4 Sheets—Sheet 1.

W. E. SAWYER.

AUTOGRAPHIC-TELEGRAPH.

No. 171,051. Patented Dec. 14, 1875.

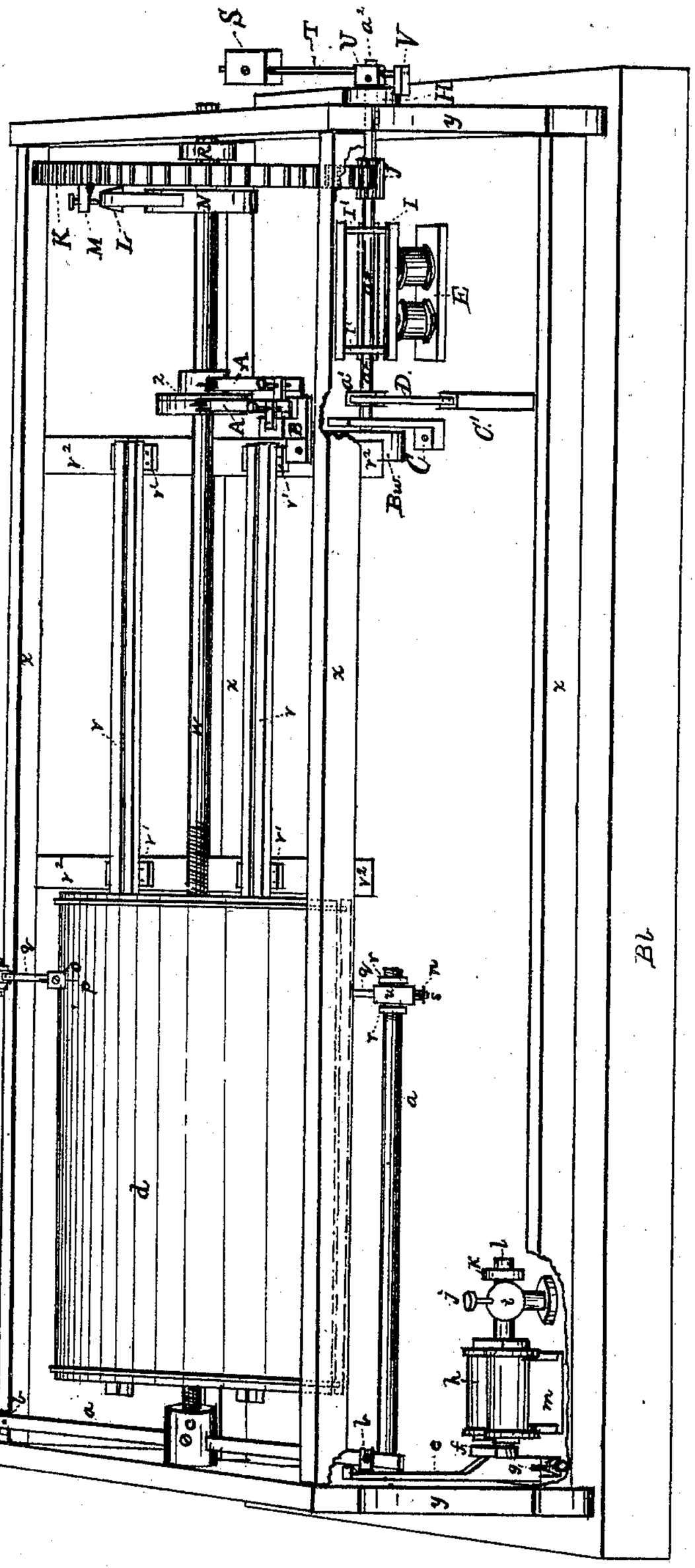

Fig. 1.

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Ha. A. Kittle

Inventor:

W. E. Sawyer

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W. E. SAWYER.

AUTOGRAPHIC-TELEGRAPH.

No. 171,051. Patented Dec. 14, 1875.

Fig. 2.

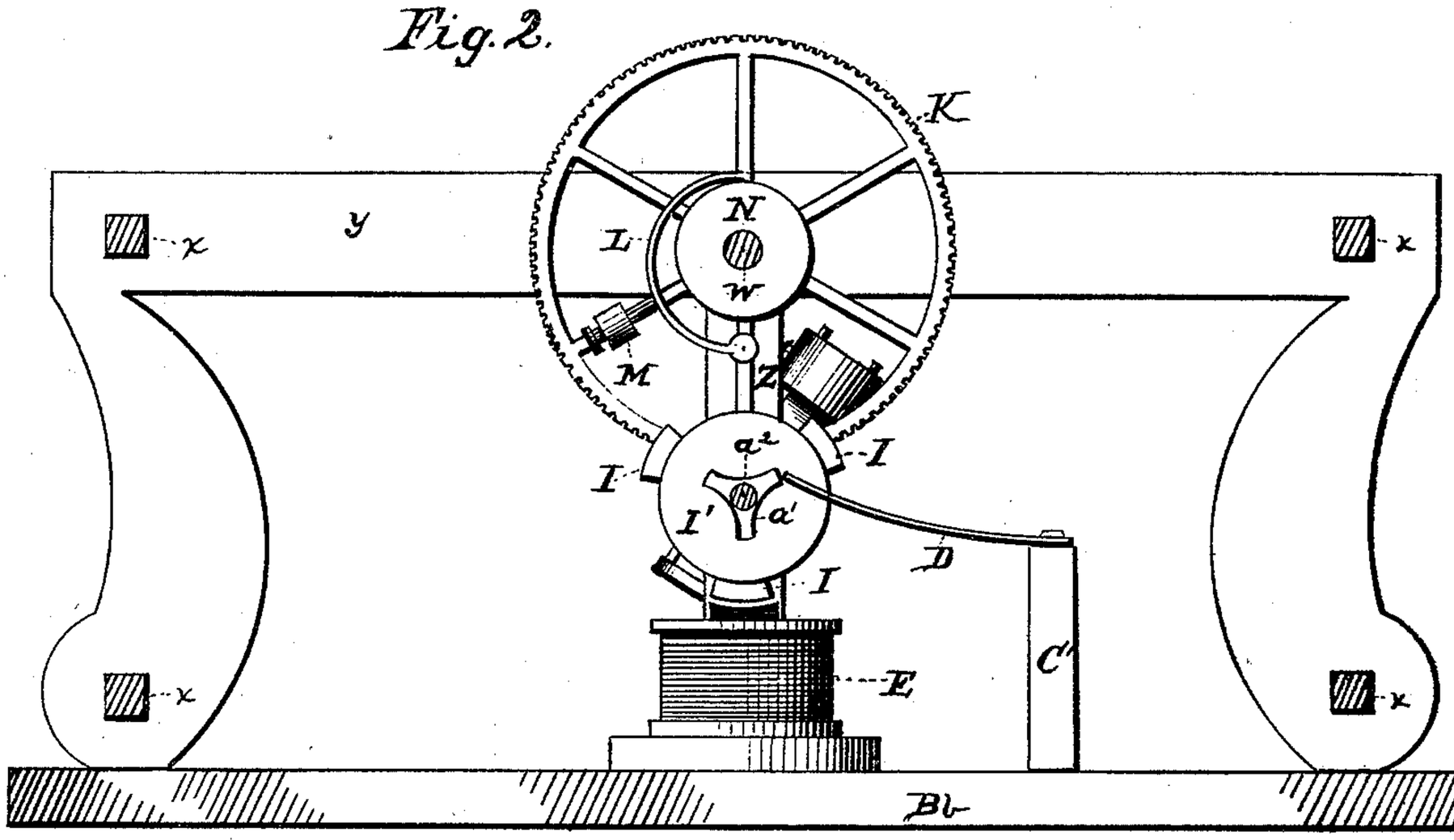


Fig. 3.

