(No Model.)

2 Sheets—Sheet 1.

L. S. CRANDALL.

TELEGRAPH KEY AND REGISTER.

No. 344,351. Patented June 29, 1886.

Fig. 3.

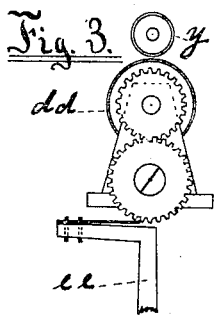


Fig. 4.

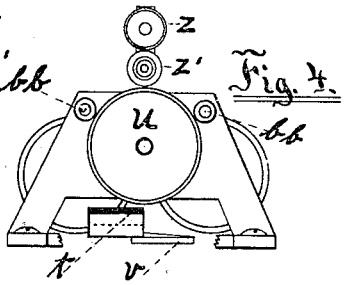
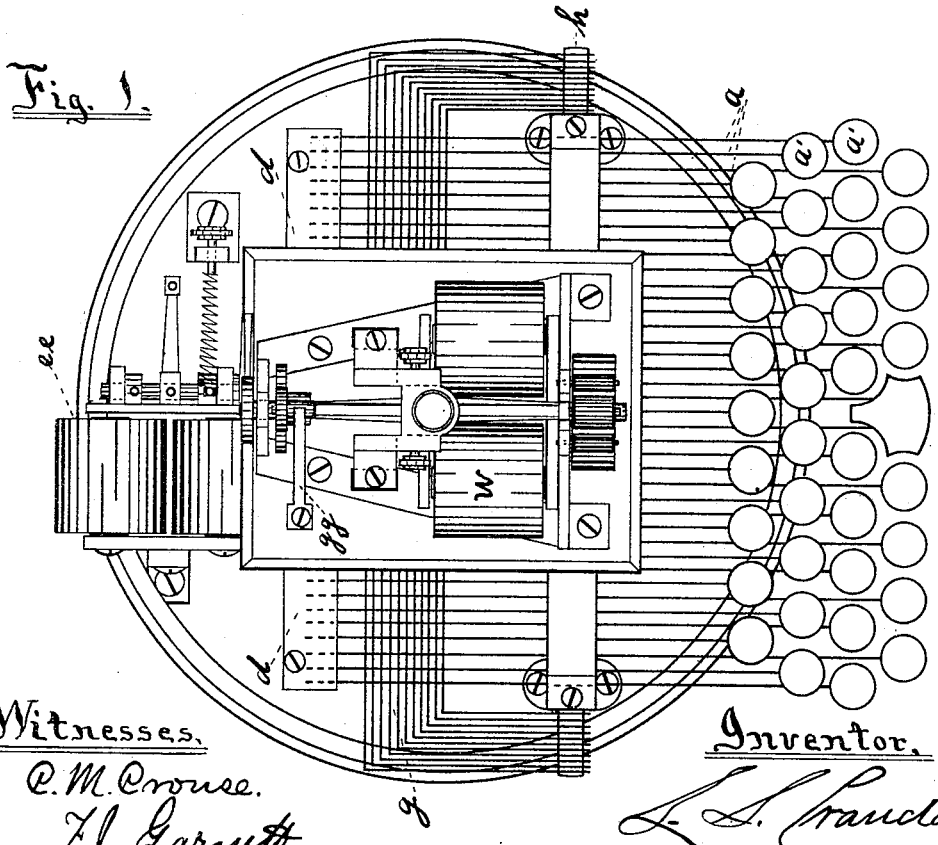


Fig. 2.

Fig. 1.



Witnesses.

C. M. Crouse.

T. J. Garnett

Inventor.

L. S. Crandall.

(No Model.) 2 Sheets—Sheet 2.

L. S. CRANDALL.

TELEGRAPH KEY AND REGISTER.

No. 344,351. Patented June 29, 1886.

Fig. 5.

