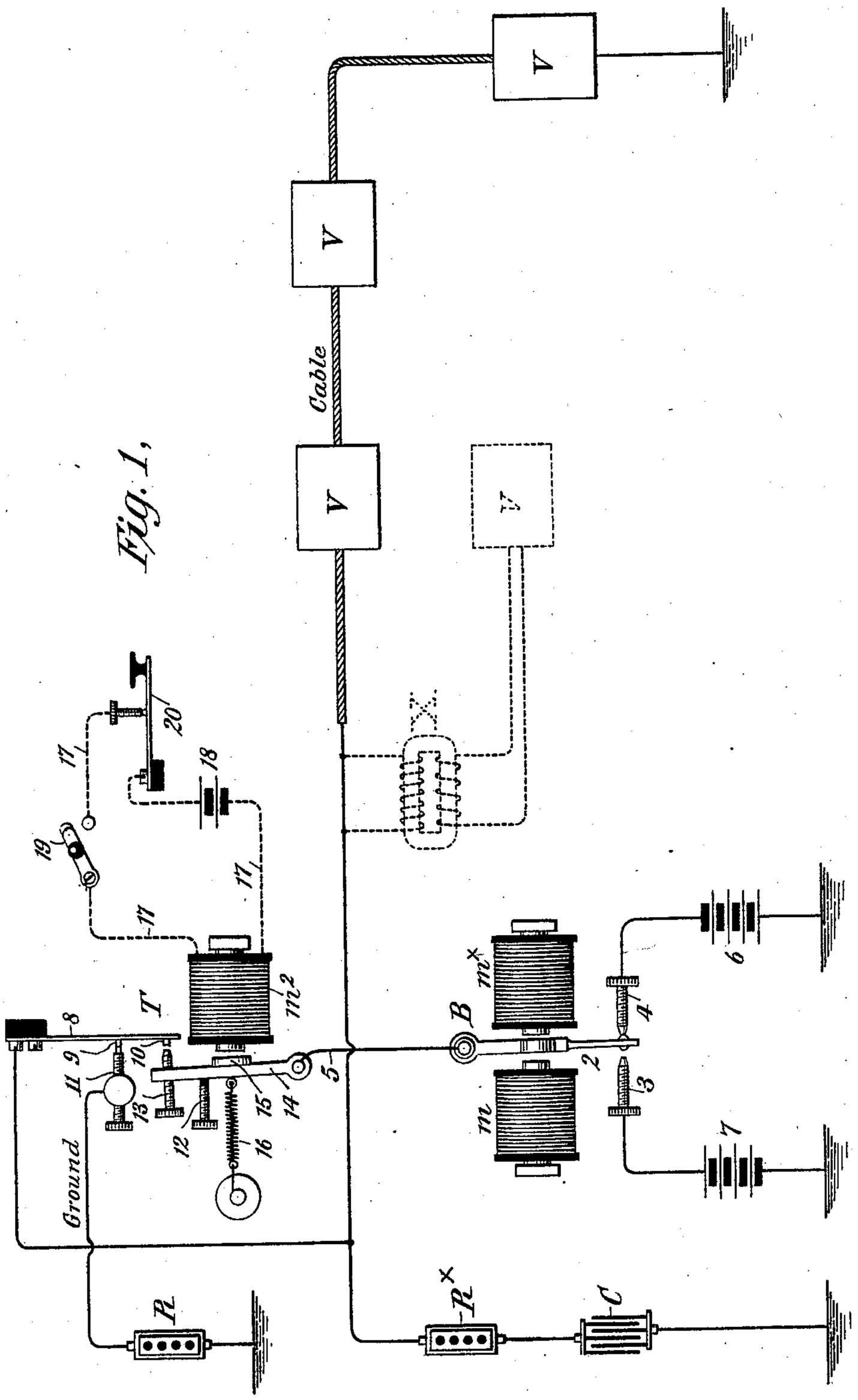
(No Model.) 3 Sheets—Sheet 1.

J. BURRY.

PRINTING TELEGRAPH SYSTEM.

No. 601,768. Patented Apr. 5, 1898.

Fig. 1,



WITNESSES:

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John Burry,

By his Attorney

Richard W. Barker.

(No Model.) 3 Sheets—Sheet 2.

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PRINTING TELEGRAPH SYSTEM.

No. 601,768. Patented Apr. 5, 1898.

