(No Model.) 2 Sheets—Sheet 1.

H. VAN HOEVENBERGH.

PRINTING TELEGRAPH.

No. 285,710. Patented Sept. 25, 1883.

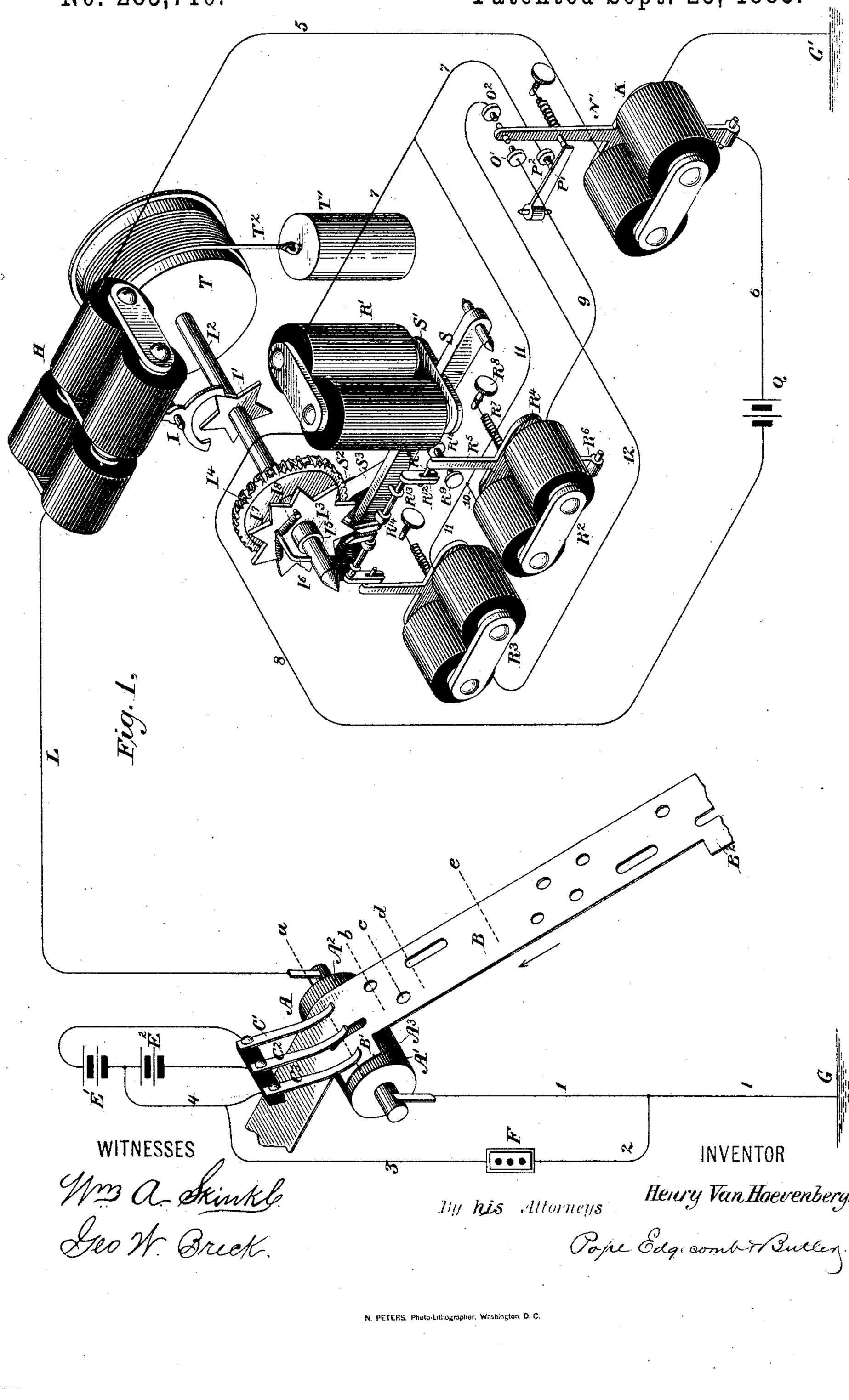

Fig. 1.