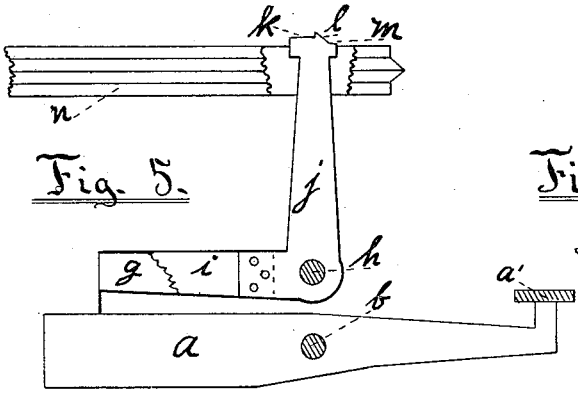


Fig. 6.

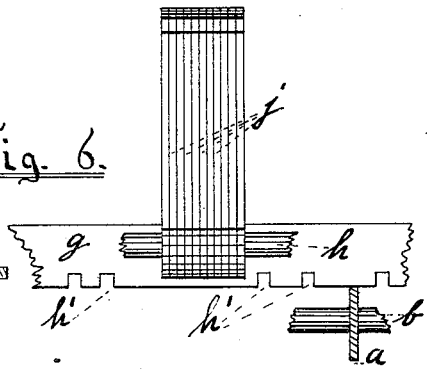


Fig. 7.

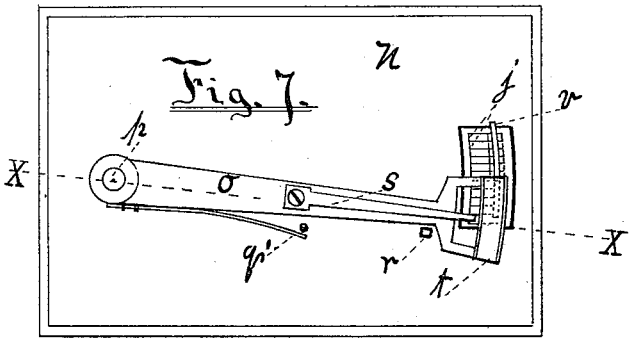


Fig. 9.

Fig. 10.

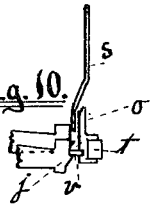


Fig. 8.

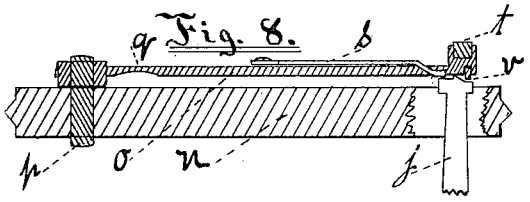


Fig. 11.

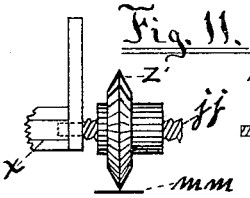


Fig. 12.

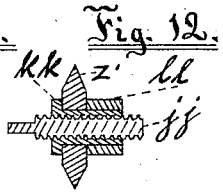


Fig. 13.

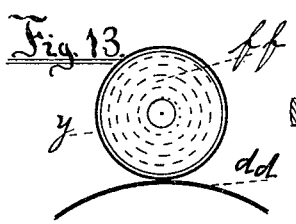


Fig. 14.

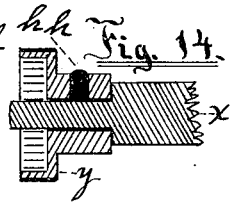
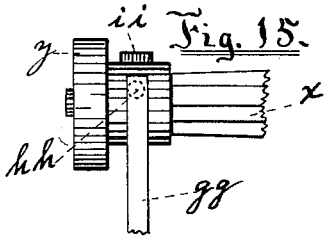


Fig. 15.



Witnesses.

C. M. Crouse.

F. J. Garnett

Inventor,

L. S. Crandall.

UNITED STATES PATENT OFFICE.

LUCIEN S. CRANDALL, OF SYRACUSE, NEW YORK.

TELEGRAPH KEY AND REGISTER.

SPECIFICATION forming part of Letters Patent No. 344,351, dated June 29, 1886.

Application filed June 8, 1885. Serial No. 167,994. (No model.)