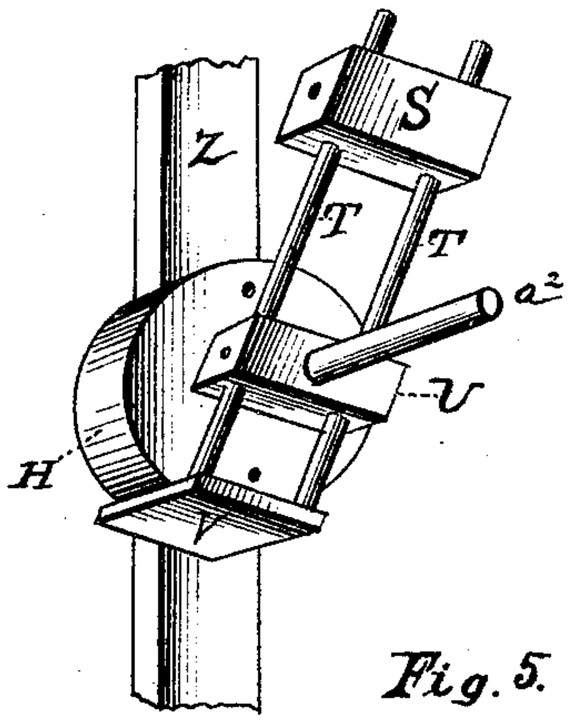


Fig. 5.

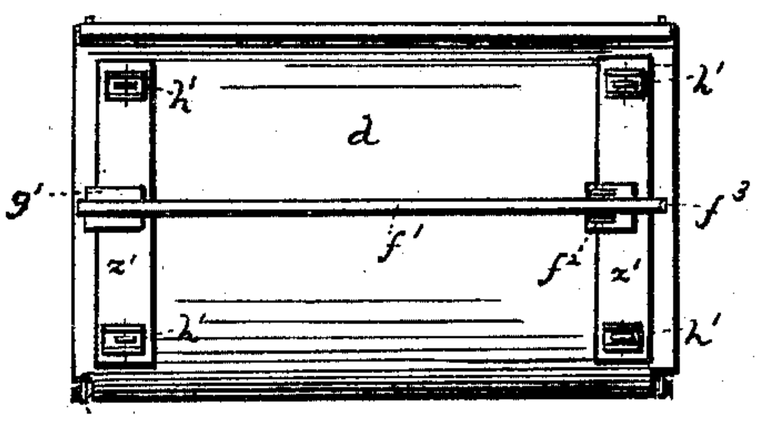


Fig. 4.

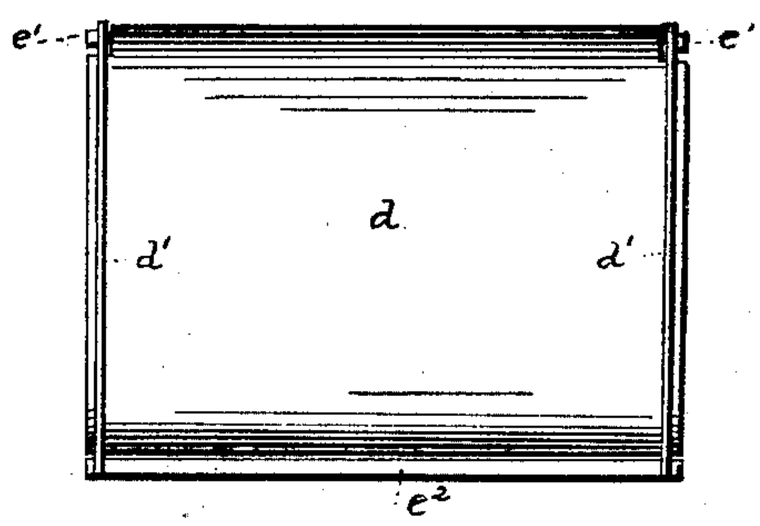
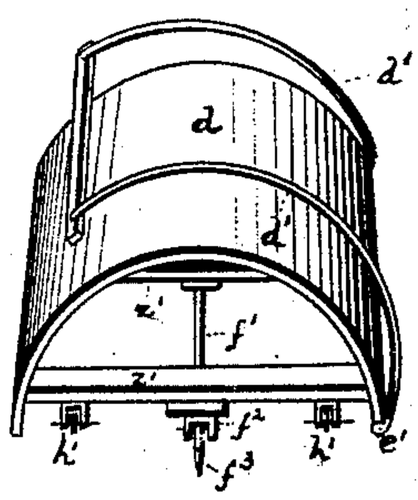


Fig. 6.



Witnesses:
James G. Smith
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AUTOGRAPHIC-TELEGRAPH.

No. 171,051. Patented Dec. 14, 1875.

Fig. 7.

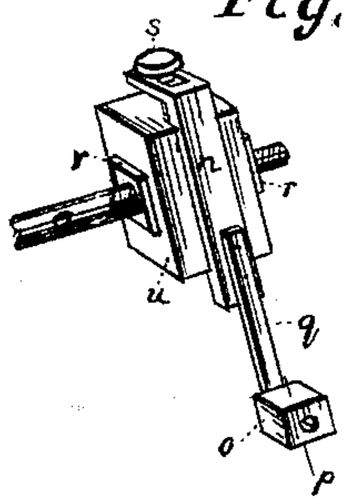


Fig. 8.

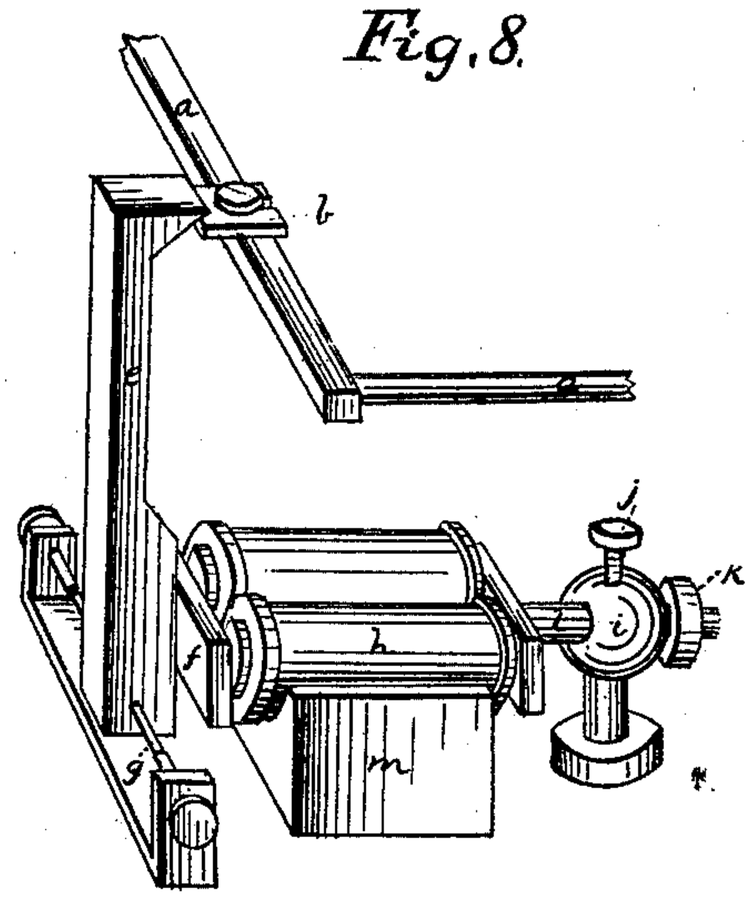


Fig. 9.