WITNESSES

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

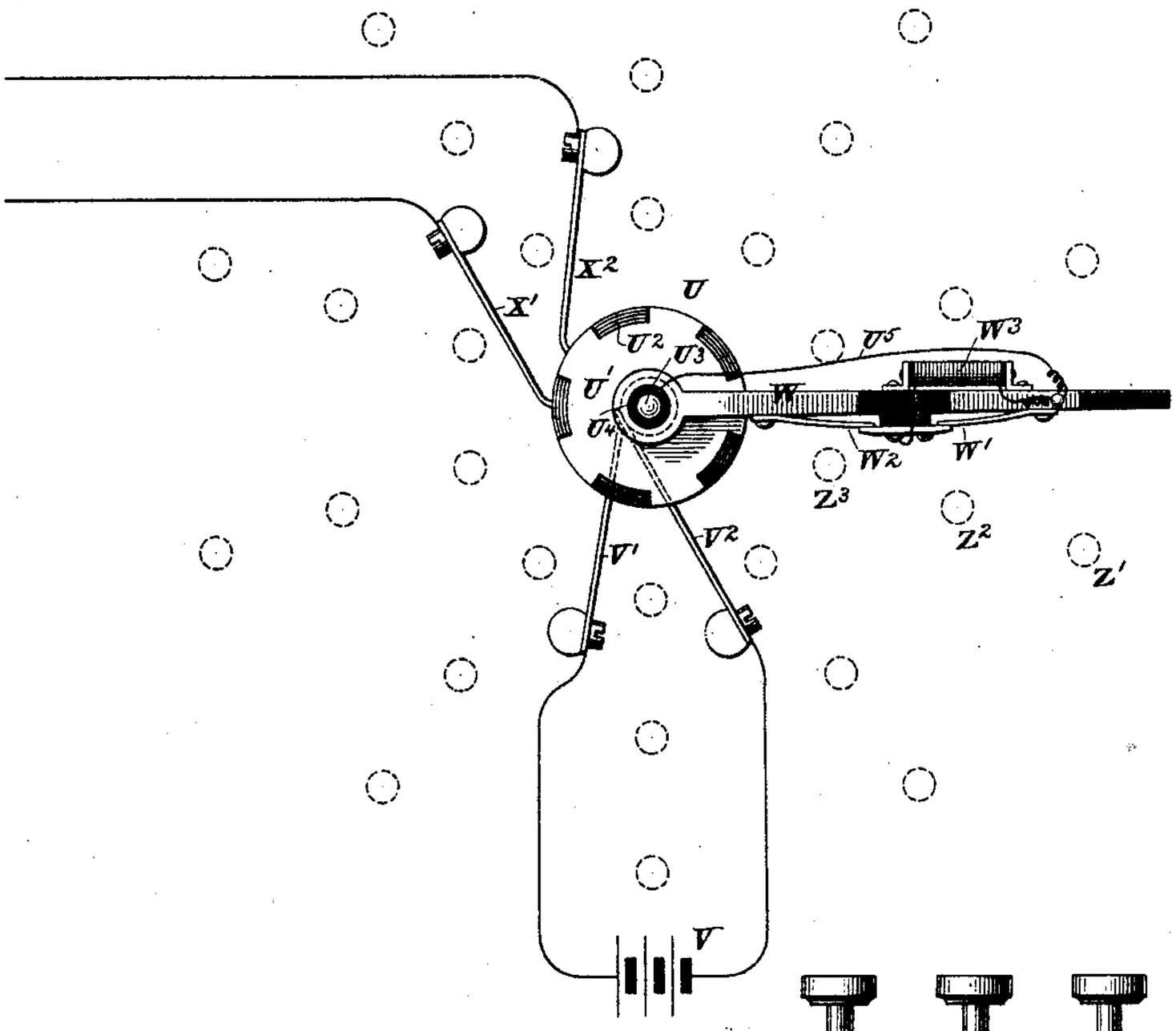
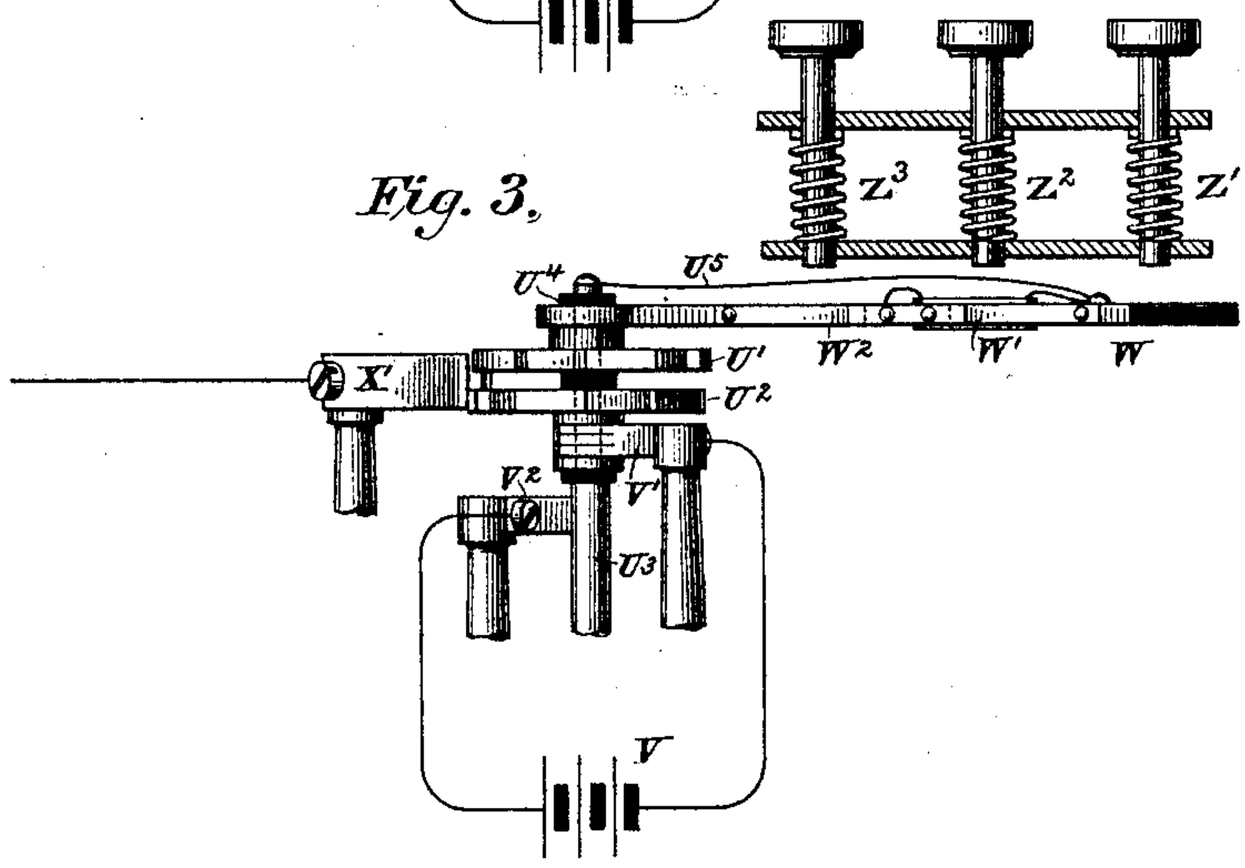


