2 Sheets. Sheet 1.

G. Caselli,

Telegraphic Apparatus.

No. 37,563. Patented Feb. 3, 1863.

Fig: 1.

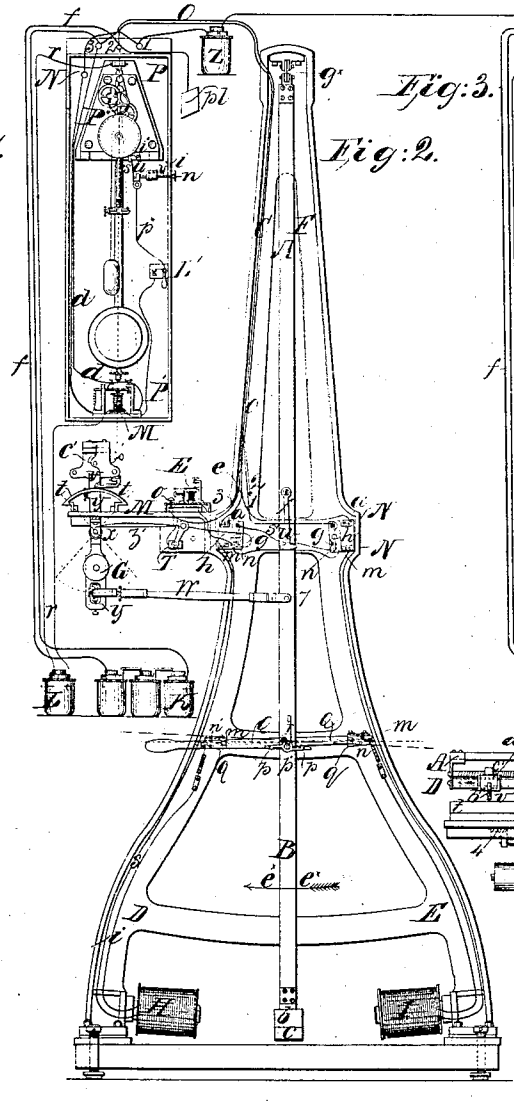


Fig: 2.

Fig: 3.

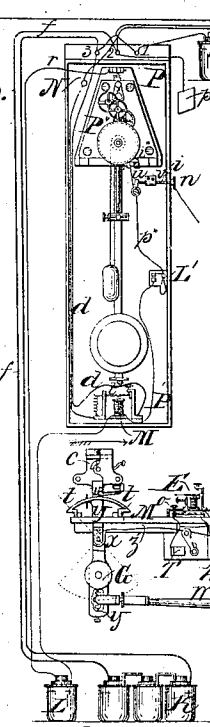


Fig: 4.

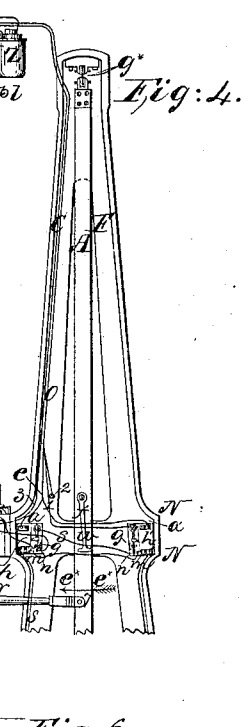


Fig: 5.

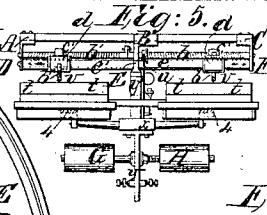


Fig: 5.a

Fig: 6.

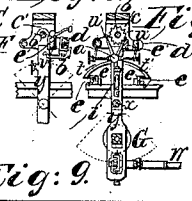


Fig: 7.

Fig: 9.

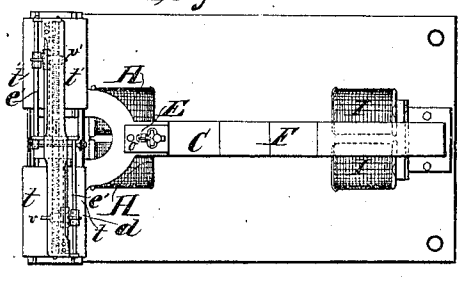
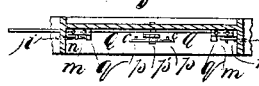


Fig: 7.



Witnesses:

D. W. Coombs

C. W. Reed

Inventor:

G. Caselli

by Munn & Co

attys.