Fig. 2,

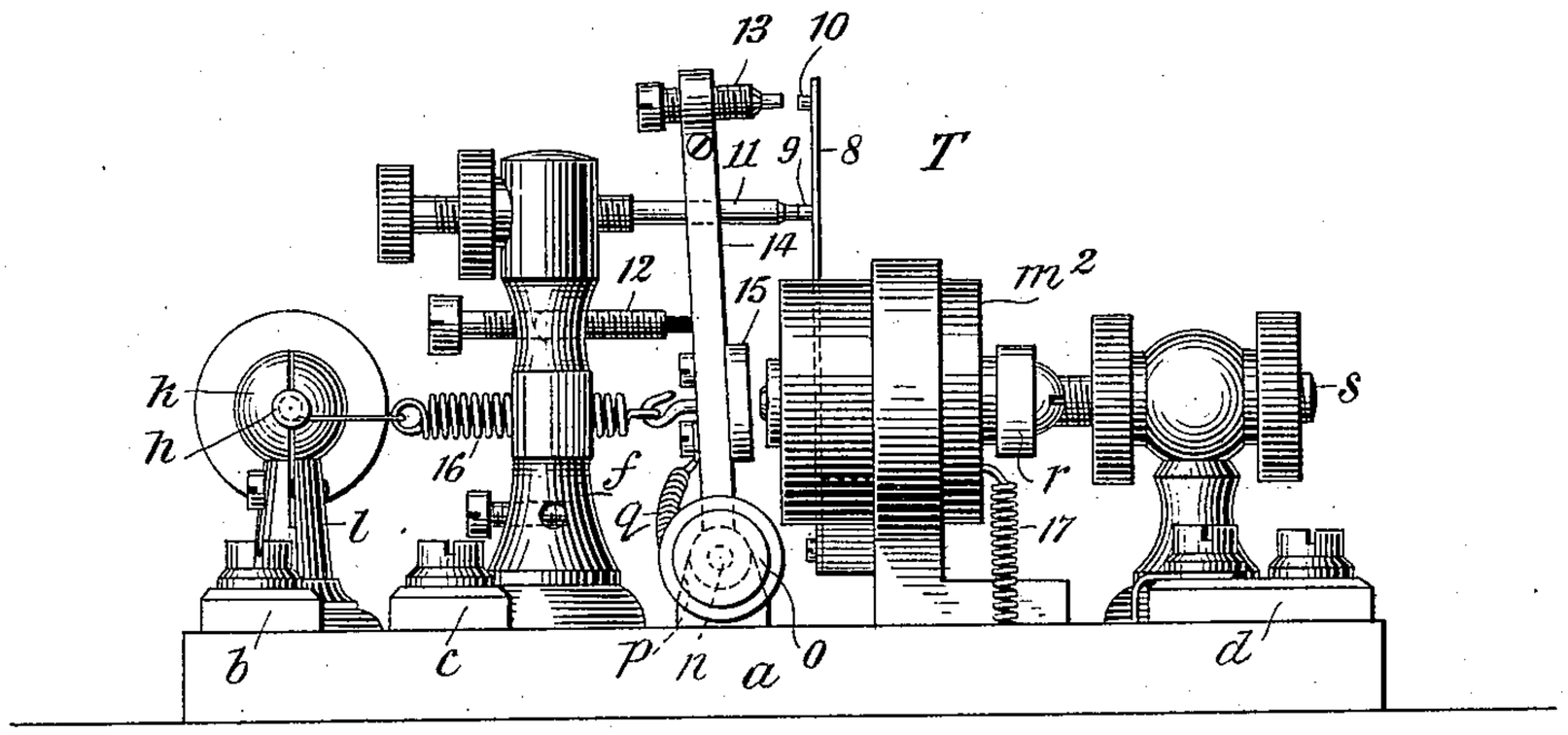