Fig. 3.



WITNESSES

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UNITED STATES PATENT OFFICE.

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PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 285,710, dated September 25, 1883.

Application filed March 16, 1883. (No model.)

To all whom it may concern:

Be it known that I, HENRY VAN HOEVENBERGH, a citizen of the United States, residing in Elizabeth, in the county of Union and State of New Jersey, have invented a new and useful Improvement in Electro-Telegraphic Printing-Instruments, of which the following is a specification.

This invention relates to electro-magnetic printing-telegraph systems. It relates both to transmitting and receiving devices for such systems.

The principal object of the invention is to secure increased rapidity of operation. To this end the type-wheel is caused to advance normally through consecutive arcs, each subtending three characters, or, in other words, so as to skip two characters at each step. When any one of the characters thus skipped is to be printed, the wheel is brought to rest upon an adjacent character thereto, and one or other of two devices is brought into action, which mechanically imparts to the wheel a supplementary movement independently of its shaft and in the required direction and extent to bring the desired character into exact position. The impression is then taken therefrom.

The invention further includes a form of automatic transmitting mechanism for operating the improved apparatus at the receiving-station.

The several consecutive operations by which the printing is effected by the apparatus at the receiving-station, as herein described, may be set forth as follows: First, a type-wheel is caused to advance by successive steps, each subtending three characters or circumferential divisions; secondly, it is arrested in position to print either the desired character or a character adjacent thereto; thirdly, a further or independent adjustment of said type-wheel is then effected (in case the required character is not already in position) by imparting a supplementary angular movement thereto in the direction and to the extent necessary to bring the required character into the proper position for printing; fourthly, an impression is taken of the character which has thus finally been brought into position. The object of the third of the above-mentioned operations—namely, that of precisely adjusting the type-wheel—is to render it practicable to use the three-letter-step movement in place of the usual single-letter step. The result produced is a material diminution of a number of independent electric pulsations, and more particularly of the time required for bringing the type-wheel into position for printing any required character, and hence with this improved instrument great speed in the transmission of electro-telegraphic communications is attained.

The apparatus by which these results are accomplished may be briefly described as follows:

The transmitter.—This instrument may be constructed to be operated manually or automatically. If it is to be manually operated, it is provided with a key-board, the office of which is twofold: first, to transmit to line by its normal continuous action a series of alternate positive and negative impulses for causing the progressive movement of the type-wheel at the receiving-station; secondly, to establish upon the line, as required, one or another of three electrical conditions, which are as follows: first, the condition in which the line is traversed by a current of a given strength; second, the condition in which the line is traversed by a current less than said given strength; and, third, a neutral condition, or one in which no current traverses the line. The keys upon the key-board are accordingly divided into groups comprising three keys each. The first key of any group throws the line into the first-named condition, the second into the second-named condition, and the third into the third. For rapid transmission, the automatic form of transmitter will be preferred. In this instrument the passage of a peculiar form of prepared tape or pattern-strip over metallic surfaces and beneath a series of resilient springs, connecting with the batteries and ground, causes the establishment upon the line of the three electrical conditions mentioned above. Various forms of transmitting apparatus may be de-

vised to execute this work. Two will be shown hereinafter, one of which may be operated manually, the other automatically. The latter is the form which it is proposed to claim in detail in the present application.

The receiver.—This instrument is provided with a central shaft for carrying the type-wheel, revolving under the action of a suitable constant force or maintaining-power and controlled by an escapement mechanism. The escapement mechanism is actuated by a polarized magnetic system, the helices of which are in the main circuit, and with every escape the type-wheel advances through an arc subtending three characters. The main-line current also traverses the helices of a relay the armature-lever of which may be brought to rest in any one of three positions—namely, two extreme positions, one in each direction, and a central intermediate position. The position which the armature-lever will assume in any case depends upon the condition of the main line as established by the transmitter hereinbefore described. With a continuous current of definite strength the relay will pause on its front contact-stop, with a weaker current it will assume the intermediate position, and when no current is upon the line it will rest against the back stop. In the intermediate position referred to, this armature-lever closes the printing-circuit and produces the impression upon the tape of the character then in place. When upon the front stop, a local circuit is closed, including the printing mechanism and an electro-magnetically operated device through the agency of which the type-wheel is advanced through an arc subtending a single character just before the impression is taken. In the case of a pause upon the back stop, the branch of local circuit which is closed will include the impression or printing magnet and an electro-magnetically operated device by which the type-wheel is set back a single division just before the impression is produced. Thus while the type-wheel normally advances three characters at a time the impression of any one of three characters may be taken after it has come to rest.

The particular subject-matter claimed will be hereinafter specifically designated.

In the accompanying drawings, Figure 1 is a theoretical diagram designed to explain the operation of the several parts, which are shown in perspective, and so distributed as not to interfere with each other. Fig. 2 shows a manually-operated transmitter which may be substituted for the form shown in Fig. 1. Fig. 3 is a vertical view of the latter form.