G. Cappelli, 2 Sheets. Sheet 2.

Telegraphic Apparatus.

No. 37,563. Patented Feb. 3, 1863.

Fig: 8.

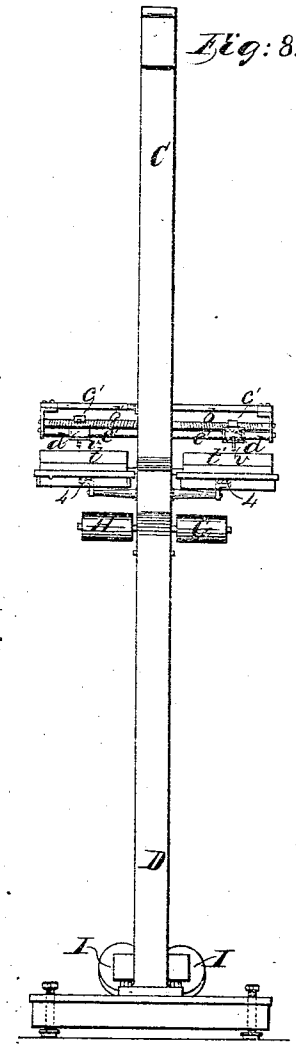


Fig: 11.

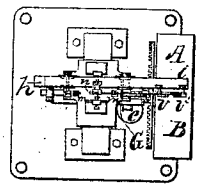


Fig: 12.

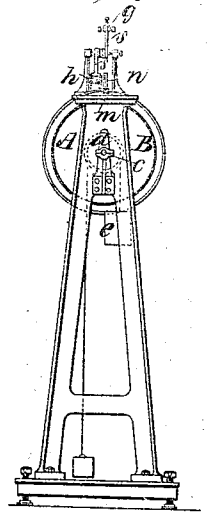
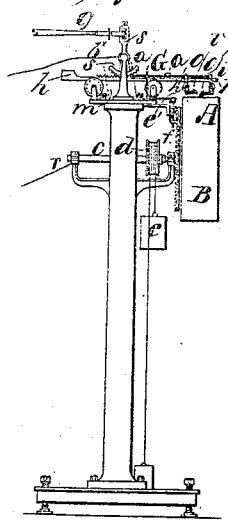


Fig: 10.



Witnesses:

J. W. Coombs

G. W. Reed

Inventor:

G. Cappelli

by Munn & Co

Attys

UNITED STATES PATENT OFFICE.

GIOVANNI CASELLI, OF FLORENCE, ITALY.

IMPROVEMENT IN TELEGRAPHIC APPARATUS.

Specification forming part of Letters Patent No. 37,563, dated February 3, 1863.

To all whom it may concern:

Be it known that I, GIOVANNI CASELLI, of Florence, in the Kingdom of Italy, have invented Improvements in the Construction of and Mode of Working Telegraphic Apparatus; and I do hereby declare that the following is a full and exact description of the said invention.

By this application of this invention the following results may be produced—viz., first, colored letters or characters are obtainable upon white paper direct by the line-current without any local battery or relay, and from original writing in ordinary ink; secondly, dispatches may be reproduced either of the same size as the originals or reduced, the character of the original writing being at the same time retained; thirdly, different messages may be simultaneously transmitted through a single line-wire; fourthly, telegrams written in Morse or similar characters may be reproduced by electro-chemical action.

In the accompanying drawings, Figures 1 and 2 represent an instrument with its batteries complete or set up at one station, and Figs. 3 and 4 represent a similar instrument with its appliances as arranged for a distant station, the two instruments being connected by means of a line-wire. Details of certain portions of these instruments are shown more clearly at Figs. 5, 6, 7, and 7*, as also in the edge view, Fig. 8, and the plan view, Fig. 9.

A B is a pendulum six feet in length, provided at its lower extremity with a rectangular piece of iron, *b*, and a piece of lead, *c*, weighing twelve pounds. This pendulum is mounted in a cast-iron framing or standards, C D E F, to which it is attached by a pendent strip of thin metal, *g**, or it may be simply hung on a pivot.