To all whom it may concern:

Be it known that I, LUCIEN S. CRANDALL, a citizen of the United States, residing at Syracuse, in the county of Onondaga and State of New York, have invented a new and useful Improvement in Telegraph Keys and Registers, of which the following is a specification.

My invention may be broadly designated as a "mechanical substitute for manual dexterity in the production and recording of telegraphic signals;" and its principal object is to provide a means whereby comparatively unskilled persons may transmit and receive telegraphic messages under the Morse system.

The principal elements of my invention are, first, a key-board similar to that of a type-writer; second, a circuit-breaker or transmitting device; third, intermediate mechanism connecting the former with the latter; fourth, a recording device or receiver; fifth, a motor operating the mechanism of both transmitter and receiver; sixth, a governor controlling said motor, all automatic in operation and independent of the operator after his initial touch upon any given member of the key-board.

The above-mentioned elements are more fully described hereinafter. Reference is also had to the accompanying drawings, which form a part of this specification, and in which throughout the several views similar letters refer to similar parts.

By my invention telegraphic signals identical with those of the Morse system are produced and recorded; but the means by which I obtain these results will be better understood if it is borne in mind at the outset that whereas by the Morse key in general use the signals are produced at moments of magnetization, by my key and register they are produced at moments of demagnetization.

In the accompanying drawings, Figure 1 represents a plan view of my automatic telegraph key and register. Fig. 2 is a side elevation of the same. Fig. 3 is a rear view, designed to show the relation of the moving parts to the motor. Fig. 4 is a front view, designed to show more clearly the relation of the registering device to the circuit-closer. Fig. 5 is a detail view, designed to show the peculiar features common to each one of the eleven determinating elements of the circuit-breaker, also the connection thereof to one of the eleven actuating-bails, and its general relation to the finger-key levers. Fig. 6 is another view of the parts shown in Fig. 5, showing the eleven determinators as they are grouped in the instrument, also showing a section of one of the actuating-bails with notches in its lower edge, so placed that certain of the finger-key levers will act upon it and certain others will not, according to a predetermined arrangement. Fig. 7 is a top view of the upper plate of the instrument, with the register and its supporting-frame removed so as to expose the vibrating arm, return-spring, contact-tongue, locking-cam, and return-stop of the circuit-closer and their general relation to the eleven determinators. Fig. 8 is a sectional view of Fig. 7 on the line X X. Fig. 9 is a top view of the contact-tongue and locking-cam and the eleven determinating elements of the circuit-breaker as they would appear at the moment of operating the proper finger-key lever to produce the Morse character representing the first letter of the alphabet. Fig. 10 is another view of Fig. 9, and is designed to further explain the position of the parts thereof. Fig. 11 is an enlarged view of the writing-wheel or rotary stylus, showing means for adjusting the same longitudinally, so as to utilize more than one section of the receiving-tape. Fig. 12 is a sectional view of Fig. 11, and shows more clearly its elements and method of construction. Fig. 13 is an enlarged view of the governor-wheel with return-spring of the same and its general relation to the governor-driving wheel on main shaft of register. Fig. 14 is a sectional view of the governor-wheel; and Fig. 15 is a perspective view of the same with local circuit-breaker, local circuit-closer, and governor-wheel stop in position at moment of magnetization of main line, all of which are more particularly set forth hereinafter.

The key-levers *a* are preferably grouped, as in Figs. 1 and 2, and are provided each with a lettered button, *a'*. In their general features they so closely resemble those of a type-writer as to need no particular description. They are hung on a shaft, *b*, and their rear ends fit loosely in a guiding-comb, *c*, which is provided with a cap, *d*, recessed to receive the stop-cushion *e*, which operates to arrest the movement of the rear end of *a* when any given

