(No Model.) 2 Sheets—Sheet 1.

H. VAN HOEVENBERGH.

PRINTING TELEGRAPH.

No. 455,075. Patented June 30, 1891.

Fig. 1.

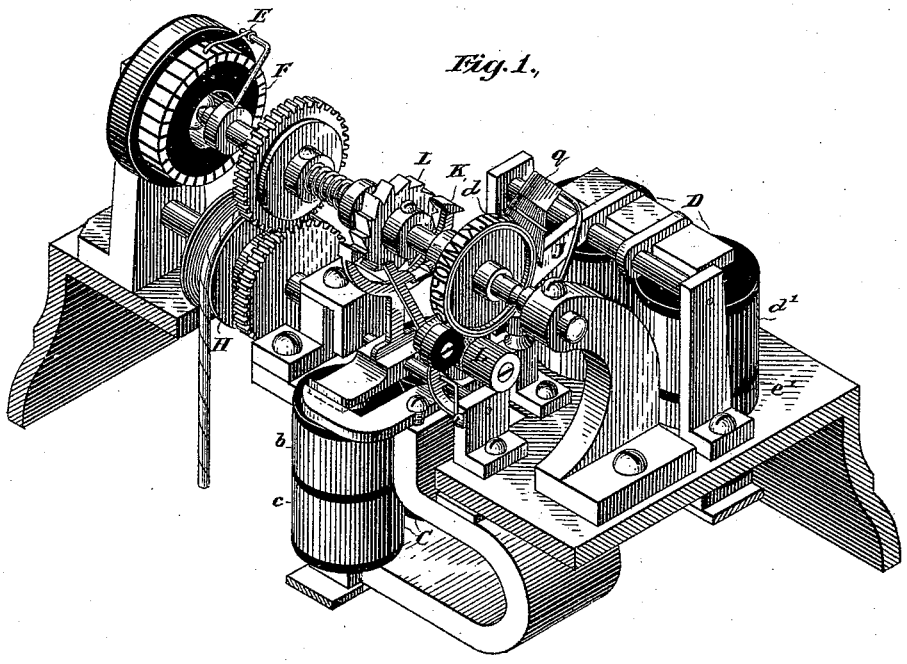
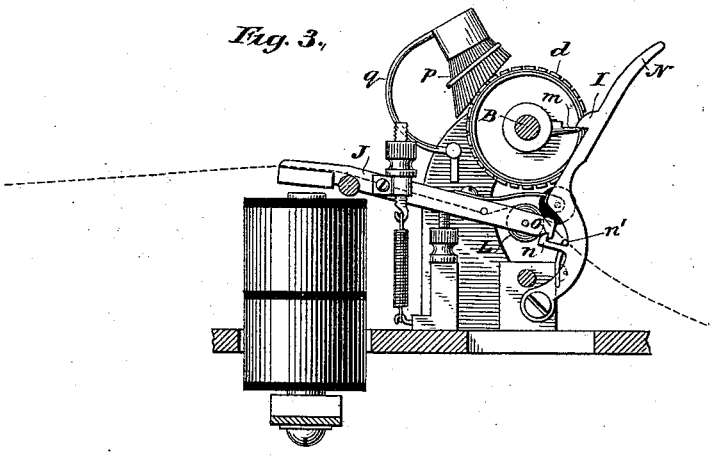