K is a battery, the current of which passing from the positive pole + arrives at the button 3 of the regulating apparatus. Fig. 1 follows the wire *d d*, and after having traversed a magnetic apparatus, M, returns to the button N. The current thence passes through the cable O to the point *e*, Fig. 2, where it is divided into two conducting-wires, which terminate at the small copper-plates *a* and *a'*. The pendulum A B, being in the position shown in the drawings, (that is, midway between two fixed electro-magnets, H and I,) the current will be interrupted at the said plates of copper *a* and *a'*, which are mounted upon pieces of wood or other insulating material; but so soon as the pendulum (being made to deviate from its perpendicular position) follows the direction of the arrow *e** *e**, it will, on arriving nearly at the end of its course, cause the arm *f w* to press against the ivory button *g*, which is carried by a small pendent lever, and thereby, through the forward movement of that lever, establish contact between a spring, *h*, and the plate *a*. The current will now pursue its course through the wire *s s* to the magnet H, and having passed through the coil surrounding that magnet it will pass up through the wire *i i* to the spring *m*, and through the stud *n'* and lever Q to the framing C F D E; thence to a wire screwed to the framing at 2, Fig. 2, and through the cable O O to the button 2, Fig. 1, and back to the negative pole of the battery K, through the conducting-wire F. If the pendulum be caused to advance in the opposite direction the arm *f w* will act upon the button *g'*, and the current from the battery K will then pass through the coils of the electro-magnet I. Thus by causing the pendulum to be deflected to the right or the left it will, so soon as it arrives at the end of its course, be firmly retained by the attraction of one of the electro-magnets, H or I, the magnetism of which reacts upon the piece of iron *b*.

The wooden box P P', Fig. 1, contains a clock-work movement or ordinary regulator, P''. The length of the pendulum of this regulator is adjusted in such a manner that it makes somewhat less than two oscillations during the time that the large pendulum A B is making only one oscillation.

The current of the battery L, starting from the positive pole +, passes through the electro-magnet M, and thence, through the circuit-breaker or commutator L' and wire *p**, to the spring *u*. Every time that the metal stud *s*, by the oscillation of the regulator-pendulum, touches the spring *u* the current passes into the wire *r r*, by which it returns to the battery L. The successive currents given off at each double oscillation of the regulator-pendulum magnetize the electro-magnet M, which, by attracting the iron lever *t*, instantly breaks the circuit of the battery K. The resulting demagnetization of the magnet H allows the pendulum A B to fall by its own gravity, and it being afterward attracted by the magnet I remains at rest a fraction of a second and again falls by the constantly repeated action of the

regulator P″. The oscillation of the pendulum A B is thus maintained for any desired length of time.

It may be remarked that the action of this regulator would be much more simple if, instead of employing the battery L for the purpose of breaking the circuit of the battery K, this were effected directly by the pressure of the pin *s* upon the spring *u* by attaching the wire *r r* to the insulated piece I* but long experience has shown that the action of the commutator M, being very prompt and rapid, the oscillations of the large pendulum A B were by this means more regular and isochronous.

In order to arrest at pleasure the movement of the pendulum A B it is only necessary to turn to the left the small lever L′, Fig. 1. The circuit of the secondary battery L being thus broken permanently, the pendulum remains fixed by one or the other of the two magnets, H I, according to whether its last oscillation was to the right or the left.

When it is desired to stop the action of the instrument for a long time the lever Q Q is to be raised by bringing it to the position of the dotted line. This movement of the lever produces two results—it stops the pendulum mechanically, either to the right or left, and breaks the circuit of the battery K. In order perfectly to understand this result reference should be had to Fig. 2, and also to Fig. 7*, which represents the said mechanism in plan view.

The double lever *p p*, which is hung on the pendulum by the pivot *p′*, is held in its horizontal position by the spring *r*, and near its extremities, which are hook-shaped, it carries two ivory studs *c c*. When the pendulum is retained to the right or the left by the action of the magnets H or I, if the lever Q be raised one of the extremities of the lever *p p* will take into the stop-piece *q*, and by being hooked onto it will keep the pendulum in its oblique position; at the same time the ivory stud *c c*, bearing upon the spring *m*, will move it away from the metal pin *n′*, and interrupt the current conducted by the wire *i i*. The same battery K, which maintains, as has been explained, the movement of the large pendulum A B, serves also to establish telegraphic communication between the two corresponding stations. As soon as either of the electro-magnets H I ceases to retain the pendulum the current starting from the pole + of the battery K is conducted to the button 3, and as it cannot pass out through the wire *d d* it enters the cable O O, which is composed of four copper wires covered with caoutchouc. The current passes out of the cable by the wire 3, Fig. 2; thence through the copper lever *z*, the stud *n*, and lever *g*, and through the wire *s′* to the lever *g′*. From this lever it passes by means of the wire 1 into the cable O O, out from thence by the button 1, Fig. 1, and after having passed through the battery Z again enters the line-wire, which conducts it to the apparatus, Fig. 4, situate at the other station. After having produced in this machine the effects about to be described, it returns through the earth to the plate *p l*, Fig. 1, and through the button 2 returns to the negative pole of the battery K.

