3 Sheets—Sheet 1.

P. B. DELANY.

ELECTRICAL SYNCHRONOUS MOVEMENT.

No. 286,274. Patented Oct. 9, 1883.

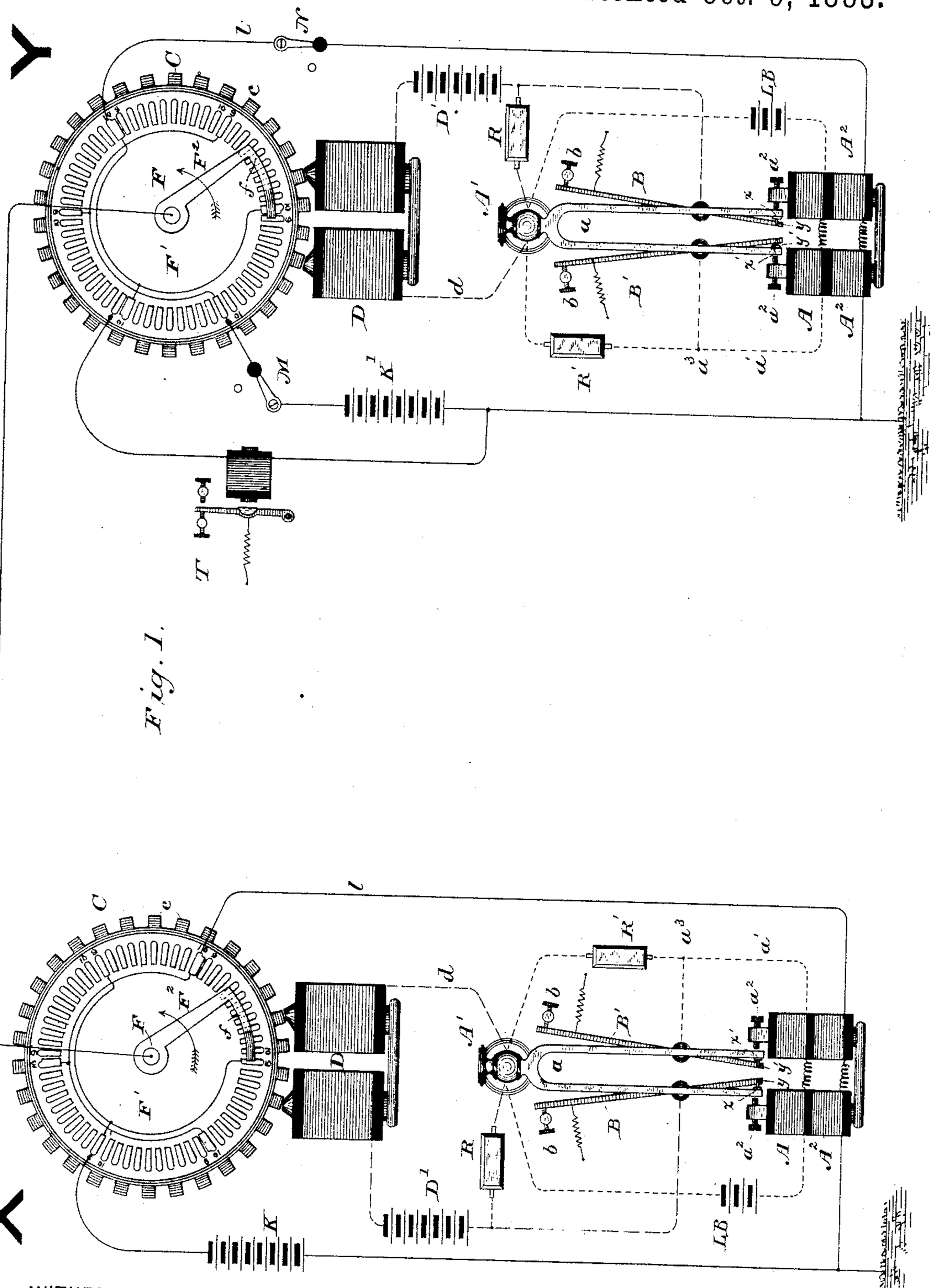

Fig. 1.

WITNESSES

Wm A. Skinkle

Francis D Shoemaker

INVENTOR

Patrick B. Delany

By his Attorneys

Baldwin Hopkins & Peyton

(No Model.)