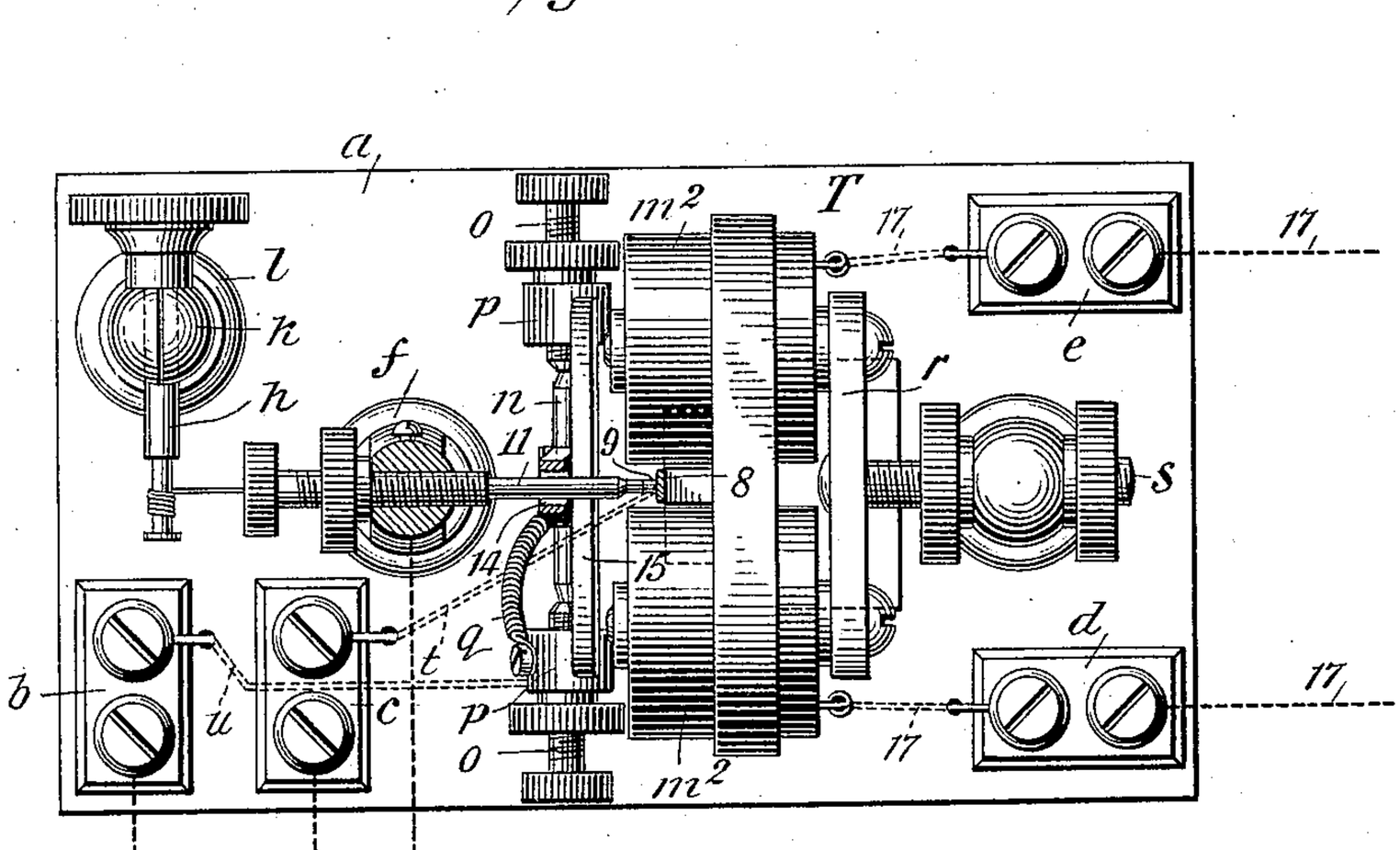