In order to show clearly the effects produced by the line-current at the receiving-station it is necessary to refer to certain parts of the machine not yet explained.

The movement of the pendulum A B is transmitted by means of the link W to a lever, *y y*, which rocks upon a fulcrum, *x*, supported in bearings attached to a bracket of the main framing. (See the detached sectional view, Fig. 7, and side view, Fig. 5.) This lever *y* carries the marking apparatus, which consists of the following parts: Two right-and-left-handed screws, *b b′*, coupled end to end, and mounted in a frame attached to the upper part of the lever, form the shaft of a ratchet-wheel, *c*, which is keyed thereto. The lever *y* carries also a pallet-lever, *i w′ w′*, two limbs of which embrace the ratchet-wheel *c*, while the pendent tail of the lever is situate between two fixed screws attached to the main framing of the instrument. As, therefore, the lever *y* is rocked on its fulcrum *x* by the connecting-rod which couples it with the pendulum A B, the tail *i* will strike against one of the screws, *e e*, which are intended to limit its movement, while the pallets *u u* will communicate an axial motion to the ratchet-wheel *c*, and through it to the screws *b b′*. Working into the threads of these screws are the threaded caps *c′ c′*, which are affixed to slides *d d′* supported by guide-bars *e′ e′*. These bars are in the form of a rectangular prism, but they are rounded at their extremities to allow of their turning in their bearings in the frame A C, Fig. 5. These bars will turn either to the right or the left, according to the direction in which the pallet-lever is rocked, and will alternately raise and lower the arms *b′ b′*, Fig. 6, attached to the slides *d d′*, which arms carry at their extremities a point or style, *v′ v′*. *t′ t′* are segmental tables. (Shown in side view at Fig. 5, and in edge view at Figs. 2 and 7.) These tables are made of tin, and are carried by a bracket of the main framing. The center of their arc is at the point *x*.

From the above detailed description of the apparatus it will be readily understood that when the pendulum A B oscillates the two styles *v v′* will alternately rise and fall simultaneously, and that at the completion of each oscillation of the lever *y* they will receive a lateral or shogging motion. Thus the successive beats of the pendulum will cause the styles alternately to describe upon the paper or other surface laid upon the segment-tables parallel arcs of circles at a certain distance from each other. The number of teeth of the ratchet-wheel *c* and the pitch of the threads of the screws it is preferred so to arrange that this distance shall be about one sixty-fourth of an inch.

G H, Fig. 5, are counter-weights for the pur-

pose of maintaining equilibrium between the two arms of the lever *y y*.

It now remains to observe the effect of the line-current, which at each oscillation of the large pendulum, Fig. 2, arrives, as has been shown at the receiving-instrument, Fig. 4. This current being positive, first meets with the battery Z, Fig. 3, the poles of which are turned in a direction contrary to it. If the batteries K, Fig. 1, and Z, Fig. 4, were of the same power, and if the line-wire were perfectly insulated, the two opposite currents would mutually destroy each other; but as the battery Z only has one or two elements, while the battery K is composed of a much larger number, the result is that the line-current entirely destroys the other and is only slightly weakened by its resistance. The current, after having passed to the button 1, Fig. 3, enters the cable O O, passes therefrom through the wire 1, Fig. 4, to the lever *g'*; thence through a wire to the lever *g* and spring *h* and by the wire Z', back to the lever *y y*. It should be observed that this lever is insulated from the cast-iron framing by pieces of wood 4. (Seen more clearly in Fig. 5.) From the rock-lever *y y* the current passes to the style *v*, and thence to the segment-table *t t*, mounted upon the cast-iron framing, and back again to the screw to which the wire 2 is attached. This wire, after passing through the cable O O, passes to the button 2, Fig. 3, and again arrives at the earth through the plate *p l*. The circuit being thus established between the two telegraphic stations, the two iron styles *v v'* will remain electrified during the whole time that they pass over and in contact with the tin segment-tables *t t, t' t'*. If the surface of these segments be covered with sheets of paper steeped in a solution of ferro-cyanide of potassium, the iron styles, being positively electrified, will decompose the said cyanide and trace lines of a light-blue tint, which will gradually cover the whole surface of the paper. The coloring thus produced by the battery placed at the other station can only be discontinued by the interruption of the line-current. This takes place, as will be readily understood, by the action of a strip of silvered paper containing the message a fac-simile of which it is desired to reproduce at the receiving-station, the message having been previously written thereon by means of an ordinary pen and ink. This paper having been placed upon the segment-table *t t*, Fig. 2, notice is sounded at the other station by a bell, and the transmitting and receiving instruments are set in motion by the mechanism already described with reference to Figs. 1 and 3.