Fig. 3.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

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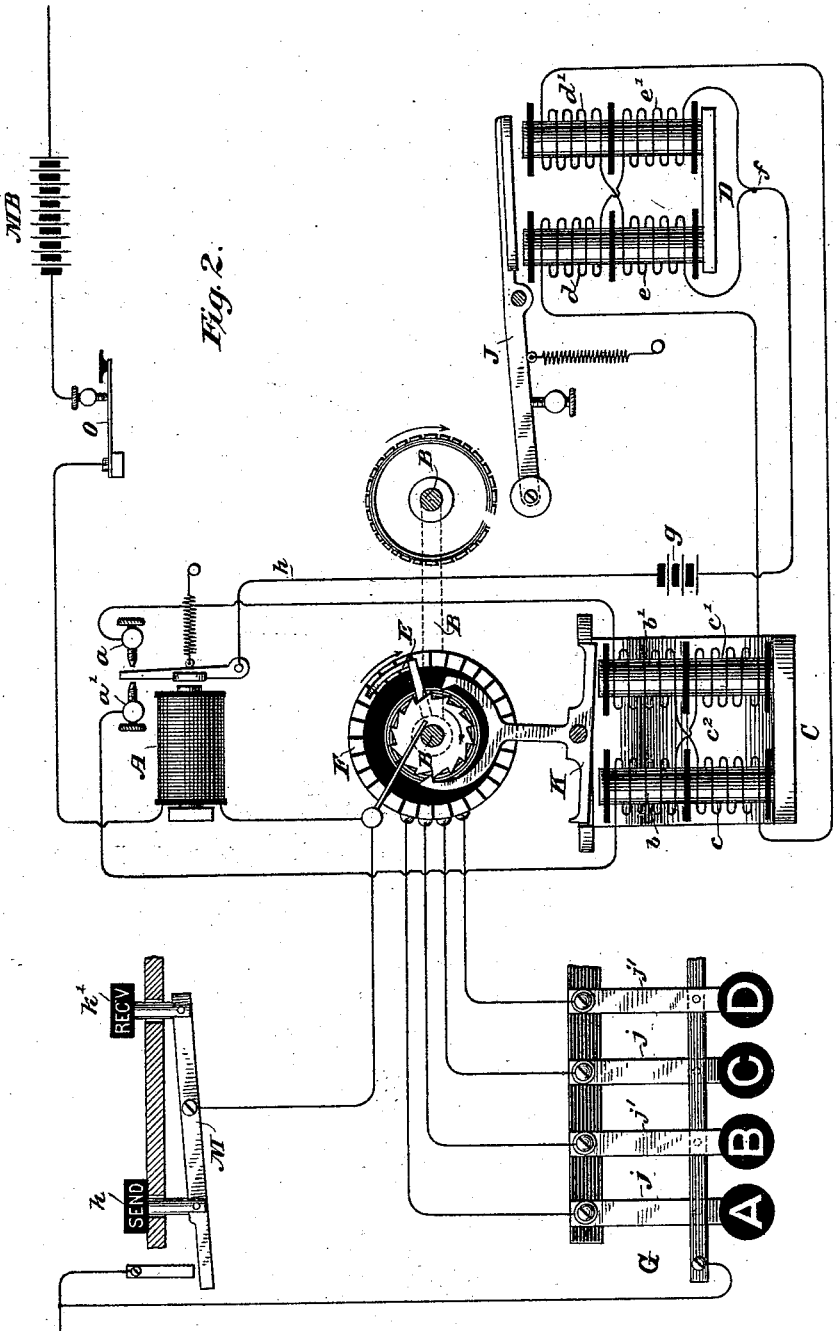
Fig. 2.



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UNITED STATES PATENT OFFICE.

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PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 455,075, dated June 30, 1891.

Application filed February 24, 1891. Serial No. 382,541. (No model.)

To all whom it may concern:

Be it known that I, HENRY VAN HOEVENBERGH, a citizen of the United States, residing in the city, county, and State of New York, have invented a new and useful Printing-Telegraph, of which the following is a specification.

My invention relates to that class of printing-telegraph instruments in which a revolving shaft carrying a type-wheel, escapement-wheel, and other attachments necessary for its proper operation is controlled by currents of electricity transmitted over a telegraph-line.