Fig. 3,



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(No Model.) 3 Sheets—Sheet 3.

J. BURRY.

PRINTING TELEGRAPH SYSTEM.

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Fig. 4,

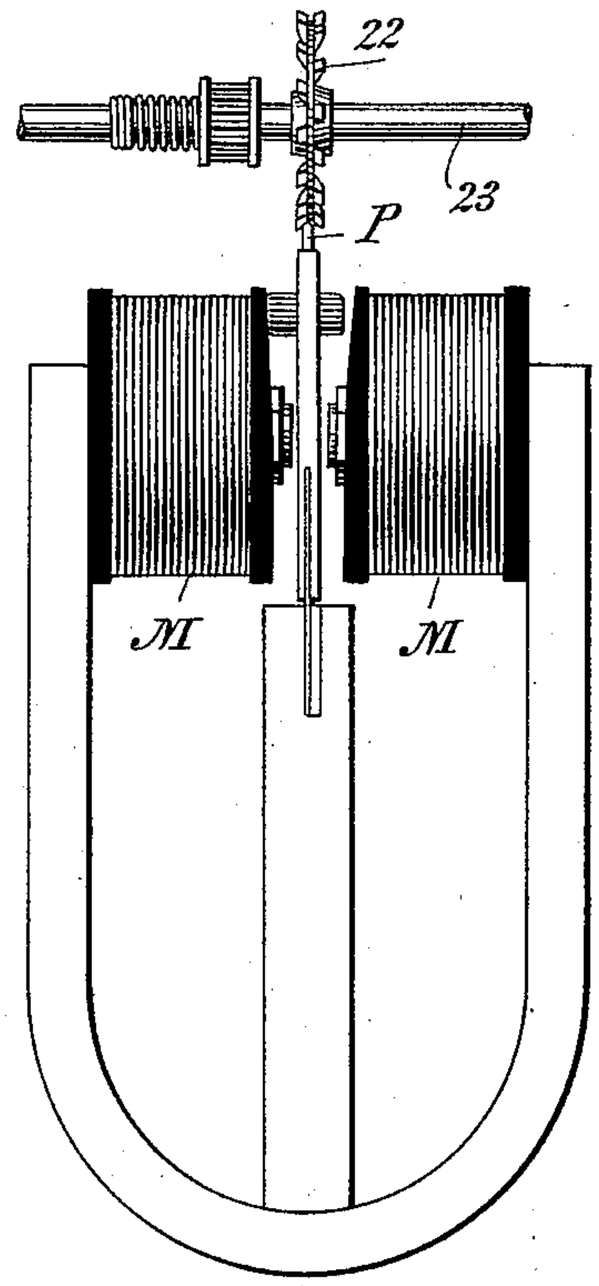


Fig. 5,

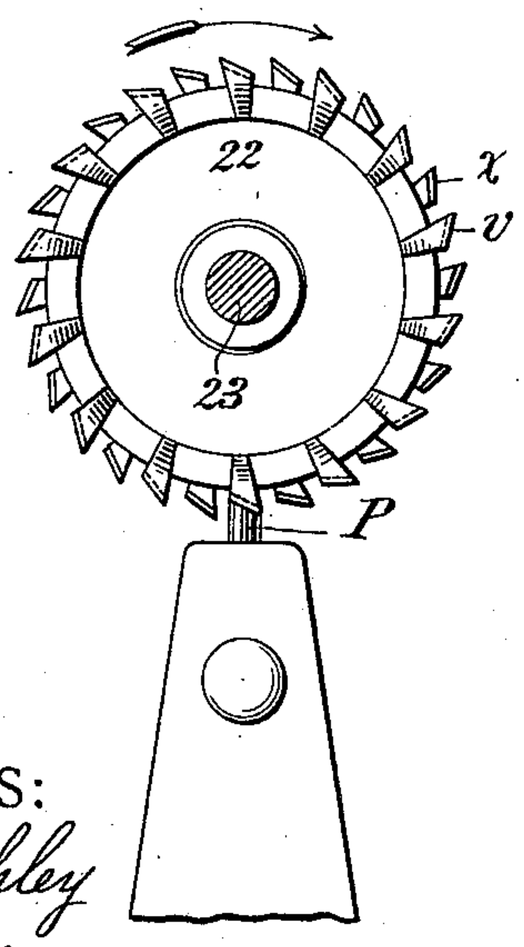
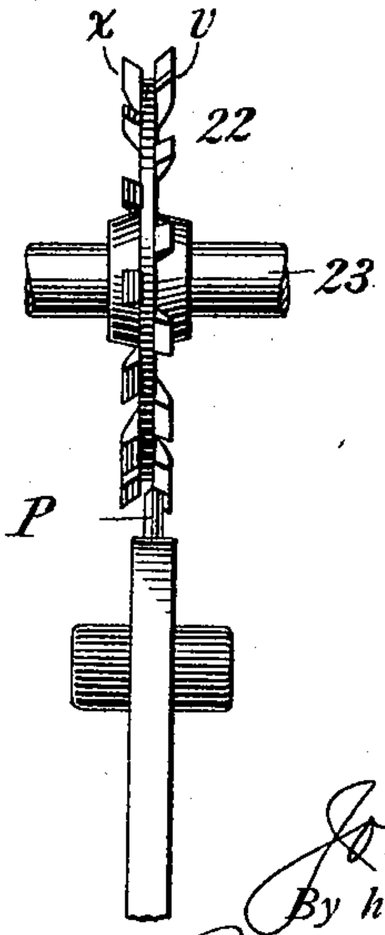


Fig. 6,



WITNESSES:
C. E. Ashley
H. W. Lloyd

INVENTOR:
John Burry,
By his Attorney
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UNITED STATES PATENT OFFICE.

JOHN BURRY, OF FORT LEE, NEW JERSEY.

PRINTING-TELEGRAPH SYSTEM.

SPECIFICATION forming part of Letters Patent No. 601,768, dated April 5, 1898.

Application filed September 10, 1897. Serial No. 651,165. (No model.)

To all whom it may concern:

Be it known that I, JOHN BURRY, a citizen of the United States, and a resident of Fort Lee, in the county of Bergen and State of New Jersey, have invented certain new and useful Improvements in Printing-Telegraph Systems, of which the following is a specification.

This invention relates to printing-telegraph systems in which a single line-wire is employed in operating the type-controllers and printing devices of the receivers and has the printing of diverse characters in rapid succession combined with the rapid and easy repetition of any character alongside itself for its primary object.