A is a transmitting cylinder or roller, over which the prepared paper tape or pattern-strip B passes. The cylinder A is divided into two parts, A′ and A^2, electrically insulated from each other at A^3. The part A^2 is directly connected to the main line L, while the part A′ is in electrical connection by conductor 1 with the earth at G. The brushes or contact-springs C′ and C^2 press upon the division A^2, or upon that portion of the tape B which is upon said division. A brush, C^3, rests upon the division A′ and is normally in contact therewith. The tape B is provided at intervals, determined by the particular character to be printed, with lateral projections B′ B^2, &c. These pass between the springs C^3 and the division A′, and serve to insulate them from each other during such passage. The spring C′ is connected to the positive pole E′ of the battery, and the spring C^2 to the negative pole E^2 of the battery. The remaining poles of both these batteries are connected by a common conductor, 4, to the spring C^3, and thence to ground at G by way of the division A′ of the cylinder A and conductor 1. In the event of the passage of one of the lateral projections, B′, of the tape insulating the spring C^4 from the division A′, the batteries will still remain in connection with the earth; but the route of the earth-circuit will then be by conductors 4 and 3, rheostat F, and conductors 2 and 1. The tape B is provided with arbitrarily-grouped perforations of two classes—circular and elongated—and also with lateral projections B′ B^2, &c., upon one side. The specific manner in which this tape or pattern-strip is formed does not constitute any part of the subject-matter of the present invention, but is to be embodied in a separate application.

The functions and objects of the perforations may be best explained by considering what takes place when the tape is made to pass beneath the contact-springs. As shown in the drawings, the part of the tape crossed by the transverse dotted line *a* is beneath the springs; hence the spring C^2 is in contact with the division A^2 through an elongated perforation, and the negative pole of battery E^2 is consequently to line. The spring C′, in connection with the battery E′, is insulated, leaving the battery-circuit open. As the lateral projection B′ upon the tape intervenes between the spring C^3 and the division A′, the battery E^2 is grounded through the rheostat F, as heretofore explained. There is therefore sent to line a pulsation diminished in strength by the resistance of the rheostat, which it is compelled to traverse, and which may be represented by the symbol —1. If, now, the tape be caused to advance in the direction indicated by the arrow, on reaching the part *b* of the tape the spring C′ will come into contact with division A^2 of the cylinder through one of the circular openings, and the spring C^3 simultaneously into contact with the division A′, and hence the battery E′ will be put to line by its positive pole, the negative pole being at the same time to earth directly through the division A′. The resulting electric impulse may now be conveniently represented by + 2. Similarly, when the part *c* is reached an impulse represented by the expression — 2 will be sent to line. At *d* a current represented by the expression + 2 will be sent to line, which will

be prolonged in consequence of the elongated shape of the slot. When the part *e* passes, both contact-springs C′ and C² will be withdrawn from the line and an elongated pause produced, during which there will be no current upon the line.

Reviewing what has been said, it will be seen that by reason of the passage of the tape, arbitrarily punctured in the manner described, the line is traversed by a series of short pulsations of alternate polarity, and also at intervals prolonged pauses occur, during which the line will be traversed either by a current of given strength or by a weaker current, or by no current whatever.