3 Sheets—Sheet 2.

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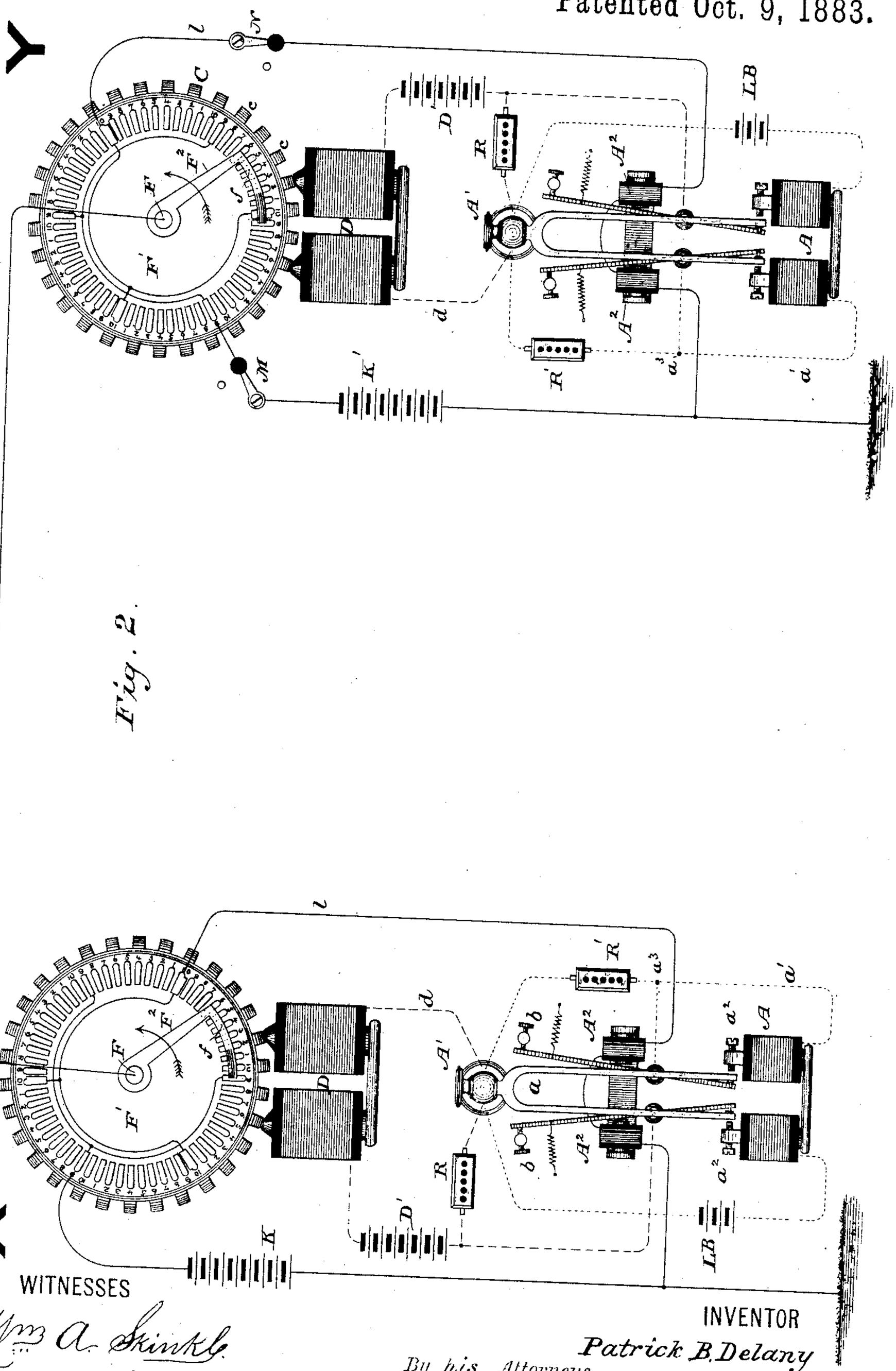

Fig. 2.

WITNESSES

Wm A. Skinkle

Francis D. Shoemaker

INVENTOR

Patrick B. Delany

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(No Model.)

3 Sheets—Sheet 3.

P. B. DELANY.

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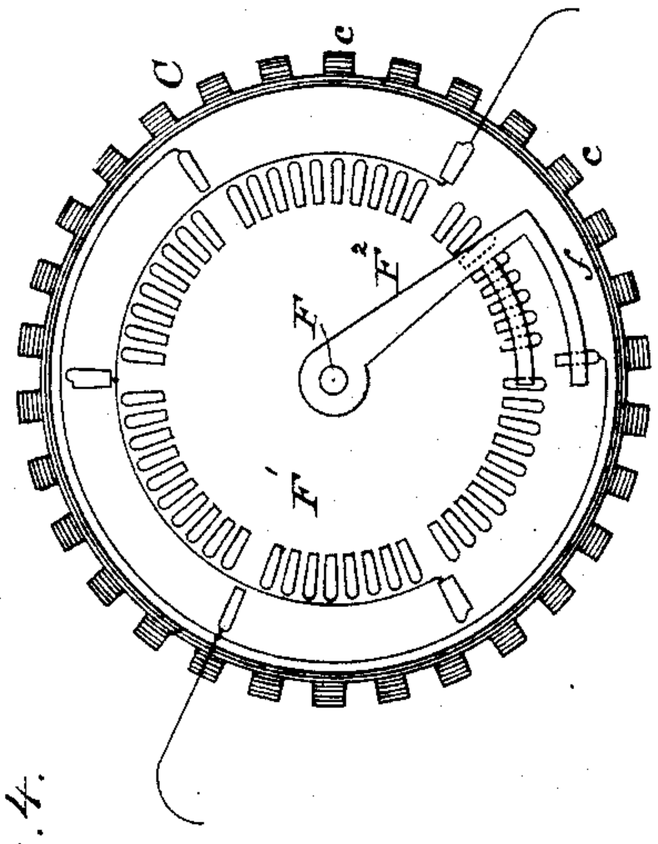

Fig. 4.