It should be first remarked that when the point *v*, (which should be made of platinum,) passes over the silvered surface of the paper without coming in contact with the written characters, the current of the battery K cannot circulate in the line-wire. In fact, on starting from the positive pole it passes to the button 3, Fig. 1, through the cable to the wire 3, Fig. 2; passes through the brass lever Z, the wire *z'*, the double lever *y y*, and the platinum style *v*; thence through the silvered paper into the segmental piece *t*, through the cast-iron framing to the screw 2, enters the cable, passes from it to the button 2, Fig. 1, and returns to the negative pole of the battery K. But every time this style comes in contact with the ink-lines, as that substance is a non-conductor, the electric communication is interrupted, and the current of the battery K, not being able to pass out on that side, enters the line-wire, following the course already pointed out, and passes to the receiving station where it produces the coloring of the chemically-prepared paper.

When the movements of the pendulums placed at the two corresponding stations are perfectly synchronous the arrangement of the blue lines will be identical with that of the ink-lines forming the original dispatch. If their movement were not perfectly synchronous, the result would be that the copy of the writing would not have exactly the same form as that of the original, but it would be more or less inclined to the right or the left, according to whether the oscillations of the pendulum of the receiver were slower or faster than those of the pendulum of the transmitting apparatus.

In order to maintain the synchronous action at the minimum fraction of a second, it is necessary from time to time to act upon the pendulum of the regulator P'', Fig. 3, so as to augment or diminish the duration of its oscillations. This is readily effected by means of the spring *u*, the pressure of which upon the point *s*, fixed upon the pendulum of the regulator, may be increased or diminished by the micrometric screw v^{x}, upon which is fixed the index *i*. On turning the button *n* of this screw the index or pointer will pass over the divisions of a graduated arc on the side of the box P P, (but not shown in the drawings.)

If the pressure of the spring *u* be increased by turning the index some degrees to the right the movement of the pendulum will be sensibly accelerated, and if, on the contrary, the index be moved to the left its movement will be retarded. By this means, which is extremely simple, perfect synchronism (which is an essential condition for the perfect reproduction of writings or drawings) is obtained; but identity in form between the characters of the original and those of the copy is not the only condition necessary for the perfect reproduction of telegrams. The lines of the writing or drawing must also be clear and well defined. This is attended with difficulties, especially when the operation is carried on at great distances.

To obtain clearness in the reproduction of pantelegraphic dispatches the action of a weak current in a contrary direction to that of the line-current is employed. This weak current is developed from the battery L, Fig. 3, at each interruption of the circuit of the battery K,

Fig. 1. It is not necessary to explain in what manner this negative current from the battery L may be produced, as it has been already shown that the action of that battery is only prevented by the passage of the principal current which starts from the other station. The effect of this counter-current is to depolarize the iron style v', and immediately to arrest its chemical action upon the surface of the paper.

In order simultaneously to transmit two different dispatches, the originals are to be laid upon the two segments of cylinders t t and t' t' of the instrument represented at Fig. 2. The friction of the styles v v' upon the surface of the two dispatches being alternate the lines of the one cannot be confounded during their reproduction with those of the other, and they are reproduced separately and at the same time upon the chemical papers placed upon the segments of the instrument shown at Fig. 4.

From the foregoing description the instrument Fig. 4 would appear to be the receiver, and the instrument Fig. 2 the transmitter. It must, however, be remarked that the two instruments are similar in construction, that the only difference between that which transmits and that which receives the telegrams being that in the one the position of the lever Z (as in Fig. 2) is turned to the left, while (as in Fig. 4) it is turned to the right. In order to transmit dispatches from the instrument Fig. 4 to that shown at Fig. 2 it is only requisite to place these levers z in an inverse position and to change the styles, those which glide over the originals being made of platinum, and those which touch the chemical papers of iron.