The object of my invention is to provide a simple and reliable instrument which shall print upon a slip of paper intelligence transmitted from a distance in Roman letters and without danger of disarrangement of its parts by continued or severe working; that shall contain no superfluous working parts; that shall not be easily affected by induction, and that may be operated by a single main battery placed at any point in the line. The transmitting-instrument is under the control of the receiving-operator as well as the transmitting-operator, so that the former may arrest its action whenever he desires. The instrumentalities used for accomplishing these results are comparatively few and simple. Upon a base, preferably of cast-iron, are mounted two supports. These hold the end bearings of the shaft, carrying a type wheel or carrier, an escapement-wheel, two friction flange-clamps, and an arm with a light steel spring. One of the friction-clamps is rigidly fastened to the shaft, the other being free to slide upon it longitudinally, but compelled to revolve with it by means of a pin working in a groove in the shaft. A gear-wheel is clamped between the two friction-clamps, the loose one of which is pressed against it by a spring, two washers of cloth separating the rubbing-surfaces and providing the necessary friction. The teeth of this gear-wheel mesh into those of another located underneath it and fastened to a shorter shaft, to which also is fastened a pulley. When power is applied, if nothing is interposed to prevent, the upper or type-wheel shaft will be carried with the gear-wheel by means of the friction. It is held, however, by an anchor-escapement working into the escapement-wheel and rocking upon its bearing to allow the escapement-wheel, with the shaft, type-wheel, &c., to escape the distance of one-half tooth on each actuation of the anchor-lever. There is an arm rigidly fastened to the rear end of the shaft carrying a spring or trailer, which presses upon the periphery of a segment-wheel fastened to the frame of the instrument. This constitutes a main-line-circuit breaker. Other forms of circuit-breakers are known in the art. This segment-wheel is cut into twenty-eight insulated sections, each one of which is connected by a wire to the spring of one of twenty-eight finger-keys. Each alternate spring is normally pressed upward against a metal bar, making an electrical connection with it. The remaining alternate springs are pressed normally out of contact with the metal bar with which they make connection when pressed downward. One of the main-wire connections comes to this bar. The other main wire is connected to the frame of the machine, and is therefore in electrical connection with the segment-arm. Both the escapement-magnet and the print-magnet are wound with two windings. Each winding of each magnet is connected to a similar winding in the other magnet and one winding is connected to the front contact of a common Morse relay and one to the back contact. As these windings conduct the local current around the magnet-cores in different directions, it is evident that a current sent first through one and then through the other would have the effect of a reversed current on the iron of the cores, though the current itself is not reversed. The escapement-magnet and its armature may be polarized by a permanent magnet. The magnet that operates the press mechanism has only an ordinary iron armature and is not polarized. The instrument as thus organized will act either as a transmitter or receiver, the change from one to the other being made simply by the movement of a circuit-closing switch. When acting as a transmitter, the combined operation of the relay and the circuit-breaking arm on the shaft result in a continued revolution of the shaft and a continued vibration or opening and closing of the current on the

main line. The manner in which this is effected can be understood by a reference to the drawings accompanying this specification, in which—

Figure 1 is a perspective view of my improved instrument, the key-board being omitted; Fig. 2, a theoretical diagram showing the electrical connections, and Fig. 3 a detail view showing the unison device and inking brush.