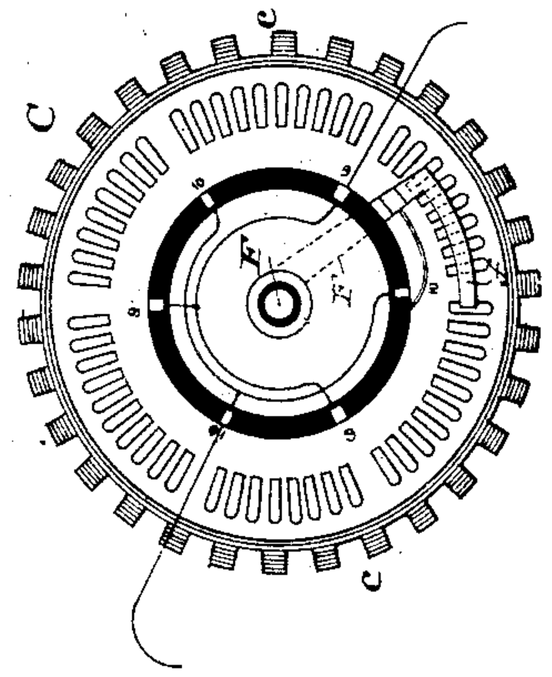

Fig. 5.

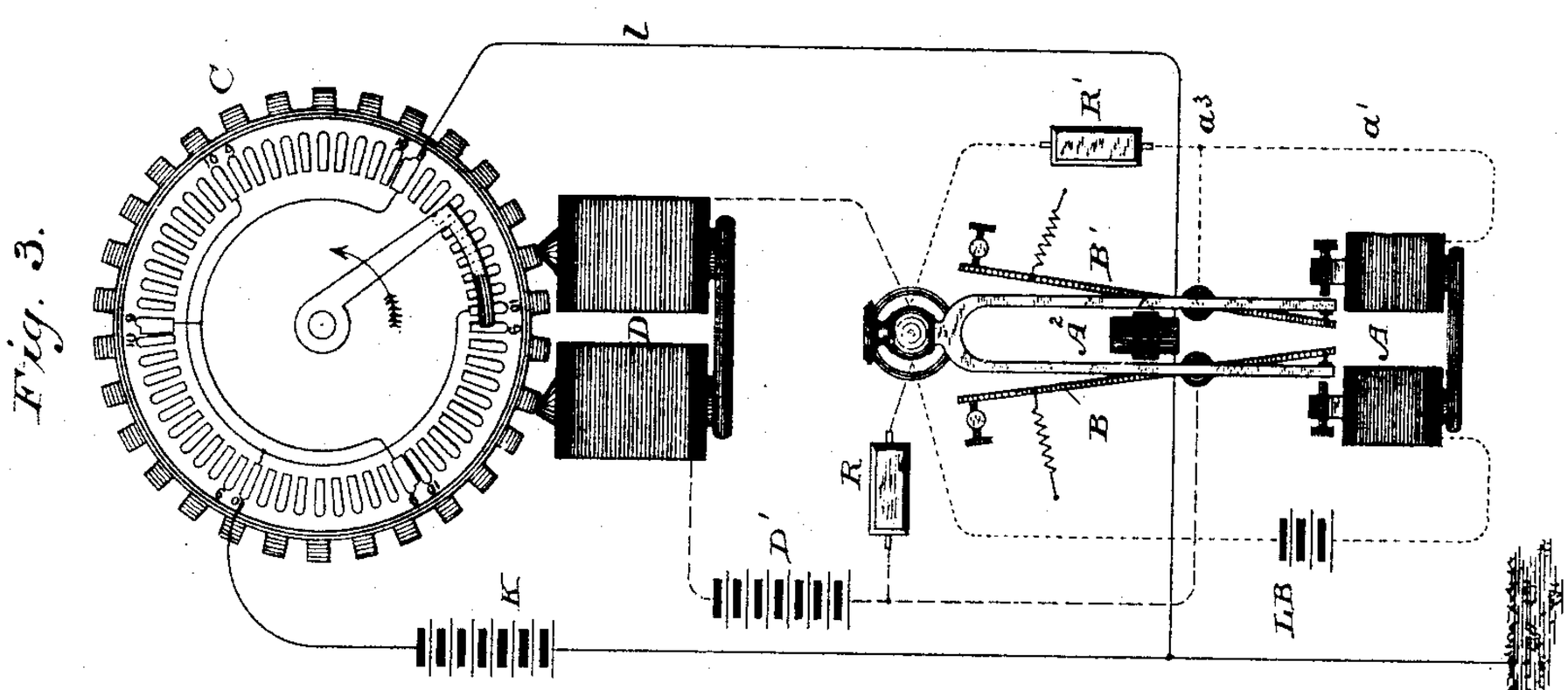

Fig. 3.

WITNESSES

Wm A. Skinkle

Francis D. Shoemaker.

INVENTOR

Patrick B. Delany

By his Attorneys

Baldwin Hopkins & Peyton

UNITED STATES PATENT OFFICE.

PATRICK B. DELANY, OF NEW YORK, N. Y., ASSIGNOR TO THE STANDARD ELECTRIC MANUFACTURING COMPANY, OF SAME PLACE.