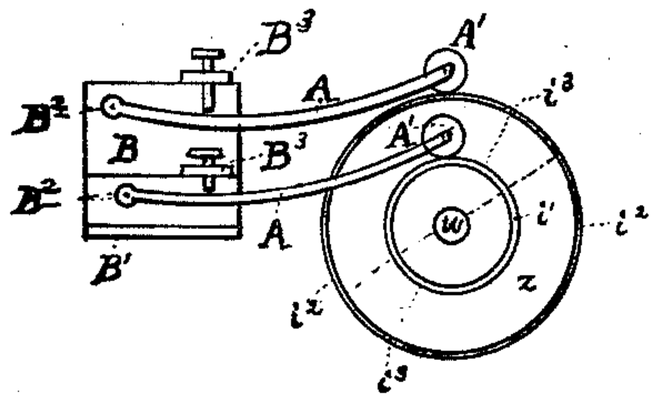


Fig. 10.

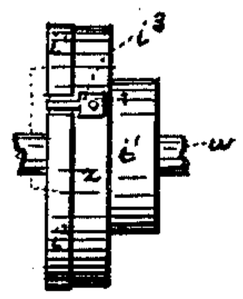


Fig. 11.

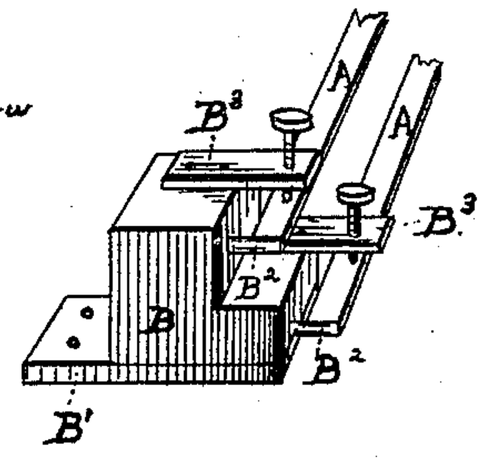


Fig. 12.

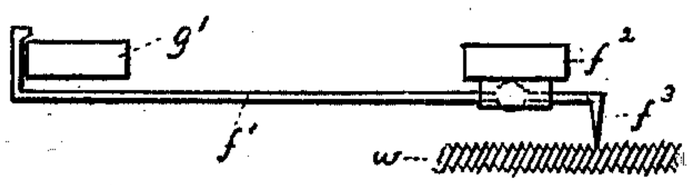
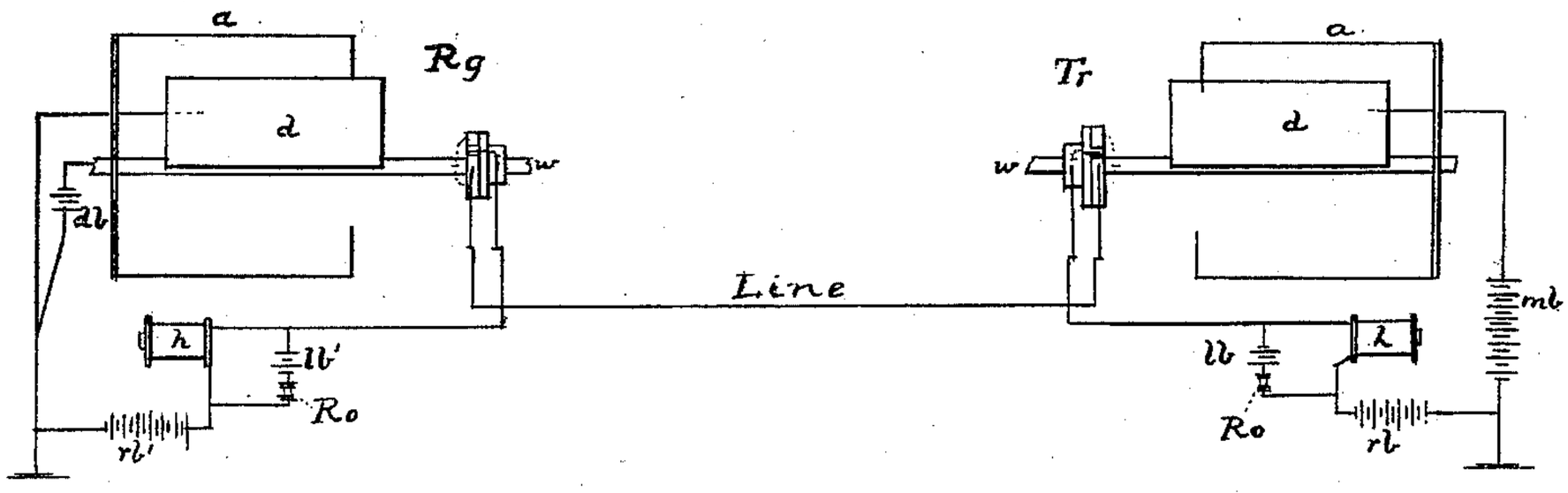


Fig. 13.

Fig. 14.



Witnesses:

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4 Sheets—Sheet 4.

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AUTOGRAPHIC-TELEGRAPH.

No. 171,051. Patented Dec. 14, 1875.

Fig. 15.