letter key or button is struck by the operator. The rear end of *a* ordinarily rests on the cushion *f*. Resting across *a* are eleven bails, *g*. which are hung on the shaft *h*. These bails are cut away, as at *h'*, Fig. 6, according to a predetermined scheme, so that certain of the key-levers, when oscillated by the operator, will raise *g*, and certain of them will not, according as *g* is or is not cut away over said key-levers. By this means it will be seen that any given key-lever may be made to lift up any predetermined combination of the bails *g*. For example, if, as in case of the Morse character for the first letter of the alphabet, bails Nos. 1, 3, and 4 are to be lifted, all others of the eleven bails will be cut away, as at *h'*, over the key-lever set apart to represent said first letter of the alphabet, and so forth. Each of the bails *g* is near its center provided with a forwardly-projecting arm, as at *i*, Fig. 5, to which is rigidly attached one of the eleven determinators *j*, which determinators are placed closely side by side and oscillate on the same shaft, *h*, as do the bails *g*. The determinators *j* are provided at their free ends with a plane surface, *k*, curved symmetrically with the path of their oscillation on *h*, a tooth-shaped cam, *l*, and another plane surface, *m*, somewhat nearer than *k* to the center of oscillation. The office of *k*, *l*, and *m* will be explained further on.

On the top plate, *n*, (see Figs. 7 and 8,) is mounted an arm, *o*, which is capable of a hingewise oscillation on the short shaft *p*, and also of an up-and-down oscillation by means of a spring which is formed on *o*, as at *q*. This arm is provided with a return-spring, *q'*, whereby its hingewise oscillations are always brought to rest at the stop-pin *r*. On *o* is also mounted the circuit-closing contact-tongue *s*, which rests upon and slides over the determinators *j* at *k*, whenever *o* is caused to oscillate hingewise. By reference to Fig. 7 it will be seen that the free ends of *j* are arranged on a curved line symmetrical with the path of the free end of *o*. If, now, it is understood that the determinators *j*, through the bails *g* and shaft *h*, constitute one element of an electrical circuit, of which *s*, through *o* and *p*, is the other element, it will readily be seen that if *o* is caused to oscillate excursively over the determinators when grouped, as in Fig. 7, the circuit will remain closed, because of the contact of *s* on *j* at *k*; but if the free ends of certain of the determinators are withdrawn out of the path of *s*—as, for example, in Fig. 9—the circuit will be interrupted in a predetermined manner. The free end of *o* is provided with a friction-pad, *t*, which, when said free end is lifted, impinges on the register-platen *u*. If this occurs when *u* is in motion, *o* will be caused to oscillate thereby and carry *s* over *j*. The motion of *u* is always in a direction calculated to carry *o* away from *r*. If, therefore, by any means the free end of *o* is lifted so as to bring *t* into contact with *u*, the circuit-closing tongue *s* will be caused to pass over *j* in a direction contrary to the retractile effort of *q'*. If, at any moment in said passage of *s* over *j*, the upward pressure on the free end of *o* is removed, said free end will drop to normal position, because of the retractile effort of *q*, and will also return to *r* because of the retractile effort of *q'*. On the lower side of the free end of *o* is a downwardly-projecting ledge or lip, *v*, insulated from *o*, but rigidly attached thereto. This lip is curved on a line symmetrical with the hingewise movement of *o*, and is so placed that one of its ends is on a radial line from *p* through *s*, and its other end reaches out sufficiently far to cover all of the determinators at *m* when *o* is at position of rest against *r*. When the various parts are at rest, *v* stands upon *m*, and *t* is not in contact with *u*; but when any one or more of the determinators is oscillated into position, as in Fig. 9, *v* will slide up and over *l* onto *k*, which latter, being higher than *m*, operates to bring *t* and *u* into contact. While *v* rests on *k* it will be seen that the upward extension of *l* by contact with the outward side of *v* operates to prevent the return of *j* to normal position. In other words, *j* is locked into position and will remain so locked after the operator withdraws his finger from the letter-key. If *o* is caused to oscillate by reason of the contact of *t* and *u* while *j* is locked, as above, at the moment that *s* passes beyond the place normally occupied by each determinator thus withdrawn and locked, *v* will also slide past said determinator and leave it free to return to normal position. When *v* has thus passed beyond and released the last one of any combination of the determinators, the free end of *o* falls down into place, with *v* resting on *m*, *u* ceases to impinge upon *t*, and *o* is free to return to *r*.