ELECTRICAL SYNCHRONOUS MOVEMENT.

SPECIFICATION forming part of Letters Patent No. 286,274, dated October 9, 1883.

Application filed April 12, 1883. (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 the city, county, and State of New York, have invented certain new and useful Improvements in Synchronous Movements, of which the following is a specification.

My invention relates to the electrical synchronous movement of apparatus at different stations. In other words, the apparatus at the different stations must move simultaneously and perform each unitary movement in the same time. Momentary variations within limits, either of acceleration or retardation, which are automatically and immediately corrected by retarding or accelerating electrical impulses under my system are not imperfections in the operation of my invention.

Various devices have heretofore been employed for operating such synchronous movements. Among these a tuned fork automatically vibrated by a local battery has been arranged to transmit to magnets actuating a vibrating fork at the distant station a series of electric impulses corresponding in number with its vibrations. It has also been proposed to employ a tuned fork vibrated by a local battery to make and break a second circuit for electrically driving and rotating apparatus, and from the apparatus so rotated to send to the distant station by means of suitable contacts a predetermined number of impulses for each revolution of the apparatus to vibrate the tuned fork at the distant station, the natural rate of vibration of the fork, which is tuned at the same pitch as the fork at the sending-station, being relied upon to maintain the synchronism of the two forks during the intervals between such impulses.

I am also aware that in an organization like that last referred to it has been proposed to divide the face of the rotary apparatus at each station into a series of electrically-insulated contacts, over which a trailing arm should rotate, some of said contacts being devoted to the sending of predetermined electrical impulses over the line from one end or station for the purpose of vibrating the fork which makes and breaks the circuit of the electrically-rotated apparatus at the other station, and the remainder of the contacts being devoted to other purposes where synchronous movements are required.

The fork-vibrating impulses under the system above outlined are transmitted at predetermined intervals, regardless of the fact whether the fork at the distant station is vibrating in time with the fork at the transmitting-station.

It is very difficult to obtain a series of tuned forks which so accurately correspond as to vibrate at exactly the same rate. The forks being vibrated by electro-magnets, through the coils of which the current is automatically made and broken for each vibration of the fork, the tines of the fork necessarily vibrate more or less through a magnetic field, and for this reason their normal rate of vibration is modified. In vibrating against the contacts, which are necessarily very light and elastic, the tines of the fork alternately follow up the contact of the spring in vibrating in one direction, and are followed by the spring-contact in vibrating in the opposite direction, so that the impulses of magnetic attraction in the vibrator-magnet are more or less prolonged, and for this reason the vibration of the fork is modified. Owing to these considerations, and, perhaps, to others, which it is deemed unnecessary to here recite, it is difficult to obtain a lasting synchronous movement of electrically-connected apparatus.

The object of my invention is to remedy all the difficulties which have heretofore been experienced in obtaining and maintaining such movements, and to provide an apparatus in which the synchronism of the apparatus at the different stations is absolutely insured, and can be maintained for long periods of time without adjustment and with perfect accuracy.

The system of operation and the details of my invention are hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a diagrammatic plan view of a portion of the apparatus, showing two electrically-connected stations; and Fig. 2 is a view showing a slight modification of the arrangement for magnetically correcting the rate of vibration of the forks. Fig. 3 is a view showing apparatus arranged for accelerating corrections, and Figs. 4 and 5 are detail views of modifications.

To maintain the synchronous movement of the apparatus, I make use of a vibrator at each station, electrically actuated by an independent local circuit. These vibrators may be of any character, the sole condition being that they shall vibrate in response to the action of electro-magnets, the circuit in the coils of which is rapidly made and broken, or be vibrated by electrically-controlled apparatus. Thus, a vibratory tongue, bar, reed, or diaphragm of any character suitable to fulfill the conditions of the apparatus may be employed; but it is not necessary that the vibrator shall be confined at one end and free at the other, as a vibratory strip confined at both ends and held either under tension or not may be employed, and such vibrators, confined at the ends, may vary from a straight metal strip to a diaphragm. I prefer, however, to avail myself of tuned reeds or forks which possess a normal rate of vibration depending upon the tone to which they are tuned.

I have shown in the drawings tuned forks of ordinary construction, and I prefer to employ them on account of the ease with which they may be adjusted, although my invention, as above mentioned, is not dependent upon their use.

By employing forks which are tuned to correspond as nearly as possible, so as to give equal or approximately equal numbers of vibrations per second, the apparatus at the different stations may be arranged so that when the forks are vibrated by their independent local circuits at each station their rates of vibration will be approximately equal. Of course, the more equal the rates of vibration the more easily the apparatus can be brought to synchronism, and the synchronous movement may be maintained with fewer correcting-impulses than where the normal rates of vibration of the different vibrators are more unequal.

With this general explanation I will proceed to a detailed description of my invention, which will render the entire system clear to those skilled in the art.

Referring first to Fig. 1, two stations, X and Y, are shown, at which the apparatus is substantially identical. A vibrator or fork, *a*, at each station is automatically vibrated by a local battery, L B, and magnet A, the circuit of the local battery being marked *a'*. The cores of the vibrator-magnet are provided with extension-screws a^2, of magnetic metal, so that the poles of the magnet may be approached to or withdrawn from the tines of the fork with great nicety, to regulate their rate of vibration.