It may aid in an understanding of the present invention to have it described in connection with the particular forms or types of apparatus, as transmitters, current-reversers, and receivers, in connection with which I have used it in practice. However, I am not to be understood as limiting my claims to the use of such apparatus. In general the system comprises a receiver provided with a rotary type-controller operated by polarized electromagnets and an armature and commonly in the form of an escapement, which is governed from the central office, (such a receiver is shown in my Letters Patent dated April 27, 1897, and bearing number 581,411,) a relay for automatically reversing the polarity of the line-current, (an example of a suitable relay is that shown in Letters Patent of the United States dated December 5, 1893, bearing number 510,156,) a transmitter for controlling the motions of the armature of the relay, as in Letters Patent No. 541,149, dated June 18, 1895, and a keyboard (the keys thereof are commonly referred to as "transmitter-keys") whence the "transmitter" is stopped and started. The transmitter normally moves its trailer over the sunflower and also switches the current through the electromagnets of the relay to cause its armature to vibrate rapidly in unison with the passage of the trailer from segment to segment of the sunflower, thus reversing the polarity of the line-current with each motion of the armature. The type-controller is moved or is permitted to move at each reversal of the polarity of the line-current, and a character is imprinted whenever its key on the keyboard is depressed.

It is well known that in printing-telegraph systems the type are either disposed on a type-wheel or on a series of levers pivoted in a circle or arc, as in some type-writing machines, and that there is usually but a unique example of each character in each receiver. It is also known that in such cases the electrical and other conditions necessary for securing the rapid transmission and imprinting of diverse characters are different from those necessary for securing the repetition quickly and readily of a character alongside itself. In fact, the two sets of conditions are incompatible with each other. For the rapid printing of diverse characters the best conditions involve a "lively" circuit and instruments—quick discharge of the circuit and the like. On the other hand, when it is desired to repeat a character alongside itself without rotating the type-controller clear around in those cases in which there is but one example of each character in the receiver the conditions permitting thereof with the least delay are incompatible with a lively circuit. In other words, the circuit should be sluggish rather than lively.

In order to make the circuit lively, it is common to connect a condenser therewith. If the condenser is connected to the line on the battery side of the "repeat-circuit" opener, there results excessive sparking and other evils. For example, if the line includes a cable or underground wiring the static charge throws the receivers ahead and so prevents repeating. It may also pierce the insulation. With the condenser on the line side of the repeat-circuit opener the sparking is reduced, but other difficulties remain. In order to repeat, it is requisite that the action of the condenser should be minimized; but this can be done only at the expense of the efficiency of the transmission and printing of diverse characters—that is, at the expense of the "liveliness" of the system. In short, since the static discharges of the line, including the condenser, are utilized by adding them to the succeeding "impulses" sent by the battery and current-reverser in order to make the circuit lively it is obvious that speed must be saved at the expense of repeating, and vice versa. The addition of a permanent "leak" in order to be able to repeat only sacrifices speed. It may

be observed in passing that the duplication of characters in the receiver is really a case or species of what I herein term "diverse" characters, inasmuch as the type-controller is moved one or more steps in passing from one "1," say, to the other "1" stop, just as in passing from "a" to "n," whereas the repeating to which my invention relates is that case wherein the type-controller remains stationary during the repeating of a character.

In my invention during the printing of diverse characters the circuit or line is lively or in the condition which militates against the repeating of a character alongside itself without moving the type-controller and is "sluggish" during the repeating of the character without moving the type-controller. For the purpose of rapidly positioning the type-controller I employ an alternating current adjusted to resonance, as this gives a lively circuit. It also materially quickens the charging of the printing-magnet whenever a prolonged or printing impulse is sent over the line. In order to repeat a character alongside itself while keeping the type-controller still, I secure that the "printing-magnet" of the receiver shall be deënergized momentarily, so that the "printing-lever" shall fall away from the type-wheel (or that the type-bar shall fall) and follow with a "direct" current or impulse—that is, an impulse moving in the same direction as the impulse that was used to first imprint the character which is repeated. This I do as many times as the character is to be repeated or duplicated alongside itself. In practice the current is alternated at substantially a given number of times per second. Hence I employ means for varying the capacity, self-induction, and resistance of the circuit to bring the frequency at which the circuit tends to oscillate into substantial coincidence with the frequency of the periodic alternations of the current that I employ—that is to say, I adjust the circuit to resonance or tune it electromagnetically. The conditions as to resonance above specified are incompatible with repeating a character alongside itself in a system employing receivers provided with unique examples of each character and type-controllers which are quiescent during repeating, because of "throwing ahead" one or more steps by the "kick." In the case of my "slipping" escapement, hereinafter described, this so-called "kick" causes all the receivers to "throw ahead" one or more steps. As intimated above, the so-called "kick" is highly advantageous in positioning the type-controller, but has to be avoided in repeating a character alongside itself, inasmuch as the "bias" of the armature of the type-controller for that polarized electromagnet which last attracted it must not be disturbed, although the armature of the printing-magnet must be drawn away from the core thereof; also, the press or printing-magnet must be deënergized one or more times (according to the number of times the letter is to be repeated) without disturbing this bias. This involves a slow discharge or non-resonant state of the line, whereas the lively circuit used in positioning the type-controller involves an abrupt discharge. In my method of repeating I pass from the conditions giving resonance to the conditions preserving the bias aforesaid and giving the slow discharge of the line. In such wise there is an "overlapping" in point of time, so to speak, of the conditions giving the abrupt and the slow discharges. In other words, there is a time when both are on. In my method of repeating I throw off the line-battery and simultaneously ground the line through a non-inductive resistance (to prevent fusing of contact-points, the short circuiting of the line-batteries, and a too slow discharge of the line) and then throw on the line-battery and simultaneously throwing off the said ground. The reëstablishment of the circuit through the battery brings up the press-lever and causes the printing of the character the second time. The character may be repeated as often as desired by repeating the same cycle of operations. I remark that in receivers provided with type-wheels the means for feeding the paper are commonly operated by the press-lever or by the prolonged impulses. In all cases that which ultimately causes the printing causes also the paper to be fed forward the proper distance.