A is the controlling-relay, the magnet-coils of which are in circuit in the main line. From the front and back contacts a and a' of this relay wires pass to coils b and b' of the escapement-magnet C, thence to coils c and c' of the same magnet, thence to coils d and d' of the press-magnet D, thence to coils e and e' of the same magnet. Emerging from this coil the two wires join at the point f, running thence to the local battery g. From this local battery a wire h runs to the armature-lever of the relay A. There are thus two independent circuits from the relay-lever to the point f. The main or line circuit, starting from the main battery MB, which may be situated at any point on the line, runs first to the coils of the relay A, thence to the shaft B and trailing spring E. This spring E, revolving with the shaft B, presses in succession upon each block of the segment-wheel F. From each one of the metallic blocks of the segment-wheel F a wire runs to the spring of a key j or j' of the key-board G. These keys are of two classes. One class j of keys are normally pressed against the metal contact-bar forming their upper limits, making electrical contact therewith and having an insulated limit underneath. The alternate keys j', on the contrary, are normally out of contact with the metal bar until depressed, when they make electrical contact with it. Thus as long as the keys maintain their normal positions the effect is precisely as if each alternate segment of the segment-wheel was insulated, the main-line circuit being open when the trailing spring E presses against it. When thus organized and power is applied to the pulley H, tending to make the type-wheel shaft revolve in the direction indicated by the arrow, the operation of the instrument when transmitting is as follows: The spring E being upon a segment connected with a closed key, the current from main battery MB, acting in the relay-magnet A, causes it to attract its armature and close the local circuit through the contact-point a' and coils b, c', d, and e'. This rocks the polarized escapement-lever K in one direction, allowing one tooth of the escapement-wheel L to pass and the type-wheel shaft to revolve the distance of one twenty-eighth of an entire revolution. This permits one letter of the type wheel or carrier to pass the impression roller or platen, and the trailing spring E to pass from one segment of the segment-wheel to the next one. The effect upon the press-magnet D will be described hereinafter. As the trailing spring E now rests upon an "open" segment of the segment-wheel—*i. e.*, one connected with a normally-open key—the main circuit is now opened, and the relay-armature-lever falls against its back contact a. This closes the local circuit through the contact-point a and coils b' c and d' e. As the current now traverses the coils in a direction the reverse of that first described, the effect upon the iron of the cores of the magnets is precisely the same as though the battery had been reversed, although as a matter of fact this has not been done. The polarized armature K is therefore rocked to its opposite limit, allowing the shaft to again move the same distance as before. The trailing spring E now rests upon a "closed" segment of the segment-wheel, closing the main-line circuit, when the operations just described are repeated. This results in a rapid and regular revolution of the shaft and a steady vibration or opening and closing of the current on the main line. While thus revolving, if one of the keys—for instance j—be depressed, the revolution continues until the trailing spring reaches the segment of the segment-wheel that is connected to the depressed key. As this segment is then converted from a closed to an open segment, the revolution of the shaft will be stopped at that point, as the main-line circuit will be held open and the relay-lever will remain against its back contact. As soon as the key resumes its normal position, the revolution will be resumed. If now key j be depressed, the trailing spring will find that the key has been converted from an open to a closed circuit-key, and the revolution of the shaft will be arrested at that point, the relay-armature remaining against its front contact a'.

As before explained, the influence of the current traversing the different windings is the same upon the magnet-cores as if the local current had been reversed at each alternate impulse. These impulses sent in quick succession have no effect upon the unpolarized armature of the press-magnet and its comparatively heavy impression-lever J, held by its spring at some distance from the cores of the magnet. When, however, one of these impulses is prolonged by the depression of a key, the cores have time to receive their maximum charge of magnetism and the lever to respond, raising the impression-roller L and pressing the paper strip (represented by the dotted lines on Fig. 3) against the type-wheel and imprinting the character that is then opposite the roller. Thus by touching the lettered keys in the proper order and holding each one long enough for the impression to be effected any communication may be quickly spelled out. Any ordinary feed device may be used.

To arrange for receiving, the button k' of the switch M is depressed. This closes the main-line circuit, shunting or cutting out the segment-wheel, trailing spring, and key-

board. A button k is also provided for similarly operating the switch M to put the instrument into condition for sending. When receiving, main-line vibrations are received from some other instruments on the line acting as a transmitter. These vibrations are received upon the main-line relay A, the lever of which sends the local circuit alternately through the circuits $a\,f$ and $a'\,f$. This rocks the escapement-lever, as before described, until the desired letter is brought opposite the impression-roller, when a prolonged completion of the local circuit causes the impression to be taken.