On the inner faces of the tines of the fork platinum contacts *x x'* are placed, which make and break contact with very delicate platinum contact springs or fingers *y y'*, which are carried upon adjustable insulated arms or levers B B', pivoted upon the bed-plate of the apparatus. These arms are adjusted by thumb-screws *b*, against which they are drawn by spiral springs, so that the platinum spring contact-pieces may be adjusted with great delicacy and firmness relatively to the contacts carried on the tines of the fork.

The local circuit, which is indicated by the fine dotted lines, runs from the positive pole of the battery through the coils of the vibrator-magnet to the point a^3. From this point the circuit runs to the insulated lever B', contact-spring thereon, tine of the fork, head or support A' of the fork, and back to the opposite pole of the battery.

In order to prevent sparks between the platinum contact *x'* and *y'*, a shunt containing a resistance, R', is run from the head or support A' of the fork to the point a^3 in the local circuit. When the fork is mechanically started into vibration, its local circuit will be automatically made and broken in the ordinary way, and its vibration be maintained continuously by the electro-magnets A. The contact *x* on the opposite tine of the fork vibrates against a platinum spring contact-finger, *y*, on the insulated arm B, and at that point, as the fork vibrates, makes and breaks another local circuit, which contains the battery and magnet which continuously rotate the transmission apparatus C. This circuit, which I will call the "motor-circuit," is indicated by the broken lines, and runs from the positive pole of the battery D' to the lever B, through its platinum contact-finger *y*, the tine of the fork *x* to the head or support A' of the fork, then by wire *d* through the coils of the motor-magnet D D back to the opposite pole of the battery. A shunt containing a resistance, R, is run from the head or support of the fork to the line of the circuit between the positive pole of the battery and the lever B, to prevent sparks between the platinum contacts *x y*. When the fork is mechanically started into vibration, it will continue to vibrate automatically, and at each vibration will make and break the motor-circuit, and will alternately magnetize and demagnetize the cores of the magnet D D. The cores of this magnet are preferably somewhat pointed, and their faces are formed on the arc of a circle, to permit the teeth *c* of the rotary electrical transmission apparatus C, which teeth constitute the armatures of the magnet D D, to pass in as close proximity to the faces of the poles of the magnet as possible.

The apparatus C consists, essentially, of a stationary table of contacts, F', arranged concentrically around a vertical rotating shaft, F, which is fast on the armature-wheel C and is driven thereby, and is connected with the main line. A radial arm, F^2, projects from the vertical rotating shaft, and carries a trailing finger or circuit-completer, *f*, which traverses the contacts on the circular table. This will be sufficient to enable any one skilled in the art to construct an instrument fulfilling the above conditions. The instrument is, however, fully illustrated and described in detail in an application for improvements in telegraphy filed simultaneously herewith, and serially numbered 91,493.

When the motor-circuit is automatically made and broken at each vibration of the fork, as above described, the cores of the magnet D are alternately magnetized and demagnetized, and the armature-disk caused to rapidly rotate. In starting the disk an impulse of rotation of somewhat greater speed than the speed at which it will be rotated by its actuating-magnet should be imparted to it, and then, as the speed of the disk gradually decreases, the armature-teeth will come into proper relation to the poles of the magnet and into time with the makes and breaks of the motor-circuit, and the disk will be continuously driven by the motor-magnet. With a little practice the disks may be started, as above indicated, without difficulty. This arrangement for driving the armature-disk forms no part of my invention, however, is well known, and needs no further description.

I have shown on the circular tables of contacts F′ sixty insulated contact-pieces, the contacts on each table being numbered from 1 to 10 in six independent series. Two numbers in each series of 10's may be connected in the same circuit, and as there are six series each of the circuits so connected will have twelve contacts for each revolution of the wheel. Thus the 1's and 5's in each series may be connected in the same circuit, the 2's and 6's in another circuit, the 3's and 7's in another circuit, and the 4's and 8's in another circuit. The contacts are shown as connected in this way in four circuits in the application above referred to. They may, however, be connected differently, as desired, with a greater or less number of circuits. When the contacts from 1 to 8 in each series are apportioned among four independent circuits, each circuit will receive twelve contacts and twelve electrical impulses, as will be hereinafter described, for each revolution of the trailing finger or circuit-completer. When the trailing contact-fingers *f* at both stations are upon the contacts bearing the same number, the corresponding instruments, whatever they may be, connected to those contacts at each station, will be placed in communication over the line, the circuit being completed through the contact-finger *f*, the radial arm in which it is mounted, and the vertically-rotating shaft F. As the trailing fingers *f* at the two stations continue to move synchronously, they will pass to the next contact, and successively over all the contacts at each station. During the moment when the moving contact-fingers *f* are upon correspondingly-numbered contact-pieces at each station, the circuit from the contact at one station to the corresponding contact at the other station is complete and entirely independent of the other circuits. The spaces covered by the series of contacts 1, 2, 3, 4, 5, 6, 7, and 8 may be divided differently, or connected in any way to obtain the desired electrical conditions to suit the purpose for which the apparatus may be used. When the contacts are, however, arranged and connected as shown in the drawings, as there are six series of numbered contacts in one revolution of the trailing fingers, the four independent circuits will be each completed twelve times. Assuming that the forks vibrate normally at the rate of eighty-five vibrations per second, and I have operated telegraphically with a fork vibrating at that rate, and that there are thirty armature-teeth on each of the disks C, the armature-disks and trailing fingers will be rotated two and five-sixths times per second, and each circuit will therefore be completed thirty-four times in every second. The circuits are therefore practically unbroken.