In the preferred form of my invention I introduce a two-way switch (which in effect is a repeat-circuit opener) in the line-circuit between the "battery" (as I shall call the generator of the current whatever may be the actual form thereof) and the receiver and provide a ground, (through a non-inductive resistance,) with its terminal adjacent a movable member of the said switch. I also provide a lever which normally holds said movable member away from the ground-terminal and connects said member with the line leading to the current-reverser. That part of the line connected with the receivers is electrically connected with the said movable member of the switch and with a suitable adjustable condenser. While printing diverse characters the circuit passes through the said movable member and said lever to the receiver end of the line. Whenever a character is to be repeated, its key is depressed, as usual, and is held down while the lever aforesaid is moved to throw off the battery and cause or permit said member to make contact with the ground-terminal simultaneously. The throwing on of the battery and simultaneously throwing off of the ground causes the second printing or repetition of the character, as aforesaid, all without moving the type-controller of the receiver. While the two-way switch may be operated direct by the operator or sender, it is more convenient and expeditious to operate it by means of an auxiliary circuit, key, and electromagnet. It is the latter form that I illustrate in the accompanying drawings and will describe hereinafter. The drawings

also show an improvement in the form of the escapement for the receiver which contributes materially to the attainment of the main object I have in view. This improvement consists in a wheel provided with two peripheral rows of teeth, each tooth having a bevel or slant inwardly and forwardly, the teeth of each row being staggered with respect to the teeth of the other row, and a pallet or anchor provided with two bevels for coaction with the said slants of said teeth. The construction is such that the type-controller or escapement runs down or to unison when the circuit is left open.

The invention also includes other features, all of which are more particularly pointed out in the claims concluding this specification.

The preferred form of the invention is illustrated in the accompanying drawings, forming part hereof, in which—

Figure 1 is a diagrammatic view showing the arrangements of the circuits and instruments. Fig. 2 is a side elevation, and Fig. 3 is a plan, partly in section, of my two-way switch. Fig. 4 is an elevation of the escapement-magnets and wheel, taken at right angles to the shaft of the latter. Fig. 5 is a side elevation of the escapement-wheel, showing the pallet or anchor also; and Fig. 6 is an enlarged view of some of the parts, shown on a smaller scale in Fig. 4.

The arrangement shown in Fig. 1 omits the transmitter and shows only the "repeat-key" of the keyboard.

The reference-letter B indicates the current-reverser, whose armature 2 is vibrated between the contact-points 3 4 by the electromagnets m $m^{\times}$, thus reversing the polarity of the current in the line 5 by connecting the batteries 6 7 therewith alternately. The line 5 is connected with the armature-lever 14, whose armature 15 coacts with the electromagnet m^2 and is provided with the adjustable contact-point 13. A spring 16, connected with the lever 14 and a suitable shaft, serves to draw the lever 14 away from the electromagnet whenever the last is deënergized. An adjustable insulated stop 12 for the lever 14 is shown. The electromagnet m^2 is part of a circuit formed by the wires 17, battery 18, key 20, and switch 19, the said key 20 being the repeat-key of the keyboard aforesaid. Whenever the lever 14 is drawn over by the magnet m^2, its contact 13 comes in contact with the contact-point 10 of the spring-arm 8 and pushes the last over, so that its second contact-point 9 is moved out of contact with the stationary but adjustable contact 11, which forms the terminal of a "ground" provided with a non-inductive resistance R. The arm 8 is in electrical connection with the receiver end of the line, the receivers being indicated by the reference-letter V.