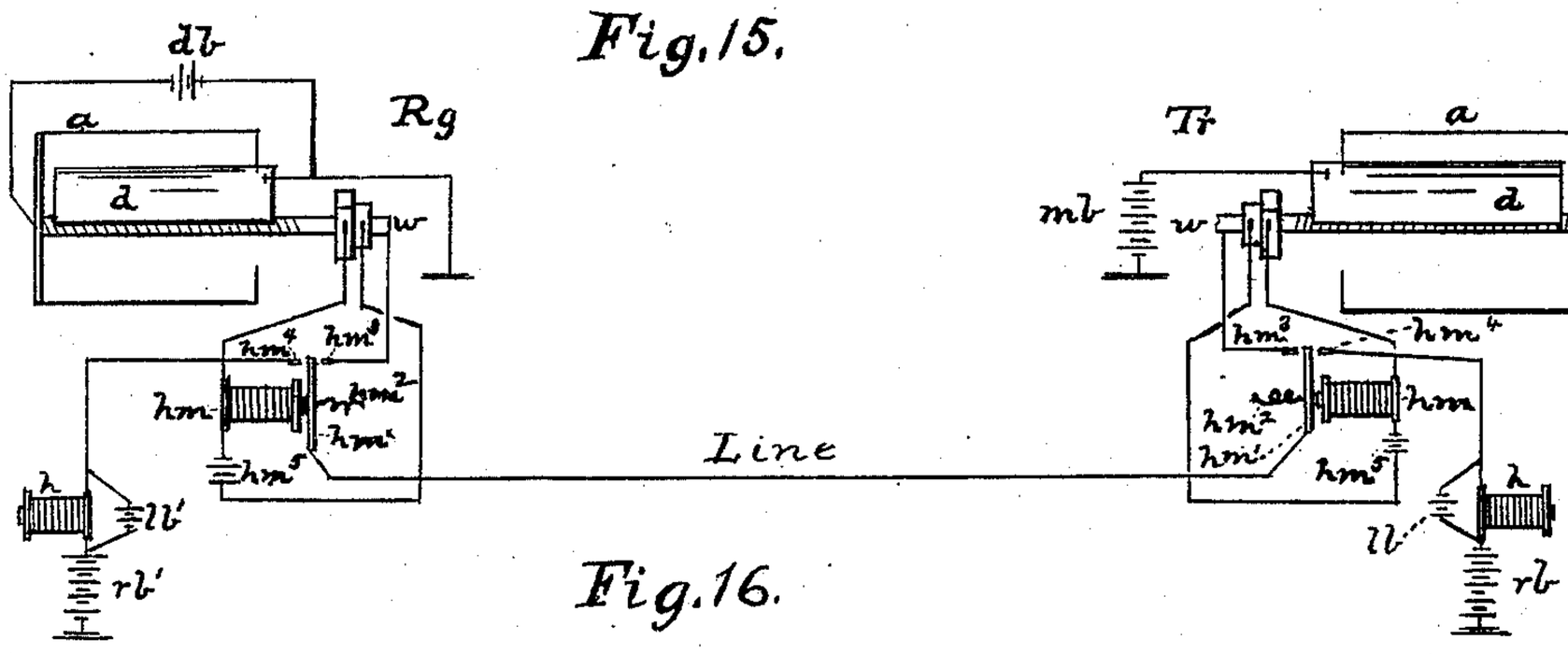


Fig. 16.

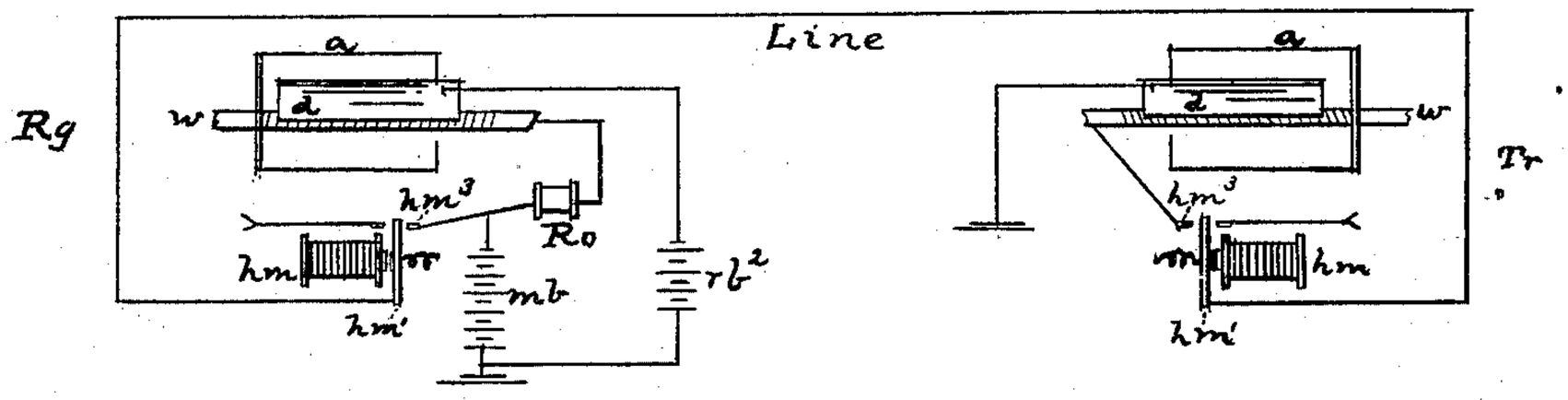


Fig. 17.

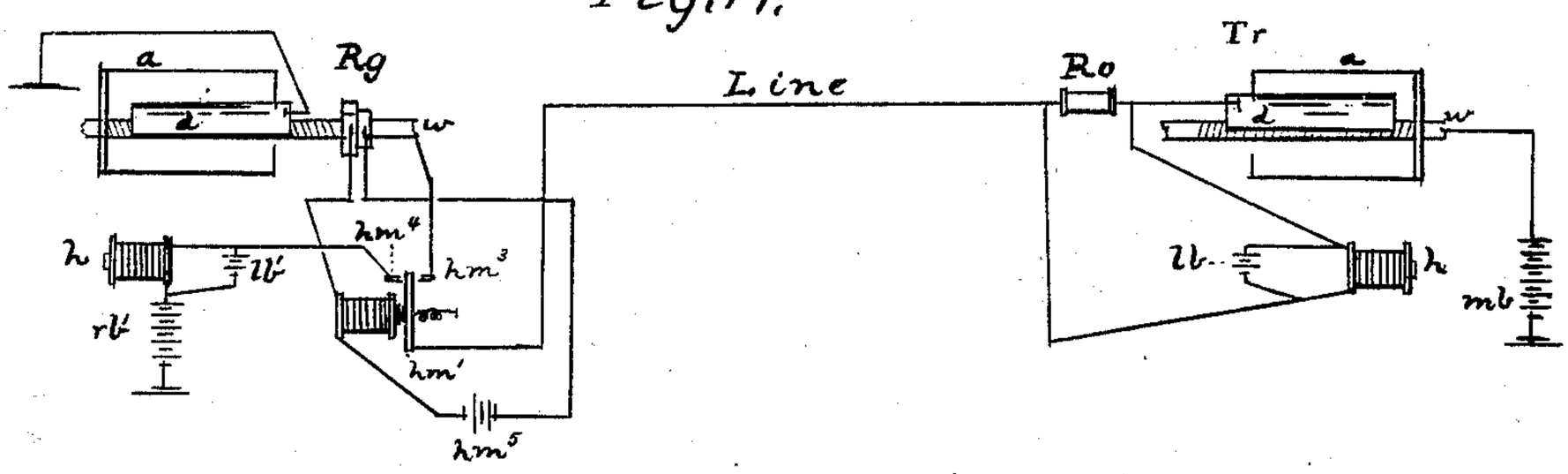


Fig. 18.