Having thus quite fully explained the general operation of the vibrators and motors, and described one way in which the contacts may be connected, I will now describe the means by which the synchronism of the apparatus is obtained and maintained.

In speaking of the contacts as being apportioned among four circuits, it will have been noticed that the 9's and 10's were not described as connected with any of those circuits. These contacts I devote to maintaining the synchronal movement of the apparatus.

Referring to Figs. 1 and 2, it will be observed that at station X three of the 9's farthest removed from each other are connected together and to a battery, K, and that three of the 10's farthest removed from each other are connected to each other and to a line, *l*, which passes through two correcting or regulating coils, A^2 A^2, on the cores of the vibrator-magnet A A, and thence to ground. The remaining three intermediate 9's and 10's are thrown out or unconnected with any circuit. At station Y the 9's corresponding to those connected to the battery at station X are thrown out, while the alternate 9's, which correspond with those thrown out at station X, are connected with the battery K′, and the 10's at station Y, which are connected with each other and with the correcting-coils A^2 A^2 on the cores of the vibrator-magnet, correspond with those which were thrown out at station X, the 10's at station Y, corresponding to the connected 10's at station X, being also thrown out or unconnected. At both stations the three 10's, which are connected with the correcting-coils on the cores of the vibrator-magnet, are built out or extended toward the adjoining 9's, which are not connected with any circuit. When the trailing contact-arms *f* at both stations are moving synchronously and rest on corresponding contacts and on about the same portions of those contacts, the four independent circuits will successively be completed, as described. If the apparatus at Y runs a trifle faster than that at X, the finger *f* at Y will touch the extended side of a 10-contact. While the finger at X is still on a battery-connected 9, a current or impulse of electricity will be sent from the battery K through the contact 9 and finger *f* at station X over the line, and through the contact 10 and line *l* to the coils mounted on the cores of the vibrator-magnet A. The effect of

this pulsation of electricity is to increase the power of the vibrator-magnet and momentarily slow the vibration of the fork and the rotation of the armature disk and finger, and the trailing contact-finger *f* will immediately drop back into its proper relative position. Exactly the same operation occurs if the contact-finger *f* at station X moves faster than that at station Y. There is therefore an automatic mutually-compensating correction from either end of the line as the apparatus at one station moves faster than that at the other. As the connected 10's are extended toward the adjoining 9's, a variation of speed very much less than that sufficient to carry one trailing-finger across the space between any two of the other contacts is immediately corrected, and there is no danger, therefore, of any disturbance by bridging before the variation is corrected.

I prefer to connect the correcting-contacts as above described, so that three correcting-impulses of electricity may be received over the line for each revolution of the trailing finger. Under this organization, when the trailing finger at one station is on a connected 10 the finger at the other station will be on the corresponding unconnected 10, and the circuit will be open, so when the fingers are on the 9's one of them will be connected to a correcting-battery and the other will be unconnected. If desired, however, all the 9's may be connected to each other and to the batteries, and all the 10's may be connected to each other and with the correcting-coils. With the contacts thus connected, when the fingers at both stations are upon 9's, the two correcting-batteries will be opposed to each other, and when they are upon 10's there will be a complete circuit from the ground and correcting-coils at one station to the correcting-coils and ground at the other station; but there will be no battery on the line. Should either one of the fingers run faster than the other, the corrections will take place exactly as above described, and six correcting-impulses may be received in one revolution of the trailing fingers.

It will be noticed that in this instance the correcting or regulating impulses are deterring ones. The apparatus may just as well be arranged for acceleration when one instrument runs slower than the other. The only modification necessary is to reverse the battery and correcting-coil connections, extend the 9's toward the 10's, and place the accelerating-magnet between the tines of the fork, as illustrated in Fig. 3. Such an accelerating-magnet is also described and illustrated in another application for a synchronous movement filed by me simultaneously herewith, serially numbered 91,490, and patented of even date herewith. No claim is made herein to an accelerating-magnet, broadly. In explanation of the operation of such an interposed magnet, I desire to say: The vibrator-magnet, when placed outside of the tines of the fork, as here illustrated, creates magnetic fields, through which the tines vibrate, and which, to some extent, retard and interfere with their normal rate of vibration. Any impulse of electricity, therefore, which increases the strength of these fields acts as a further retardation, as above described, while, on the contrary, if the vibrator-magnet is placed on the outside, as here illustrated, and another magnet be placed between the tines of the fork, any magnetic impulse in such an interposed magnet operates to neutralize the effect of the magnetic fields of the magnets on the outside of the fork, and the tines of the fork are therefore permitted to vibrate with more freedom in response to the makes and breaks in the motor-circuit, and consequently with greater rapidity. At station Y one of the thrown-out 9-contacts is connected to ground through a ticker or sounder, T, and when the apparatus is running synchronously there will be a stroke on the ticker at each revolution of the trailing finger. When the operator, therefore, hears a continued sound on the ticker, he knows that the instruments are running synchronously.