The line is shown as being partly overhead and partly underground or cable. It may be wholly one or the other also. The escapement-magnets of the receivers may form part of the line or they may be operated by the line-currents through inductoriums. The former case is shown in full lines in Fig. 1, while the latter is indicated at X V in dotted lines. Inasmuch as the best working conditions are secured by having the entire system in "balance," I connect a condenser C, which I prefer to have adjustable with the receiver end of the line, employing a suitable resistance $R^{\times}$ in conjunction therewith. The batteries, the line, the ground, and the condenser are all connected to earth, as indicated.

The two-way switch shown diagrammatically in Fig. 1 is shown also in Figs. 2 and 3, wherein the reference-letter a marks a suitable base, as wood, on which the various parts are mounted in appropriate manners.

The reference-letters b c d e f indicate binding-posts, while the parts marked 8 9 10 11 12 13 14 15 16 m^2 have the functions of the similarly-marked parts shown in Fig. 1. The contact 11 is carried by the post f in an adjustable manner, and so also of the stop 12. The spring 16 is attached to the arm 14 at one end and at its other end is connected with the shaft h, which is frictionally held in the split head k (on the standard l, rising from the base a) in a well-known manner. The lever 14 is carried by a shaft n, which is provided with coned ends, which coact with the coned screws o in a well-known manner. The screws o engage with screw-threaded openings in standards p. The coiled wire q connects one of the posts p electrically with the lever 14, the ends of the wire being secured by screws or otherwise to these two parts. The magnets m^2 are borne by a cross-head r, which is itself carried by a shaft s, adjustable lengthwise toward and from the armature 15, carried by the lever 14. The spring-arm 8 is electrically connected with a binding-post, as c, by means of an insulated wire t. The binding-post b is electrically connected with the standard p, which carries the end of wire q, as by a wire u, and the line 5 is connected with the same binding-post b. The ground is electrically connected with the standard f. The electromagnets m^2 are electrically connected with the binding-posts d e, as are also the terminals of the circuit 17. Whenever the circuit 17 is closed the armature 15 is drawn toward the cores of the electromagnets m^2. The contact 13, striking the contact 10, pushes the same with its carrying-spring 8 toward the right in Fig. 2 a sufficient distance to break the contact between the points 9 11, as in the arrangement shown in Fig. 1. The lever 14 in Figs. 2 and 3 is provided with an opening through which the contact 11 passes freely without touching, thus giving an air-space insulation between the two. The post f is provided with an opening through which the spring 16 passes freely.

In the improved escapement or type-controller shown in Figs. 4, 5, and 6 the escape-wheel 22 is provided with two rows of teeth disposed at the sides of the disk the teeth of

each peripheral row being disposed opposite the spaces between the teeth of the other row; also, each tooth is beveled in such wise that each beveled face is lower at its front or leading edge, as shown by the arrow in Fig. 5, and also at that edge nearest the adjacent row of teeth, so that, roughly speaking, the disk presents a V-shaped groove on its periphery when viewed edgewise, as in Figs. 4 and 6. The pallet P is provided with two faces for coaction, one with the beveled faces of the row *v* and the other with the like faces of the row *x* of the teeth on the scape-wheel. The pallet P and the electromagnets M operating the same are or may be mounted and operated as in my Letters Patent No. 581,411 aforesaid. The shaft 23, on which the disk 22 is secured, may be provided with a type-wheel, as in my Letters Patent last aforesaid, or it may be provided with a trailer coacting with a sunflower each segment of which corresponds to a different lever in a type-writing machine, and is electrically connected with a suitable electromagnet for operating its said lever whenever a printing impulse is sent over the line while the trailer is upon the corresponding segment of the sunflower. The escapement shown is of such nature that whenever the line is allowed to stand open the instruments or receivers all go to unison, for the pallet is pushed or slips from one row of teeth to the other, owing to the positions of the bevels aforesaid. In other words, the shaft 23 is held from revolving by the force of the magnets M. It should be borne in mind, however, that this only occurs when the line-circuit is left open a sufficient length of time for the bias of the armature carrying the pallet P for the electromagnet which last directed it to die out. A quick break and make of the line-circuit, as by depressing and releasing the key 20 quickly, does not overcome this bias. The result is that the pallet and wheel 22 are held against motion by that magnet M nearest which the armature carrying the pallet P happens to be when the said key 20 is depressed.