Passing now to the receiving mechanism, the electric currents entering by line L pass first through the electro-magnetic system H, where they produce to and fro oscillations of an anchor-escapement mechanism, I, of well-known construction. The scape-wheel I′ of this mechanism is provided with five teeth, and as both pallets of the anchor engage with each tooth the shaft I² makes one advance revolution for every ten reversals of current. The shaft I² also carries a ten-toothed wheel, I³, and type-wheel I⁴, provided with thirty characters. These wheels are both mounted on a loose sleeve, I⁵. A pin, I⁶, projects from the shaft I², and is flexibly attached by means of springs I⁷ and I⁸ to the face of the wheel I³. Under the action of these springs the wheels I³ and I⁴ tend to retain a constant fixed position upon the shaft I²; but both wheels may be revolved slightly in either direction under the influence of independent mechanism, as hereinafter explained. The main line passes from the electro-magnetic system H to the relay K by conductor 5, and thence to the earth at G′. The armature-lever N′ of the relay K plays between contact-stops O′ and O². At an intermediate position between these stops it makes contact with the spring P′. The forward motion from this point removes the spring P′ from its resting contact-point P². The backward motion breaks contact between the armature-lever N′ and the spring P′. The three positions thus described serve to transmit the current of the battery Q through three different channels, respectively. These may be traced as follows: First, in the intermediate position, which is the position shown in the drawing, the current passes from battery Q by conductor 6, lever N′, lever P′, contact-point P², conductor 7, printing-magnet R′, conductor 8, to battery Q. When the lever N′ is on its forward contact-stop, O′, the local current will traverse the conductor 6, armature-lever N′, stop O′, conductor 9, electro-magnet R², conductors 10, 11, and 7, magnet R′, and conductor 8, again to battery. When on the rear contact-stop, O², the current passes from battery Q by conductor 6, lever N′, stop O², conductor 12, magnet R³, conductors 10 11 7, magnet R′, conductor 8, again to battery Q. In each of these cases the local current traverses the coils of the electro-magnet R′. In the first case it traverses them alone. In the second it traverses said coils, and also, in conjunction therewith, the coils of electro-magnet R². In the third case it traverses the coils of electro-magnet R′, and, in conjunction therewith, those of electro-magnet R³. Each of the electro-magnets R² and R³ operates an independent mechanism for imparting a supplementary movement to the type-wheel I⁴. The mechanism operated by the magnet R² advances the wheel, while that operated by magnet R³ gives it a retrograde movement.

The lever devices operated by the magnets R² and R³ are practically similar to each other, and may be described as follows: The attraction of the electro-magnet is exerted upon an armature, R⁴, actuating an armature-lever R⁵, fulcrumed at R⁶, and normally kept at a distance from the magnet by a spring, R⁷, adjustable by a screw, R⁸. The excursion of the armature R⁴ is determined by the adjustment of the screws R⁹ and R¹⁰, the former limiting its forward motion toward the magnet and the latter its backward motion away from the magnet. A pin, R¹¹, carried by the armature-lever R⁵, articulates with the bent lever R¹², which turns in eyelets R¹³ and R¹⁴, projecting from the side of the main printing-lever S, which is actuated by the electro-magnet R′. To permit the rise and fall of the said bent lever, the articulating pin R¹¹ traverses a slot in the end of the bent lever R¹², so that the latter may be operated by the motion of the lever R⁵, regardless of its vertical position. The ends of the bent levers are beveled. In the case of the lever actuated by R² the bevel is in such form as to cause the advancement of the wheel I³ by impinging upon one side of the tooth acted upon when the printing-lever is thrown up. In the case of the lever actuated by the magnet R³ the action is precisely similar in nature, but in a reverse direction.

The printing mechanism may be of any convenient form, and need not therefore be minutely described. It preferably consists of an armature-lever, S, carrying the armature S′, actuated by the pole of the magnet R′, and carrying a platen, S², over which passes the paper tape S³, upon which the impressions are to be taken. The advance movement is imparted to the type-wheel shaft I², when released by the escapement, by means of a drum, T, suspended weight T′, and cord T², or other equivalent mechanism.

The operation of the receiving-instrument as thus described, under the action of the several conditions of the line caused by the pauses of the transmitter, as hereinbefore described, is as follows: All the prolonged currents represented by the expression ±1 bring the relay armature-lever N′ to its central position, and therefore cause the actuation of the printing mechanism only. The pauses in which the condition can be represented by the expres-

sion ±2 cause the actuation of the printing mechanism and of the magnet R^3, thus setting forward the wheel a single division. The pauses represented by the expression O cause the actuation of the magnet R′ and magnet R^2, and hence take an impression immediately after setting back the type-wheel. The alternating pulsations caused by closing the circuit through the circular punctures upon the tape, while causing the advance movement of the type-wheel through divisions subtending three characters each, are not of a sufficient duration to operate the printing mechanism.