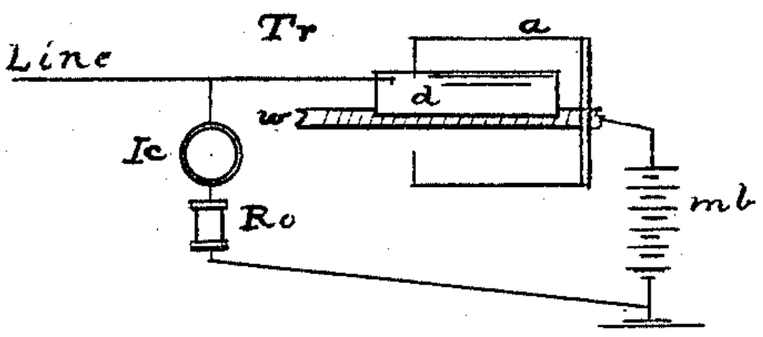
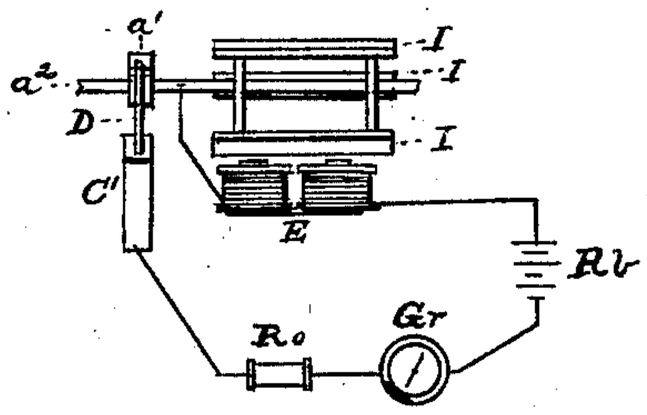


Fig. 19.



Witnesses:
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H. W. Baskette

Inventor:
W. E. Sawyer.

UNITED STATES PATENT OFFICE.

WILLIAM E. SAWYER, OF NEW YORK, N. Y.

IMPROVEMENT IN AUTOGRAPHIC TELEGRAPHS.

Specification forming part of Letters Patent No. **171,051**, dated December 14, 1875; application filed November 5, 1875.

To all whom it may concern:

Be it known that I, WILLIAM EDWARD SAWYER, of the city of New York, in the State of New York, have invented certain new and useful Improvements in Copying or Autographic Telegraphs, of which the following is a specification:

My invention relates to certain mechanism for the purpose of accomplishing autographic or fac-simile transmission of messages over lines of telegraph, and to various electrical circuits therefor.

In my Letters Patent No. 159,460, dated February 2, 1875, the principal features of fac-simile transmission are so fully outlined that it is deemed unnecessary to present an extraneous description here. I shall, so far as possible, confine myself to a description of the mechanism of my present invention.

One of the principal features of my present invention is found in my method of obtaining a regular and steady motion of the required mechanism.

In all existing systems of fac-simile telegraphs the action is obtained from the ultimate point in the mechanism—that is to say, the transmitting and recording points, styles, or other similar devices, or accompanying devices, are actuated by a train of wheels, to the slowest-moving of which is applied the driving-power. The inherent fault in this mechanism is, that any variation in the primary actuating medium is exaggerated by every multiplication of the motion, so that what would be a slight and inconsequential error in the revolution of the shaft to which the power is applied is magnified in marked degree at the ultimate or transmitting and recording shafts, for reasons that do not require explanation. The only instance in which this error has been avoided is that of Casselli, who employs a pendulum as the actuating-power, with the transmitting and recording mechanism situated at a point of the pendulum where the exaggerations of the weighted lower extremity are reduced—namely, near the pivot upon which the pendulum gravitates. By means of this device Casselli has succeeded in obtaining an absolute synchronism; but to the delicacy of parts of the mechanism, and the difficulties of their management, there are serious objections, and there is a most serious objection to the variations in speed of the motion of the pendulum, which speed of motion, when the weight of the pendulum is at the lowest point in the arc it describes, is much greater than at the starting or intermediate points.

It has been my aim in the present invention to obviate all these difficulties, and, by the employment of the simplest mechanism, to render the instruments so easily managed as to dispense with operators of mechanical skill. In the attainment of this end it has been necessary to avoid all mechanism which would tend to exaggerate primary errors; and, instead of the ordinary method, I employ, for the actuating mechanism, rapidly-moving parts or revolving wheels, which are so geared, and move so rapidly, that the more slowly moving or revolving parts, comprising the transmitting and recording mechanism, may be made to attain any desired speed of motion. Thus, for instance, and as an example merely, if the shaft to which is attached the transmitting or recording mechanism shall make one hundred revolutions per minute, the shaft to which is applied the driving-power shall be made to revolve at the rate of one thousand times per minute, in order to produce the speed of one hundred revolutions in the shaft of the transmitting or recording mechanism, whereby an error of one degree in the driving-power is decreased at the actual working-point to an error of but one-tenth of one degree, contrary to what would occur in ordinary fac-simile mechanism, in which an error of one degree at the driving-shaft would be magnified to an error of ten degrees at the transmitting or recording point in the mechanism, where the least error is desirable.

Such is the chief function of my present invention, and in its attainment I do not limit myself to the application of any special power.

I have preferred to apply to my mechanism the power generated by an electro-motor, and have preferred to employ a train of gear-wheels; but it is obvious that I may make use of any other power, such as compressed air, steam, heat, water, or other equivalent, or, in place of a train of gear-wheels, may make use of friction-rollers, or of a lever or a series of

levers, or a large wheel with the transmitting and recording mechanism attached to a point where the motion is less than at the point at which the power is applied, or both. Numerous applications of my principle are readily suggestive. Further, in order to keep the mechanism at different stations in synchronous motion, I prefer to regulate the same periodically by means of a line-current, the operation being to bring the instruments, or at least one of them, periodically to a complete, or nearly complete stop, so far as the transmitting or recording mechanism is concerned, and set them in motion together, it being understood that the actuating mechanism does not stop when the transmitting or recording mechanism is stopped. This will be understood upon reference to the drawings and accompanying descriptions.

The motion of the mechanism is steadied or governed by a centrifugal governor of a new design, the chief advantages of which are its simplicity and the facility with which it may be adjusted. In addition to the governor, the speed of the motor is regulated by a rheostat (shown in the drawings) in the circuit of the motor, but which may, with equal advantage, be placed in a secondary circuit from the motor-battery, so as to lessen the force of the battery in the motor-circuit by diverting a portion of the battery into the circuit of the rheostat. A galvanometer should be used for the purpose of noting the force of the battery, in order that the battery may be maintained at a uniform strength.

With this general reference to the nature of my invention, I will proceed to describe the construction of the mechanism in detail, so far as is necessary to an understanding of the same by persons skilled in the art.

In the drawings accompanying and forming a part of this specification, Figure 1 is a general view of the instrument for transmission and reception of messages. Fig. 2 is an interior sectional end view of parts of the same. Fig. 3 is a view of the centrifugal governor. Figs. 4, 5, 6, and 12 are views of the semi-cylinder, from and upon which messages are sent and received, and parts of the same. Fig. 7 is a view of the transmitting or recording point and holder therefor. Fig. 8 is a view of the arrangement for stopping and releasing the mechanism. Fig. 9 is a view of the circuit-changer, connecting with the stopping and releasing mechanism, Figs. 10 and 11 being other views of the same. Fig. 13 is a view of a shaft, having a right-hand and a left-hand thread cut thereon; and Figs. 14, 15, 16, 17, 18, and 19 are views of circuits.