In order to produce telegraphic copies of a size less than that of the originals a duplicate of the apparatus carried by the bracket M M must be provided and set up on a bracket at N N, on the right-hand side of the instrument, the duplicate apparatus being similar to that shown, (with the exception of the bell apparatus E,) but of smaller dimensions. Supposing the segmental piece t' t', Fig. 7, to have a radius of five inches and the ratchet-wheel c to have eighteen teeth—if it were required to reduce the breadth of the copy of the dispatch by one-sixth—the radius of the new segmental piece must be four inches, and the wheel c must have fifteen teeth. In this case by employing the apparatus at the right side of the instrument as the receiver, telegrams on a reduced scale would be obtained, reproducing faithfully the form and proportions of the original writing. This arrangement might be of great utility, especially between stations situate at great distances apart, as the electric action being concentrated upon a surface of less extent, the dispatch will be well marked and legible, even supposing the line-current to be much weakened.

The bell or signal apparatus E, Figs. 2 and 4, can only work while the pendulums A B of the two instruments are stopping, provided that the levers Q Q are placed in the direction of the dotted lines.

On pressing with the finger upon the stud O of one signal apparatus it is easy to follow upon the drawings the course of the current of the battery K, in order to arrive at the magnet of the signal apparatus at the other station.

Figs. 10, 11, and 12 represent an apparatus which is added to that above described in order to obtain copies of telegrams previously written with a pen in Morse's characters on metallized paper. A band of tinned or silvered paper about four inches broad, and which may be even a yard in length, is laid over a cylinder, A B, Fig. 10, which is mounted on a shaft, c d, and turns by the action of a weight, e. The rotation of this drum is governed by stops or pallets e' f', working the teeth of an escape-wheel attached to the cylinder A B. At the side of the iron standards C D E F of the receiving and transmitting instrument, and at a distance of about three feet therefrom is placed the apparatus here described, the two conducting-wires b^x r of this apparatus being connected to the points x and 2 of the instrument Figs. 2 and 4. The connecting-rod g g, which is about three feet long, is attached to the pendulum A B instead of the rod w, which is detached from the apparatus.

On putting the pantelegraph into action in the ordinary manner, the bar h i, Figs. 10 and 11, will receive a reciprocating movement from a segment-rack, s, which has a rocking movement corresponding to that of the pendulum. At the same time the segment-rack s gearing into rack-teeth on the bar h i, the points v v' will fall and rise alternately by the action of the double lever n, which is mounted in brackets attached to the bar h i, and strikes against the screws m m. This lever n is connected by means of a horizontal rod, o o, with two rock-levers, h' h', which carry, respectively, the styles v v', Figs. 10 and 11. The pallets e' f', worked vertically by the lever G by coming in contact with the stop-pieces a a, will allow the cylinder A B to turn by intermittent motions to the extent of about one-sixth of an inch under the points v v'.

If on the periphery of the wheel A B a metallized sheet has been placed bearing an original telegram written in Morse's characters traced in pen and ink exactly upon parallel lines at a distance from each other of about one-fifth of an inch, and a strip of paper saturated with a solution of ferro-cyanide of potassium has been placed upon a similar cylinder situate at the other station, the result will be that every time the platinum point gliding over the surface of the tinned paper comes in contact with the ink-lines the current of the battery K will pass to the other station and reproduce faithfully upon the chemically-prepared paper wound upon the periphery of the cylinder A B all the points and strokes composing the dispatch.

In this manner a most exact copy of telegrams written on Morse's plan may be rapidly obtained.

Having now set forth the nature of my invention of improvements in the construction of and mode of working telegraphic apparatus, I wish it to be understood that

I claim—

1. The combination of the spring *u*, and the micrometric screw *v**, with the pendulum of the regulator P″, substantially in the manner herein shown and described.

2. The employment of the marking device consisting of the oscillating lever *y*, screws *b b′*, slides *d′ d′*, styles *v v′*, and tablets *t t*, or their equivalent parts, combined and operating together substantially as herein shown and described, with the pendulum A B, as set forth.

3. The employment of the copying device consisting of the segment-rack *s*, bar *h i*, levers *h′ h′*, styles *v v′*, and intermittent drum A B, or their equivalent parts, combined and operating together, substantially as herein shown and described, with the pendulum A B, as set forth.

In witness whereof I, the said GIOVANNI CASELLI, have hereunto set my hand and seal this 5th day of July, in the year of our Lord one thousand eight hundred and sixty-two.

GIOVANNI CASELLI. [L. S.]

Witnesses:

GEO. HUTTON,

DAVID FULLER,

Both of 60 *Rue de Chaussée D'antin, Paris.*