In starting the apparatus the instrument at station X is put in motion, as hereinbefore described, and the adjustment of the apparatus is completed by the operator at station Y. The fork at Y is started into vibration, and the switch M, between the connected 9's and the battery K′, and the switch N, between the connected 10's and the correcting-coils, are left open.

If the trailing fingers happen to start in synchronism, the sounder T will tick, and if the ticking continues for a short time the operator will know the apparatus is synchronous, and closes the switches M and N, and the apparatus is in working condition.

If the apparatus does not start in synchronism, there will be no sound at first on the ticker T; but the operator at station Y, by screwing the pole-pieces away from the tines of the fork, will cause them to vibrate at a speed which, by previous understanding, he will know to be very much greater than that of the fork at the distant station. The finger at Y will therefore gain rapidly on the finger at X, and as they occasionally come into conjunction there will be a stroke on the sounder. Then by gradually adjusting the pole-pieces to approach them to the tines of the fork, the strokes on the sounder will become less frequent, and by continuing the adjustment the fingers will travel together sufficiently long to give a series of ticks on the sounder, and when the ticking on the sounder continues for several seconds or more the switches M and N are closed and the apparatus is in proper condition, any subsequent variation being automatically corrected, as above described.

The organization illustrated in Fig. 2 is identical with that shown in Fig. 1, with the exception that instead of mounting the correcting or deterring coils A^2 A^2 on the cores of the vibrator-magnet, they are placed upon the poles of a supplementary independent magnet, which act upon the outsides of the

tines of the fork to increase the magnetic influence thereon in exactly the same manner as is done by re-enforcing the vibrator-magnet by placing the correcting deterring-coils thereon.

Instead of placing the contacts devoted to synchronism in the same circle with the other contacts, they might be placed on the same table on the edge or outside of the circle, and the radial arm extended and provided with another trailing finger, or a trailing finger of extra width to sweep both sets of contacts, as shown in Fig. 4; or they might be arranged upon a separate table placed above or below the first table and traversed by a separate finger, as illustrated in Fig. 5. Such modifications, however, are immaterial, and many of them will doubtless be suggested by persons skilled in such matters.

The right to hereafter file other applications for any subject-matter herein described or shown, but not fully claimed, is reserved.

In my application of even date, numbered 91,493, I have shown apparatus identical with that herein shown; but said application is confined to the organization of apparatus for telegraphic transmission of messages. In other applications, also filed simultaneously herewith, and numbered 91,490 and 91,491, I have shown organizations designed for the accomplishment of the same result as the apparatus herein described; but such applications are confined to certain organizations and operations not involved herein.

The manner of working by imparting a tendency of acceleration to the apparatus at one station, and then constantly retarding it by electrical impulses from the other station, is claimed in Case No. 91,492, and no claim is made herein to such arrangement.

Any subjects-matter herein shown or described, but claimed in Cases 91,488, 91,491, 91,492, 91,493, or 91,490, filed of even date herewith, or No. 102,928, filed August 6, 1883, are disclaimed herein.

What I claim as my invention is—

1. The combination, substantially as set forth, of a vibrator, means for automatically independently actuating it, and correcting magnetic coils for correcting the motion of the vibrator.

2. The combination, substantially as set forth, of a vibrator, a local circuit and vibrator-magnet, means for adjusting or varying the attraction of such magnet, an electric circuit, and magnetic correcting-coils which act on the vibrator.

3. The combination, substantially as set forth, of the table of contacts, the trailing arm or circuit-completer, the correcting magnetic coils, and the correcting-contacts on the table, with which said coils are connected, the vibrator, means for actuating it, the motor circuit and magnet, and the armature-disk.

4. The combination, substantially as set forth, of the trailing finger or circuit-completer, the correcting-contacts, the battery to which some of said contacts are connected, and the correcting coils or magnet with which others of said contacts are connected.

5. The combination, substantially as set forth, of the trailing finger or circuit-completer, the correcting-contacts connected with a battery, the correcting coils or magnet, and the correcting-contacts connected therewith, the latter contacts being extended toward the adjoining contacts, which correspond in position with the contacts at the other station connected with the correcting-battery.

6. The combination, substantially as set forth, of electrically-connected stations, the trailing fingers or circuit-interrupters, the correcting-contacts connected with the correcting-batteries, the correcting-contacts connected with the correcting-coils, and a vibrator at each station regulated by said coils.

7. The combination of electrically-connected stations, rotary apparatus at each station and means for driving it, the circuit-completers, the contacts, the correcting-batteries connected with some of said contacts, and the correcting coils or magnet connected with other correcting-contacts, which coils control or regulate the speed of rotation of the apparatus at either station whenever it runs out of time with that at the other station.

8. The combination, substantially as set forth, of two electrically-connected stations, at each station an independently-actuated vibrator, rotary apparatus, a motor for driving it controlled by the vibrator, correcting-contacts, a circuit-completer, a correcting-battery with which some of the correcting-contacts are connected, and a correcting-magnet, which regulates the vibrator, with which other correcting-contacts are connected.