Like letters indicate similar parts in all the figures.

Referring to Fig. 1, B*b* is the base. *x*, *y*, and v^2 are any suitable metallic frame. *v v* are two metallic railways of any desired form, shown as grooved for the trucks of a car, which railways are insulated from the frame by the supports v^1. Upon these railways runs the semi-cylindrical car *d*, (better shown in Figs. 4, 5, and 6.) There are four trucks, *h'*, attached to the car by means of cross-pieces *z'*, thus forming an electrical connection between the surface of the car *d* and the railways, from which, although not shown in the drawings, any medium of connection may be carried to an insulated binding-post.

The actual operation of transmission by my invention is not essentialiy different from that of ordinary fac-simile telegraphs. A metallic point draws imaginary lines over a slowly-advancing metallic surface, upon which is an insulating writing, and the interruptions of the circuit, occasioned by the point coming upon the lines of writing, effect the record at a distant station, which record—chemical, or it may be otherwise—is a fac-simile of the insulating-lines of writing, owing to the fact that the recording-point moves over the advancing receiving-blank in synchronism with the motion of the transmitting-point. As I do not employ a complete cylinder traversed by the point, but a half-cylinder, I employ two points, so that the instant, or nearly the instant, that one of the points leaves the surface of the half-cylinder, the other point is coming upon the same.

The metallic plate, upon which is the insulating writing or the chemical receiving-paper, is placed upon the semi-cylindrical car, when the curved frame d' e^2, pivoted at e^1, is shut down upon it, thus holding it securely in place. The car is moved along under the points by means of the point f^3, which is caused to close into the thread cut upon the main shaft *w*. This point f^3 forms the end of a spring-piece, f^1, (better shown in Fig. 12,) pivoted at f^2, and insulated from the car by means of the insulating-pieces g' f^2, which are fastened to cross-pieces *z'*. The turned end of the spring-piece f^1 closes over the insulating-piece *g'*, thus holding the point f^3 to a secure bearing in the thread on shaft *w*. When it is desired to stop the movement of the car, this end is thrown off the piece *g'*, thus allowing the point f^3 to rise from the thread.

Around and over the semi-cylinder, transversely, the shaft *w* carries two right-angular arms, *a*, fastened in hub *c*, which arms carry the transmitting or recording points *p* around the semi-cylinder.

In this manner, the arms being insulated from the car, the transmission process hereinbefore described is accomplished. So soon, or nearly so soon, as the point upon one of the arms *a* is leaving the surface of the semi-cylinder upon one side, the other point is coming upon the semi-cylinder upon the other side, so that one or other of the points is always bearing upon the message.

In the form shown in the drawings, both points travel in the same imaginary track; but one of the arms *a* may be shortened longitudinally with the semi-cylinder, so as to allow each point to traverse a different section of the semi-cylinder, the same arrangement—of

only one point being upon the semi-cylinder at a time—being maintained, as matter of course.

The motion of the shaft *w* is brought to a stop at the instant, or nearly so, that one of the points *p* is leaving the surface of the semi-cylinder, and the other point is coming up upon the opposite side of the same by means of the adjustable projecting piece *b*, held in place by a screw on arm *a* coming in contact with the beveled detent of armature-lever *e*, better shown in Fig. 8, in which *h* is a polarized magnet; *m*, the rest for the same; *f*, the armature; *g*, the pivot; *i* and *j*, the adjusting-standard and set-screw; *l*, the rod by means of which and the nut *k* the magnet is drawn back from the armature. This magnet may be any form of polarized magnet; but I have shown it in the figures relating to the line-circuits as polarized by a local battery. The magnet is depolarized or rendered neutral by the transmission automatically over the line of a reversed current at the instant the arms *a* of both the transmitting and the receiving instruments have been brought to a stop, when the armature is released, and the beveled detent yields to the motion of the projecting piece *b*, thus releasing the arms *a*, after which release the magnet again acts, and the detent is ready to intercept the next arm, when the operation of depolarization and release is repeated.

In the frame-work, *y y* will readily be understood as the end pieces, and *x x x x* the cross-rods for identifying the same. There are cross-rods v^2, mainly for the purpose of supporting the railways.

The transmitting and recording points involve a mechanism of their own, as follows: *q* is a straight or curved spring, carrying the holder *o* of the transmitting or recording point *p*. This is best shown in Fig. 7, where *n* is a right-angular piece, sliding in a dove-tailed groove in the metallic piece *u*, and having a slot cut in its upper end for the screw *s*, by means of which the point is adjusted up or down, and therefore its bearing upon the surface of the semi-cylinder regulated. *r r* are check-nuts, by means of which the piece *u* is held in position on the end of the arm *a*. The object of this arrangement is to secure great adjustability of the point; but I do not confine myself to this particular form, as many readily suggestive devices may be employed to accomplish the same purpose—for instance, the right-angular piece *n* may be grooved for another right-angular piece adjustable longitudinally with the semi-cylinder.

An essential feature of my invention, as already intimated, consists in the mechanism by means of which the transmitting or recording points are brought to a stand-still and the forward motion of the semi-cylindrical car arrested without disturbing the motion of the accompanying mechanism.

The main shaft *w* is actuated as follows: Motion is imparted from the motor-shaft a^2 and its pinion J to the large gear-wheel K, which is loose upon the shaft *w*. R is a flange upon the shaft *w*, whose object is to keep the gear-wheel K in place. N is a flange, which, like the flange R, is fastened to the shaft, and serves to keep the gear-wheel in place, and also operates to transfer the motion of the gear-wheel to the shaft through the medium of the friction-spring L, (better shown in Fig 2,) which, pivoted to the gear-wheel, is set so as to bear upon the flange with any desired force, by means of the set-screw in the projecting piece M, also attached to the gear-wheel.

It is obvious that as the gear-wheel turns, the shaft *w* also turns when unobstructed; but the instant that the projecting piece *b* on the arm *a* comes into contact with the beveled detent of armature-lever *e*, the revolution of the shaft *w* is arrested without the motion of the gear-wheel or the motor-shaft ceasing. These points are so plain that it is unnecessary to treat them in detail.

The motor I have shown in a single form. It is obvious that it may have any one of a great many forms.

Referring to Figs. 1 and 2, a^1 is the motor-circuit establisher, by means of which the motor-battery is thrown into the magnet E. The connections to binding-posts may be of any form, and are not shown in the drawings. D is a spring bearing upon the circuit-establisher, and fastened to the standard C′. The spring may be made adjustable by any of the well-known methods. I I I are armatures fixed to flanges I′ on the motor-shaft a^2. C is a standard, in which the motor-shaft has a bearing at one end, the other bearing being in the piece Z. (See Fig. 2.) One pole of the motor-battery is connected to the standard (metallic) C′, the other pole being connected to one side of the motor-magnet E, the other side of the magnet being connected to the frame-work or standard C; therefore, when the spring D bears upon the projections of a^1, the circuit of the motor-battery is through standard C′, spring D, circuit-establisher a^1, to frame or standard C, frame or standard C to magnet, and from the magnet back to battery. B*w* is a balance-wheel on the motor-shaft.