With all printing-telegraphs of this class it is necessary that the type-wheel of the receiving-instrument should be started in unison with that of the transmitting-machine—in other words, that the same letter upon each wheel shall pass the impression-roller at the same instant. This is effected by means of the lever N. Normally this lever rests upon a back-stop n', being held there by its weight. When in this position, it does not in any way affect the working of the instrument. When it is desired to bring the receiving type-wheel into unison with the transmitter, the operator presses the lever N toward the type-wheel shaft. This causes the latch n to slip into the notch o of the press-lever J. The beak or projection I of the lever N is then in the path of the unison-pin m on the type-wheel shaft B. When by reason of the revolution of the shaft the two come into contact, the shaft will be held in such position that the dot or zero of the type-wheel will be opposite the impression-roller. When the dot or zero key is depressed and the press-lever rises, the unison-lever N will not only be released, but will be struck by the press-lever and thrown back, so that the projection I will be out of the path of the pin m. As the transmitting-operator always starts by making a few dots, the shaft will be released at this point.

By following the operation, as explained above, by which the continued revolution of the type-wheel is maintained, it will be seen that the main line plays an important part in the operation. The strength of the current on the line directly controls the speed of revolution of the type-wheel shaft, as the stronger the current is the more rapidly the relay will respond to the openings and closings of the circuit. With a current of maximum strength properly adapted to the resistance of the main-line relays, the shaft revolves at a speed of about one hundred and fifty revolutions per minute. Weakening the current has the direct effect of diminishing this speed until a point is reached, when the relay fails to vibrate and the instrument comes to a stop. The instrument thus adapts itself automatically to the condition of the line. With a clear working line-wire and a strong current the instrument will transmit at its maximum speed. When the current is weakened by reason of escape on the line, development of high resistance, defective main battery, or any similar cause, the instrument will still continue to operate perfectly, although at a lower rate of speed, instead of failing altogether, as is usual with instruments of this class. This feature also makes it possible for the receiving-operator to stop or break the transmitting-operator when it becomes necessary for any reason. In most "step-by-step" printing-telegraphs hitherto invented, if anything happens to the receiving-instrument the transmitting-operator cannot be notified of it until he has ceased to transmit and gives the receiver a chance to transmit. In this machine the receiving-operator can stop the transmitter at any time by simply depressing the button or key O, which opens the main line and stops the revolution of the transmitting-shaft. The transmitting-operator then sees that something is wrong by his instrument failing to work, and setting his switch at "receive" allows the other operator to transmit to him, the process being precisely that by which one Morse operator "breaks" another and tells him from where to "go ahead" with the message.

To supply ink to the type-wheel I use a brush suitably charged with ink. I prefer to employ a thin oblong brush of camel's hair, cut diagonally across its width, as shown in Fig. 3. This is open to none of the objections incident to the use of an inking-roller and greatly improves the impressions from the type-wheel.

Printing-telegraphs controlled by a segment-wheel and operated on the opening and closing of the line-circuit are old. The patent of Moses G. Farmer, No. 15,373, dated July 22, 1856, shows such an instrument. I am also aware that the use of relays to control the local circuit of the escapement-magnet is old. In the Farmer patent the escapement is worked directly by a magnet in the main circuit, which is obviously impracticable for long distances, and the attempt to remedy this defect by putting a common electro-magnet in a local circuit opened and closed by a relay would lead to numerous difficulties of adjustment. I prefer to employ a current of one direction only on the main line and use, therefore, a neutral relay. In my telegraph there is no local adjustment to the escapement-armature, and as there is no mechanical device to complete the circuit of the press-magnet one adjustment of the relay answers for both magnets.

The great advantage of the improved method of effecting the printing in my instrument over others is distinctly shown when two letters are printed following each other in alphabetical order. Between the two impulses sent into the press-magnet to print the two characters the direction of the magnetism in the cores of the magnet is reversed, and the press-lever thus compelled to fall back to its extreme back limit. A certainty of action is thus attained that is impossible when the cir-

cuit is simply opened and closed to print the two consecutive characters.