The main circuit of a telegraph-line is brought through my instrument by way of *s* and *j*, as above. There is also placed in said circuit the magnet *w*. The armature-lever of *w* is formed as at *x x x*, Fig. 2. This armature-lever is provided with a governor-wheel, *y*, on its rear end, and an inking-wheel, *z*, and rotary stylus or writing-wheel *z'* on its front end. At moments of demagnetization *z'* is pressed down upon the platen-wheel *u* by the action of a spring (not shown) housed in the hollow boss *a a*. As *u* revolves, a paper tape is fed along between its upper side and the feed-rollers *b b*. At moments of demagnetization *z'* is pressed down, as before stated, and an ink-mark—longer or shorter, according to the period of demagnetization—is made upon the paper tape. As the paper moves along while *z'* is thus pressed down upon it, *z'* is caused to revolve, taking fresh ink from *z*, with which it is always in contact. At moments of magnetization *z'* is withdrawn from the paper, and *u*, moving forward, produces the necessary spacing in and between characters.

An electro-magnetic motor, *e e*, actuated by a local battery, revolves the main shaft *c c*, on which is mounted the platen-wheel *u*. On

this shaft is also the governor-driving wheel *d d*, which operates to revolve the governor-wheel *y* a given distance, as hereinafter explained. The motor *e e* is made in the well-known form used for ringing electrical bells, with this difference: In place of the bell-clapper is an arm provided with a spring tongue or pawl, as shown in Fig. 3, which pawl at each oscillation of said arm turns the wheel with which it engages the distance of one tooth, thus communicating intermittent rotary movement to the main shaft *e e*.

The governor-wheel *y* (see Figs. 13, 14, and 15) is mounted on the rear end of *x*, and at moments of magnetization of *w* presses down upon *d d*, which causes it to revolve a given distance in opposition to the helical spring *f f*, which is chambered into it and connected to it and *x*. One element of the local circuit is brought into the governor-wheel through *x*, and the other element is connected with it on the hub of the governor-wheel through the spring-tongue *g g*. When the main-line circuit is closed, *y* presses down upon *d d* and revolves until *g g* rests upon the insulated peg *h h*, which breaks the local circuit and stops the motor. When the main-line circuit is broken, *y* retreats from *d d* and revolves backward by the retractile effort of *f f* until *g g* is off of *h h* and the local circuit is closed, as before. A projection, *i i*, on *y*, coming in contact with the end of *g g*, arrests the movement of *y* when revolving backward by the retractile effort of *f f*, as before stated.

The amount of spacing after each completed telegraphic character is determined by the distance between *i i* and *h h*, as it is evident that after the final closing of the main line in the production of each completed character the motor will continue to move the main shaft until the point of contact between *y* and *g g* has shifted from *i i* to *h h*. As a means of utilizing the entire available surface of the recording-tape, I have made the writing-wheel adjustable. (See Figs. 11 and 12.) A screw-thread is cut upon the supporting-stud *j j*, on which is closely fitted the threaded sleeve or nut *k k*. On this sleeve the writing-wheel *z'* turns freely, being secured in place on *k k* by the tightly-fitting washer *l l*. The method of adjusting *z'* so that it will stand over any desired section of the recording-tape is obvious. In Fig. 11, *m m* represents a section of the recording-tape.

As before stated, by my invention telegraphic signals are made and recorded at moments of demagnetization. When the instrument is at rest, the main-line circuit is closed through *s* and *j*, and the local circuit is broken at *h h*. In transmitting, the operator simply depresses any desired letter-key, thereby oscillating the rear end of the key-lever to which said letter-key is attached against the stop-cushion *e*. Beyond this initial act of the operator the operation of transmitting and recording is purely automatic. If, for example, the operator wishes to transmit the Morse signals for the first letter of the alphabet, he simply depresses the button answering to said letter in the key-board, and then quickly withdraws his hand. By this initial act of the operator certain of the bails *g* are lifted simultaneously, oscillating the free ends of the particular determinators *j* to which they are attached into position, as in Fig. 9. The setting of the determinators, as above, breaks the main circuit by withdrawing the first determinator from contact with *s*. At the same time *v* moves up and over *l* onto *k* of the first, third, and fourth determinators and locks them, as before explained. At the same time, also, *t* is lifted up into contact with *u*. When the main circuit is broken, as above, *w* becomes demagnetized, *z'* drops down upon the recording-tape intervening between it and *u*, *y* is lifted from *d d* and by the retractile effort of *f f* is shifted axially, so as to bring *i i* and *g g* together, thus closing the local circuit. The motor now turns *u*, which oscillates *o* in a direction contrary to the retractile effort of *q'*, causing *s* to close main circuit on the second determinator and break it again for the space of the third and fourth, and again close it on the fifth, at which time *v* passes from *k* on fourth determinator to *m* of the fifth determinator, (the first, third, and fourth determinators having respectively returned to normal position in the meantime,) *t* drops down out of contact with *u*, and *o* returns to *r*. As *o* returns, *s* slides back over the contact-points of the several determinators before passed and comes to rest on the first determinator.