In Figs. 2 and 3 I have shown in diagram a convenient form of hand-transmitter. It comprises a pole-changing device, U, provided with two circuit-wheels, U′ and U^2, provided with alternating circumferential notches. These wheels are mounted on a vertical shaft, U^3, and are insulated therefrom by a sleeve, U^4. The lower wheel is connected to the negative pole of the battery V by means of the spring or brush V′. The positive pole of this battery is connected with the upper plate by brush V^2, shaft U^3, conductor U^5, and contact-points W′ and W^2 upon the arm W. When these contact-points are closed, the circuit-wheels may be regarded as the electrodes of the battery, and as said wheels revolve with the shaft alternating pulsations of opposite polarity will be transmitted to the line *via* the brushes X′ and X^2, which press upon the extensions between the circumferential notches upon said circuit-wheel. In this manner the current upon the line will be reversed ten times in each revolution.

The keys of the transmitter are divided into three series, each series comprising ten keys. These may be conveniently arranged in circular concentric rows $Z' Z^2 Z^3$, as shown in the diagram. The depression of any key in the outer row, Z′, causes the arm W to be arrested in a position depending upon the particular key depressed. The current then traversing the line will accordingly be prolonged during the period of arrest. Such current will be conveniently represented by the expression ±2, the effect of which will be to cause a pause of the relay-armature N′ at the receiving-station on its front contact-stop. When any key of the second series, Z^2, is depressed, not only will the arm W be arrested, but the contact-points at W′ will be separated, and the current then traversing the line will be diminished in strength by having to traverse the coils of the rheostat W^3. The current thus established may be represented by the expression ±1. Such current will cause the arrest of the relay armature-lever N′ in a central position. If any key of the third series, Z^3, be depressed, the arm W will be arrested and the contact-points W^2 separated, and the line accordingly left in a neutral condition. This will throw the armature-lever N′ of the relay on its back stop. Thus by this transmitter the same conditions are established upon the line as by the automatic transmitter described above in detail.

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, of a transmitting-cylinder, mechanism for sending to line alternating electrical pulsations of short duration, and mechanism for establishing upon the line prolonged electrical conditions of three kinds—namely, a condition of definite strength of current, a condition of lesser strength, and a neutral condition.

2. A strip of telegraphic transmitting-paper provided with lateral projections substantially such as described, which serve to break temporarily the electrical contact between a transmitting-cylinder and contact-spring normally pressing thereupon by passing between them.

3. In combination with the transmitting-circuits and battery, arranged substantially in the manner described, the cylinder divided into two divisions insulated from each other, the perforated transmitting-tape passing over one of said divisions, provided with lateral projections extending so as to traverse the other division, and the contact-springs normally pressing upon said cylinder, except when insulated therefrom by said strip or its lateral projections.

4. The combination, substantially as hereinbefore set forth, of the grounded division of the transmitting-cylinder, the tape provided with lateral projections which extend over said grounded division, a spring normally in contact with said grounded division, but which is temporarily insulated therefrom by the passage of any one of said lateral projections, and a circuit of adjustable resistance connecting said spring to ground.

5. The combination, substantially as hereinbefore set forth, of the cylinder divided into two insulated sections, one of which is in contact with the earth and the other with the line, contact-springs for pressing upon said sections, batteries of alternating polarity, thereby connected to line and to earth, and a shunt-circuit, whereby the line may be put to earth through an artificial resistance.

6. The combination, substantially as hereinbefore set forth, of a transmitting mechanism establishing upon the line three distinct electrical conditions, a relay pausing in three different positions by virtue of said conditions, and three local circuits completed, respectively, by said relay armature-lever, one including a printing mechanism only, a second including said printing mechanism and a mechanism for advancing a type-wheel through a definite arc, and the third including said printing mechanism and a device for retrograding said type-wheel through a similar definite arc.

7. An armature-lever making three contacts—namely, a central contact, at which point it closes the local printing-circuit, a forward

stop, at which point it closes the local printing-circuit and includes therein a device for advancing the type-wheel, and a back stop, at which point it closes a local printing-circuit and a device for retrograding said type-wheel.

8. The combination, substantially as hereinbefore set forth, of a type-wheel normally advancing through arcs subtending three characters each, mechanism for advancing said type-wheel through an arc subtending one character, and mechanism for retrograding said type-wheel through an arc subtending one character.

In testimony whereof I have hereunto subscribed my name this 9th day of February, A. D. 1883.

HENRY VAN HOEVENBERGH.

Witnesses:
WM. A. SKINKLE,
DANIEL W. EDGECOMB.