The centrifugal governor corrects variations in motion of the motor-shaft. This device is best shown in Fig. 3, where Z is a standard fastened to end piece *y* of the frame. To this standard is fixed the flange H, the flange being immovable. Through the flange passes loosely the motor-shaft a^2. Fastened to the motor-shaft is a piece, U, through which slide loosely two rods, T T, which again pass through or enter a sliding weight, S, which may be adjusted so as to be at any point on the rods T T by means of a set-screw. V is a shoe, in which the ends of the rods are fixed.

It is obvious that as the shaft a^2 revolves, the weight S will be thrown out, and the shoe V thus brought to a bearing on the flange H with a degree of force commensurate with the

speed of revolutions, creating a friction, which tends to keep the motion uniform.

It will, from the foregoing, be understood that the motor, the pinion J, and the gear-wheel K are in constant motion, while the transmitting and recording mechanism *w*, *d*, and *a* may be at a stand-still. Thus, as the arms *a* describe a revolution with the shaft *w*, the semi-cylindrical car *d* is slowly advanced by means of the thread and the point f^3, whereby spiral lines, in accordance with the fineness of the thread on shaft *w*, are drawn over the semi-cylinder, until, finally, the entire surface has been covered by these fine imaginary lines. A balance-wheel, or its equivalent, may with advantage be fixed to the gear-wheel K. It will now be assumed that one of the transmitting or recording points *p* has been carried over the semi-cylindrical surface of the car, and that another is about to come upon the same. At this instant the motion of the arm *a* is arrested by the projecting piece *b* coming in contact with the detent of armature-lever *e*. At the same instant, or nearly so, the circuit of the main line is changed by means of the circuit-changers A A and *z*, (better views of which are obtained in Figs. 9, 10, and 11,) *z* being an insulating-piece in the shaft of a double cone. On the lesser cone of this insulating-piece on shaft *w* is an unbroken metallic rim, i^1, which is connected electrically with two metallic pieces, i^3, set upon the greater cone, equidistant, and insulated from the remainder of the periphery of the greater cone. The periphery of the greater cone is thus divided into halves, excepting the slight spaces occupied by the pieces i^3. Upon the remaining spaces of this periphery, and insulated from the pieces i^3, are placed metallic half-circles, nearly, i^2, which are connected with the main shaft *w*, and consequently with the frame-work of the instrument. In Fig. 10 is seen how the piece i^3 is fixed to the periphery of the greater cone, so as to project between and separate the pieces i^2. A′ A′ are metallic rollers, or they may be springs bearing upon the greater and lesser peripheries, and insulated from each other by means of the insulating-piece B, which is fastened to the cross-rod of the frame-work by means of the bottom piece B^1.

The shape of the insulating-piece B will be best understood from Fig. 11. B^3 B^3 are metallic pieces, insulated from each other, and holding screws, which regulate the tension or pressure of the rollers A′, the springs A being pivoted at B^2. The purpose of this circuit-changer will be understood from Fig. 14, in which the line-wire is shown connected with the roller bearing upon the greater periphery. The greater periphery being, by means of the metallic half-circles i^2, connected with the main shaft *w*, the line, while the roller A′ is bearing upon a piece, i^2, is connected to the transmitting or recording point *p* through the medium of the arms *a*. In Fig. 14, T*r* is the transmitting, and R*g* the receiving, instrument. *h* is the stopping and releasing magnet; *mb*, the main battery; *lb*, the local battery, by means of which the magnet *h* is kept polarized. R*o* is a rheostat in the circuit of the local battery *lb* and magnet *h*, for the purpose of regulating the force of polarization.

The battery which acts by the main-line circuit to depolarize the magnet *h*, and thereby release the arms *a*, is indicated by *rh*. Now, it is obvious that as the upper roller is bearing upon the piece i^2 the circuit is from the earth at the transmitting end of the line, main battery *mb*, to the semi-cylindrical car *d*, and thence to the transmitting-point and arm *a*, main shaft *w*, and piece i^2, to the roller connected with the line, and, at the receiving-station, from the line to the roller, and from the roller to the piece i^2, shaft *w*, arm *a*, and recording-point, semi-cylinder *d*, and earth. Whenever, in this case, the transmitting-point *p* is bearing upon the metallic surface of the message, the battery *mb*, with negative pole to the line, will, by its flowing into the line, neutralize the local marking-battery *db* at the receiving-station, the positive pole of which is put to the shaft *w*, and, therefore, to the arm *a* and recording-point, and the negative pole of which is put to the semi-cylinder *d*. On the other hand, whenever a transmitting-point comes in contact with an insulating-line of writing, the main battery *mb* will be taken from the line, and the local marking-battery *db* at the receiving-station will effect a discoloration of the chemical paper. For all these operations either induced currents or battery-currents of great intensity are preferred.

After the transmitting and recording points have traversed in unison the semicircle of the cars *d*, and just as they come to a stop, the roller A′, which is connected with the line-wire, and which has been bearing upon the rim i^2, comes into contact with the metallic piece i^3, and the circuit is established as follows: From the earth at the transmitting end, through the reversed battery *rb*, releasing-magnet *h*, roller A′, bearing upon the lesser periphery of the double cone i^1, thence to the piece i^3, and thence from the upper roller A′ to the line; and, at the receiving-station, from the line, through the piece i^3, to the rim i^1, roller A′, magnet *h*, and reversed battery rb^1 to earth. The combined forces of the two reversed batteries *rb* rb^1, at both the transmitting and receiving stations, overcome and neutralize the polarization of the magnets *h*, polarized by the local batteries *lb* and *lb′*, and the armature-lever *e*, Fig. 1, yields to the upward pressure of the arm *a*, actuated by shaft *w* and friction-spring L, the armature-lever *e* offering no resistance to the passage of the projection *b*, when the arms *a*, thus set in motion, again carry the points *p* over the surface of the semi-cylinders, which operation is repeated until, finally, by the forward motion of the car *d*, the whole surface of the semi-cylinder is covered by imaginary spiral lines.

It is obvious that an entire cylinder may be employed instead of the semi-cylinder described, in which case only one transmitting or recording point would be required; or the metallic surface presented to the points may be only the quarter of a circle, or any division of a circle, the transmitting or recording points being of number corresponding. Both the batteries *rb rb*[1] are necessary to neutralize the polarization of magnets *h*, so that neither of the instruments can start until both have arrived at the starting-point.

In all existing fac-simile telegraphs the transmitting and recording mechanism operates in the same direction; but this is fatal to the transmission of a message which has been transferred from the blank upon which it is written to a metallic plate or surface previous to transmission. In order that the received message shall appear as the message is written, it is necessary to give the mechanism a peculiar direction—*i. e.*, if the cylindrical cars of transmitting and receiving instruments move in the same direction, the arms *a* move in opposite directions; and if the arms *a* run in the same direction in each instrument, the cars must run in opposite directions. In either case the transferred message, which is a reverse of the original, is received as written. In order to accomplish this opposite motion, however, it is necessary that upon the shaft *w* of one instrument shall be a right-hand thread for moving the car, and that upon the shaft of the other instrument shall be a left-hand thread. Where there are more than two stations on a line from and to which messages are transmitted, the shaft *w* of every instrument should have a right-hand and a left-hand thread cut thereon, as indicated in Fig. 13, it being understood that the instrument transmitting shall always work by one thread, and the instruments receiving shall always work by the other thread.