It will be seen that the main circuit is closed during the return of *s* and thereafter, and *y*, being held in contact with *d d*, is shifted axially until *h h* is brought under *g g*, when the local circuit is broken and *u* ceases to move. It will also be seen that the movement of *u* while *y* is moving from *h h* around to and under *g g* pays out a sufficient amount of the recording-tape to indicate the space between letters. Of course, at moments of magnetization, as in the act of producing spaces or breaks in letters, the governor-wheel will be caused to move more or less in the same direction as when finally breaking local circuit; but as these spaces are less than that between letters, the governor-wheel has opportunity to recover its position, through the retractile effort of *f f*, before *h h* reaches *g g*.

In case of a distant operator working his instrument, all other instruments in circuit will automatically record, as above, without any movement of *o*. In this connection it will be proper to state that in the case of two or more of my instruments working in the same circuit it is not necessary that the several motors should move synchronously. If one motor move more rapidly than another, the characters recorded on its tape will simply be coarser, and vice versa.

I do not confine myself to the use of a recording-tape, as it is evident that the vibrations of *x* may be interpreted as in an ordinary

"sounder;" but I lay no stress upon this point, as the principal object of my invention is to provide a practical instrument for comparatively unskilled operators. Another object of my invention is to considerably increase the speed of transmission over that of the ordinary Morse key; and still another object is to obviate errors by producing the various signals with mechanical accuracy and precision.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A circuit-breaker of a main-line telegraphic circuit, composed of a number of movable arms, substantially as *j*, in combination with means, substantially as *a* and *g*, for simultaneously arranging the free ends of said arms according to a predetermined scheme, and means, substantially as *l* and *v*, for locking or retaining the same when so arranged, substantially as set forth.

2. A circuit-breaker of a main-line telegraphic circuit, composed of a number of movable arms, substantially as *j*, in combination with means, substantially as *a* and *g*, for simultaneously arranging the free ends of said arms according to a predetermined scheme, means, substantially as *l* and *v*, for locking or retaining the same when so arranged, and means, substantially as *o*, *t*, and *u*, whereby *v* is caused to move out of engagement with *l*, thereby unlocking *j* and permitting its return, substantially as set forth.

3. A circuit-breaker of a main-line telegraphic circuit, composed of a number of movable arms, substantially as *j*, in combination with means, substantially as *a* and *g*, for simultaneously arranging the free ends of said arms according to a predetermined scheme, means, substantially as *s*, for automatically closing said circuit, and means, substantially as *o*, *t*, and *u*, whereby *s* is carried excursively over *j*, and caused to close circuit intermittently according to a predetermined arrangement of *j*, substantially as set forth.

4. A circuit-breaker of a main-line telegraphic circuit, composed of a number of movable arms, substantially as *j*, in combination with means, substantially as *a* and *g*, for simultaneously arranging the free ends of said arms according to a predetermined scheme, means, substantially as *s*, for automatically closing said circuit, means, substantially as *o*, *t*, and *u*, for carrying *s* excursively over *j*, and means, substantially as *q'*, for returning *o* after each excursive oscillation of the same, substantially as set forth.