I claim as my invention—

1. The combination, substantially as set forth, of a rotatable type-wheel, a segment-wheel, transmitting-keys connected with the individually-insulated segments of the segment-wheel, a trailer moving with the type-wheel and traversing the segment-wheel, a neutral relay, the trailer and relay being connected with the main line, a type-wheel-controlling magnet, a press-magnet, and two local circuits respectively connected with the front and back stops of the relay and both connected with the relay-armature lever, the type-wheel magnet and press-magnet being both included in both local circuits.

2. The combination, substantially as set forth, of a rotatable type-wheel, a segment-wheel, alternate open and closed transmitting-keys connected with the individually-insulated segments of the segment-wheel, a trailer moving with the type-wheel and traversing the segment-wheel, a neutral relay, the trailer and relay being connected with the main line, a type-wheel-controlling magnet, a press-magnet, and two local circuits respectively connected with the front and back stops of the relay and both connected with the relay-armature lever, the type-wheel magnet and press-magnet being both included in both local circuits.

3. In a printing-telegraph, the combination, substantially as set forth, of the neutral main-line relay, two local circuits respectively connected with the front and back stops of said relay and both connected with the relay-armature lever, the polarized magnet having two separate and distinct windings and the neutral magnet having two separate and distinct windings, one winding of each magnet being included in one local circuit and the other winding of each magnet being included in the other local circuit.

4. The combination, substantially as set forth, of a rotatable type-wheel, a segment-wheel, alternate open and closed transmitting-keys connected with the individually-insulated segments of the segment-wheel, a trailer moving with the type-wheel and traversing the segments, escapement devices controlling the movement of the type-wheel, a neutral relay, the relay and trailer being in the main line, a polarized escapement-magnet having two separate and distinct windings, a neutral press-magnet having two separate and distinct windings, and two local circuits respectively connected with the front and back stops of the relay and both connected with the relay-armature lever, one winding of each magnet being included in one local circuit and the other winding of each magnet being included in the other local circuit.

5. The combination, substantially as set forth, of a rotatable type-wheel, a segment-wheel, alternate open and closed transmitting-keys connected with the individually-insulated segments of the segment-wheel, a trailer moving with the type-wheel and traversing the segments, escapement devices controlling the movement of the type-wheel, a neutral relay, the relay and trailer being in the main line, an escapement-magnet having two oppositely-wound windings, a neutral press-magnet having two oppositely-wound windings, and two local circuits respectively connected with the front and back stops of the relay and both connected with the relay-armature lever, one winding of each magnet being included in one local circuit and the other winding of each magnet being included in the other local circuit.

6. The combination, substantially as set forth, with a type wheel or carrier, of a main-line-circuit breaker actuated with said type-carrier, the transmitting-keys connected with the circuit-breaker, a main-line relay, two local circuits respectively connected to the front and back contacts of the main-line relay and both connected with the relay-armature lever, and type-carrier and press-magnets included in both local circuits.

7. The combination, substantially as set forth, with a type wheel or carrier and impression devices, of a main-line relay, two local circuits respectively connected with the front and back contacts of said relay and both connected with the relay-armature lever, and type-carrier and press-magnets included in both local circuits.

8. The combination, substantially as set forth, of a type wheel or carrier and impression devices, a main-line relay, two local circuits respectively connected with the front and back stops of said relay and both connected with the relay-armature lever, a polarized type-carrier magnet having two separate and distinct windings, and a neutral press-magnet having two separate and distinct windings, one winding of each magnet being included in one local circuit and the other winding of each magnet being included in the other local circuit.

9. A unison device for printing-telegraphs, consisting of the lever N, having a latch *n* and beak I, in combination with the press-lever having a notch *o* and the unison-pin on the type-wheel shaft.

In testimony whereof I have hereunto subscribed my name.

HENRY VAN HOEVENBERGH.

Witnesses:
EDWARD C. DAVIDSON,
LLOYD B. WIGHT.