In Fig. 15 is shown a mere modification of the circuit indicated in Fig. 14. In this figure a relay or sounder is employed to change the circuit of the line from the transmitting or recording mechanism to the releasing-magnet *h*, the circuit-changer, Figs. 9, 10, and 11, merely serving to operate the relay or sounder.

I need not point out the facility with which many other forms of connection for operating the relay may be employed.

In Fig. 15, *hm* is a relay or an ordinary magnet, the armature-lever of which is connected with the line. *hm*[2] is a spiral spring for retracting the armature. When the magnet is not actuated the circuit is from line to the contact-point *hm*[3], main shaft *w*, and arm *a*, point *p*, to semi-cylinder *d*, and thence to battery and earth at the transmitting-station, and thence to earth at the receiving-station. The local battery *hm*[5] actuates the magnet *hm*, the circuit being through the magnet to the two contact-rollers A′, so that when the one roller touches the piece *i*[3] the magnet will act, and, by drawing toward itself the armature, and thus bringing its lever *hm*[1] into contact with the point *hm*[4], will put the circuit of the line-wire through the releasing-magnet *h* and reversed batteries *rb rb*[1]. In all other respects the arrangement is the same as in Fig. 14.

In Fig. 16 is shown the application of my new electrical circuit—Letters Patent No. 166,305, dated August 3, 1875—to the present invention. In the operation of this circuit I greatly prefer an incased or underground wire.

Deeming it unnecessary, in view of the foregoing descriptions, to present every detail of the circuits, Figs. 14 and 15, I have in Fig. 16 merely indicated as follows, leaving the rest to be understood: The levers *hm*[1] of magnets *hm* are connected to the line. At the transmitting end the car *d* is connected to earth, and the arms *a*, through the shaft *w*, are connected to the back contact-piece *hm*[3] of the lever *hm*[1]. At the receiving-instrument the back contact-piece *hm*[3] of the lever *hm*[1] is connected to the main battery *mb*, the negative pole of which is put to earth; and beyond this connection with the main battery is a heavy resistance, and the shaft *w*, arms *a*, recording-points *p*, and, by way of car *d*, earth, through a reversed battery, *rb*[2].

The operation of this circuit is as follows: So long as the transmitting-point at the transmitting-station is bearing upon a metallic surface the battery *mb* is diverted into the line-wire by the action of the resistance, and as this battery is only enough stronger than the reversed battery *rb*[2] to cause all action upon the chemical paper by battery *mb* to cease when the circuit at the transmitting-station is completed and a portion of battery *mb* diverted into the line-wire C—or, in other words, the diverting of a portion of battery *mb* into the line is sufficient to enable the reversed battery *rb*[2] to neutralize, and thus prevent action by, such portion of the current from the battery *mb* as continues to flow in the artificial line—there will be no mark while the transmitting-point is bearing upon the metallic surface; but, as the transmitting-point comes upon an insulating-line of writing, the battery *mb*, no longer diverted into the line-wire, there being then no line-wire circuit for the battery, will produce a discoloration of the chemical paper.

In Fig. 17 is shown the same circuit that is shown in Fig. 15, with the exception that double reversed batteries are dispensed with, the releasing of the arms *a* by depolarization of magnet *h* being effected by a single reversed battery, which may be placed at either end of a line, although shown at the receiving end. The releasing-magnet at the transmitting end is shown in a shunt with the rheostat Ro. It is obvious, however, that it need not be shunted, but placed the same as in Fig. 15.

The operation is as follows: As shown in the drawing, the transmitting must run a little faster than the receiving instrument. Therefore it will come to a stop previous to the receiving-instrument, and as the receiving-in-

strument comes to the point at which it not only stops, but introduces into the line the reversed battery rb^1, both instruments are released, and the operation is repeated to another detention, and so on.

In Fig. 18 I have shown the application, at the transmitting end, of a line of Varley's line-clearing invention, consisting of a single-wire induction-coil in a shunt. This will be readily comprehended by reference to the drawings, *mb* being the main battery, and the car *d* being connected to the line. Whenever a transmitting-point is bearing upon the metallic surface the battery divides, a part flowing into the line, and a part flowing through the induction-coil Ic and rheostat Ro, thus magnetizing the core of the coil, so that when the battery is removed from the line and coil Ic by the transmitting-point coming upon an insulating-line of writing, the coil discharges into the line an induced clearing-current of intensity, which accelerates the action of a local marking-battery at the receiving-station. I do not claim this as my own invention, or its application as my own invention.

In Fig. 19 is exhibited the connections of the motor already explained. R*b* is the motor-battery. G*r* is a galvanometer, and R*o* a rheostat. C′, D, a^1, and a^2 are the various connections. One end of the helix of magnet E is shown connected to the shaft a^2, the other end being connected to the battery.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a copying-telegraph, the combination, with transmitting or recording mechanism, having a less speed of motion than the actuating mechanism, of an electro-magnetic regulator, operated by a line-current, as set forth.

2. In a copying-telegraph, the combination, with transmitting or recording mechanism operated by friction, of driving mechanism having a greater speed of motion than the transmitting or recording mechanism, as set forth.

3. The method of operating a copying-telegraph, consisting in carrying the contact style or styles transversely over or around a cylindrical surface, each style moving in one continuous direction, instead of moving back and forth, substantially as shown and described.

4. In a copying-telegraph, the combination, with a thread-shaft, of a transmitting or recording style or styles and a semi-cylindrical surface, so arranged that the revolutions of the shaft shall both advance the semi-cylindrical surface longitudinally, and give the style or styles a transverse circular motion in respect of the cylindrical surface, as set forth.

5. In a copying-telegraph, a semi-cylindrical car, moving upon a railway, substantially as shown and described.

6. In a copying-telegraph, a semi-cylindrical transmitting or receiving car, as set forth.

7. In a copying-telegraph, the method of keeping the instruments at different stations in synchronism, and maintaining the steadiness of their motion, consisting in the employment of friction to actuate the transmitting or recording mechanism, in combination with an electro-magnetic regulator, so that the motion of the transmitting or recording mechanism may be arrested without arresting the motion of the motive or driving mechanism, as set forth.

8. In a copying-telegraph, the combination, with transmitting or recording mechanism, of a friction-connection, situated between the same and the motive power, as set forth.

9. In a copying-telegraph, the combination, with transmitting mechanism operating in one direction, of recording mechanism operating in the opposite direction, or vice versa, substantially as set forth.

10. In a copying-telegraph, the combination, with a semi-cylindrical car, of a curved frame for holding the message-blank in place, as set forth.

11. The combination, with the car *d*, of the point f^3, to engage in the thread of a shaft, as set forth.

12. In mechanism for maintaining synchronous motion of different instruments, a detent which yields to the force of advancing mechanism through neutralization by a line-current of the force which held the detent in the path of the mechanism, as set forth.

13. In a copying-telegraph, the combination, with transmitting or recording mechanism, of a magnet operated periodically by a local battery to change the circuit of the line, as set forth.

The above specification of my invention signed by me this 4th day of November, 1875.

W. E. SAWYER.

Witnesses:
JAS. G. SMITH,
CHAS. A. KITTLE.