5. A circuit-breaker of a main-line telegraphic circuit, composed of a number of oscillating arms placed side by side, substantially such as *j*, the free ends of which are adapted to be simultaneously set or arranged with reference to each other, so as to form and represent collectively the dots, dashes, and spaces of any letter of the Morse alphabet, according to a predetermined scheme, in combination with an excursively-traveling circuit-closer, substantially such as *s*, a series of key-levers, substantially such as *a*, and a series of intermediate bails, substantially such as *g*, whereby an initial movement of *a* is communicated to *j*, and the excursive travel of *s* is limited and determined, according to a predetermined scheme, substantially as set forth.

6. The combination of a circuit-breaker, substantially such as *j*, and excursively-traveling circuit-closer, substantially such as *s*, and a recording apparatus consisting of a magnet, such as *w*, an armature-lever, substantially such as *x*, a platen-wheel, substantially such as *u*, an inking-wheel, substantially such as *z*, and a rotary stylus, substantially such as *z'*, all as and for the purpose described.

7. In automatic telegraph keys and registers, the combination of a circuit-breaker, substantially as *j*, a circuit-closer, substantially as *s*, a magnet, as *w*, provided with an armature-lever, substantially as *x*, and means whereby the vibrations of *x* are caused to close and also break a local circuit, substantially as and for the purpose set forth.

8. The combination of the cam *l* and plane surface *k* on the free end of *j* and the downwardly-projecting lip *v* on *o*, substantially as and for the purpose set forth.

9. The combination of the magnet *w*, the armature-lever *x*, the governor-wheel *y*, and the governor-driving wheel *d d*, whereby (when *d d* is in motion) at moments of magnetization of *w* the said governor-wheel is pressed down upon the said governor-driving wheel and caused to rotate a longer or shorter portion of a revolution, according as said moments of magnetization of *w* are longer or shorter.

10. The combination of the magnet *w*, armature-lever *x*, governor-wheel *y*, and helical spring *f f*, whereby at moments of demagnetization of *w* (the front end of *x* being pressed down by the spring housed in the hollow boss *a a*, and consequently the rear end of *x* lifted so as to clear *y* from contact with *d d*) *y* is permitted and caused to return to normal axial position, substantially as set forth.

11. The combination of the magnet *w*, the armature-lever *x*, the governor-wheel *y*, the governor-driving wheel *d d*, the insulated pin *h h* on *y*, and the motor-circuit-closing spring-tongue *g g*, whereby after *d d* has caused *y* to rotate a given distance the motor-circuit is broken at *h h*, substantially as set forth.

12. The combination of the magnet *w*, armature-lever *x*, helical spring *f f*, stop *i i*, and spring-tongue *g g*, whereby the axial return movement of *y* (at moments of demagnetization of *w*) is arrested, and the motor-circuit closed, substantially as set forth.

13. The combination of the rotary stylus or writing-wheel *z'* with the laterally-adjustable sleeve *k k*, retaining-collar *l l*, and threaded stud *j j*, substantially as and for the purpose set forth.

14. The combination of means, substantially as *j* and *s*, for breaking and closing a telegraphic

circuit, means, substantially as *u*, *m m*, *z'*, *z*, *x*, and *w*, for recording the signals thus made at moments of demagnetization of *w*, means, substantially as *e e*, for driving the recording mechanism, and means, substantially as *y*, *f f*, *i i*, and *g g*, for the purpose of closing and also breaking a motor-circuit, all automatic in their operation after the operator's initial touch upon any given member of the key-board, substantially as and for the purpose set forth.

15. The combination of means, substantially as *a*, *g*, *s*, and *j*, for automatically breaking and closing a main-line telegraphic circuit, and means, substantially as *e e*, *c c*, *u*, *m m*, *z*, *z'*, *x*, *y*, *f f*, *i i*, *g g*, *w*, *o*, *q*, *q'*, *r*, *t*, *v*, *l*, *m*, *n*, and *k*, for automatically recording the signals so made simultaneously at the home and distant stations, substantially as set forth.

In witness whereof I have hereunto subscribed my name in presence of two subscribing witnesses.

LUCIEN S. CRANDALL.

Witnesses:

O. A. BENEDICT,

WALTER H. HINKLEY.