9. The combination, substantially as set forth, at two electrically-connected stations, of continuously-vibrating independently-actuated vibrators, with correcting mechanism which automatically corrects the movement of either vibrator when it vibrates at a different rate from the other vibrator, whereby the synchronism of the apparatus is maintained.

10. The combination, substantially as set forth, of a continuously-actuated vibrator, its local circuit and vibrator-magnet, an electric circuit, and correcting-coils which control the vibrator.

11. The combination, substantially as set forth, of two electrically-connected stations, tables of contacts, circuit-completers, actuating apparatus, and correcting coils or magnets, with the correcting-contacts 9 and 10, the alternate 9's at one station being connected to a correcting-battery, and the remaining ones unconnected, and the alternate 10's being connected to the correcting-coils, and the remaining ones unconnected at one station, the arrangement of the connected and unconnected 9's and 10's at the other station being reversed.

12. The combination, substantially as set forth, at electrically-connected stations, of mechanism at each station for successively com-

pleting and breaking the line-circuit through a contact or series of contacts, apparatus for continuously actuating such mechanism, and devices for automatically sending correcting-impulses into the line from one station to the other only when variations in movement occur, to maintain the synchronous movement of the apparatus at both stations.

13. The combination, substantially as set forth, of apparatus connected therewith, having a contact or series of contacts, means for successively placing the line in connection with each of said contacts, apparatus for continuously actuating such circuit-completing devices, and means for automatically acting, primarily, on the driving or actuating devices or apparatus by correcting-impulses of electricity, whereby the speed of the driven apparatus may be controlled and corrected.

14. The combination, substantially as set forth, at electrically-connected stations, of mechanism at each station for successively completing and breaking the line-circuit through a contact or series of contacts, apparatus for continuously actuating such mechanism, means for sending impulses of electricity from one station to the other to correct the speed of said actuating apparatus, and an electro-magnet or helix which acts electro-magnetically upon said actuating apparatus to control or correct its speed.

15. The combination, substantially as set forth, at electrically-connected stations, of mechanism at each station for successively completing and breaking the line-circuit through a contact or series of contacts, apparatus for continuously actuating such mechanism, means for automatically sending correcting-impulses of electricity from one station to the other, and an electro-magnet or helix which acts directly on said actuating apparatus to control or correct its speed.

16. The combination, substantially as set forth, at electrically-connected stations, of apparatus at each station which is continuously actuated or rotated, mechanism for continuously actuating such apparatus, and means for automatically reciprocally correcting the movement of the apparatus at either of the stations whenever it moves out of time with that at the other by an impulse of electricity received from the distant station.

17. The combination, substantially as set forth, of a vibrator, an electro-magnet and its circuit placed to act on the outside of said vibrator to actuate it, and an electro-magnet or coil placed to act on the same side of the vibrator, the coil of the latter magnet being placed in a circuit over which correcting-impulses of electricity may be received to retard the rate of vibration of said vibrator.

18. The combination of two electrically-connected stations, the vibrators, motors, and rotating fingers or circuit-completers at both stations, the battery at one station, with which some of the contacts are electrically connected, contacts at the other stations electrically connected with correcters or controllers for governing the rate of vibration of the vibrator at that station, and a sounder or synchronous tell-tale connected with one of the contacts at said station.

19. The combination of a main line, apparatus connected therewith having two or more correcting-contacts for sending correcting-impulses into the line, placed about a center of motion, a rotary circuit-completer connected with the line which traverses said contacts, and at a distant station similar apparatus having a corresponding number of contacts to receive the transmitted correcting-impulses, whereby the variation of speed of the rotator at the corrected station is corrected at different points in the circle of rotation.

20. The combination, substantially as set forth, of a main line, apparatus connected therewith having two or more correcting-contacts for sending correcting-impulses of electricity into the line to a distant station, a rotating circuit-completer connected with the main line which traverses said contacts, and a correcting battery line or circuit in which all of said contacts are included.

21. The combination of an electric circuit, actuated apparatus connected therewith at different stations, means for insuring the synchronous movement of said apparatus, and a tell-tale or sounder connected therewith to indicate when the apparatus is running synchronously.

In testimony whereof I have hereunto subscribed my name this 3d day of April, A. D. 1883.

PATRICK B. DELANY.

Witnesses:
EDWD. A. CALAHAN,
H. D. MUNSON.

Correction in Letters Patent No. 286,274.

It is hereby certified that in Letters Patent No. 286,274, granted October 9, 1883, on the application of Patrick B. Delany, of New York, New York, for an improvement in "Electrical Synchronous Movements," an error appears requiring correction, as follows: In line 2 of claim 13 the words "connected therewith" should have been omitted; and that the proper correction has been made in the records pertaining to the case in the Patent Office, and should be read in said Letters Patent to make the same conform thereto.

Signed, countersigned, and sealed this 6th day of November, A. D. 1883.

[SEAL.]

M. L. JOSLYN,
Acting Secretary of the Interior.

Countersigned:

BENJ. BUTTERWORTH,
Commissioner of Patents.