The operation of the devices hereinbefore described is as follows, it being premised that the current-reverser B is operated as aforesaid and that its vibrating armature 2 is stopped and held against one or the other of the contacts 3 4 whenever a transmitter-key is depressed and that the switch 19 is closed, so that the circuit 17 is complete, thus attracting armature 15 to the magnet m^2 and closing the line-circuit through the contact-points 10 13, and opening the ground through the contact-points 9 11: The depression of any character-key upon the keyboard causes the imprinting of the corresponding character by the receiver or receivers, operated directly or indirectly by the line-current. Whenever the operator wishes to repeat a letter alongside itself, as the "0" of "100," he first depresses the key of the keyboard which represents the "0." This causes the imprinting of the "0," thus forming "10." He now, while still holding down the key representing the "0," momentarily depresses the key 20, whereupon the spring 16 draws back the arm 14, breaks the line at the contact-points 10 13 after establishing the ground through the contact-points 9 11. The battery is thus taken off and a circuit through the receiver end of the line is established and the printing-levers of the receivers fall away from their magnets. Immediately the key 20 is released the line-battery is thrown on, the ground is taken off, and the printing-levers are actuated and the second "0" is imprinted, making the "100." The character at the printing-point in the receiver may be imprinted as many times as desired by merely continuing to break and make the current in the circuit 17 while holding down the corresponding key in the keyboard. It is to be borne in mind that in a receiver of the type shown in my Letters Patent No. 581,411 the paper is fed forward at every stroke of the printing-lever.

By the phrase "receiver end of the line," used hereinbefore and in the claims, I mean that part of the line beyond the "break" in the line-circuit when the line-batteries are thrown off. In the particular case shown this break is at the contacts 10 13. I may say also that the transmitter shown in my Patent No. 541,149 may act as the current-reverser for the line instead of the relay referred to above; also, the various resistances, condensers, and the like may be, and preferably are, adjustable.

While I have illustrated the preferred form of my invention in the drawings and have described the same hereinbefore with particularity, I am not to be understood as limiting myself to the specific forms or arrangements shown, for I am aware that the same may be varied in many ways without departing from the spirit of my invention.

What I claim is—

1. In a printing-telegraph system, the combination of a line, a receiver provided with printing and polarized type-controlling electro magnets operated by the line-current, an automatic current-reverser in said line intermediate the source of electrical energy and said receiver and adapted to be held closed while a transmitter-key is held closed, a "ground" through non-inductive resistance normally disconnected from the line and located between the said reverser and said receiver, and a two-way switch in said line between said reverser and said receiver arranged to throw the battery off and on and simultaneously to connect and disconnect the said "ground" and the receiver end of the line, substantially as described.

2. In a printing-telegraph system, the combination of a line, a receiver provided with printing and polarized type-controlling electro magnets operated by the line-current, an automatic current-reverser in said line intermediate the source of electrical energy and

said receiver and adapted to be held closed while a transmitter-key is held closed, a "ground" through non-inductive resistance normally disconnected from the line and located between the said reverser and said receiver, and a two-way switch in said line between said reverser and said receiver arranged to throw the battery off and on and simultaneously to connect and disconnect the said "ground" and the receiver end of the line, with a condenser connected to said line, substantially as described.

3. In a printing-telegraph system, the combination of a line, a receiver provided with printing and polarized electro magnets operated by the line-current and a slipping type-controlling escapement operated by said polarized magnets, an automatic current-reverser in said line intermediate the source of electrical energy and said receiver and adapted to be held closed while a transmitter-key is held closed, a "ground" through non-inductive resistance normally disconnected from the line and located between the said reverser and said receiver, and a two-way switch in said line between said reverser and said receiver arranged to throw the battery off and on and simultaneously to connect and disconnect the said "ground" and the receiver end of the line, substantially as described.

4. In a printing-telegraph system, the combination of a line, a receiver provided with printing and polarized electro magnets operated by the line-current and a slipping type-controlling escapement operated by said polarized magnets, an automatic current-reverser in said line intermediate the source of electrical energy and said receiver adapted to be held closed while a transmitter-key is held closed, a "ground" through non-inductive resistance normally disconnected from the line and located between the said reverser and said receiver, and a two-way switch in said line between said reverser and said receiver arranged to throw the battery off and on and simultaneously to connect and disconnect said "ground" and the receiver end of the line, with a condenser connected to said line, substantially as described.

5. In printing-telegraph systems employing a single line or wire for transmitting and printing, the method of transmitting and printing characters and repeating any character alongside itself which consists in transmitting and printing characters by means of a resonant alternating line-current, and in transforming the electrical conditions from the resonant state to a state of slow discharge and back to the resonant state to repeat a character alongside itself, substantially as described.

6. In a printing-telegraph system, the combination of an electromagnet, a battery and circuit for energizing said magnet, a key in said circuit, an armature-lever 14 for coaction with said magnet and provided with a contact-point 13, a spring-arm 8 provided with contact-points 9 10, a ground through non-inductive resistance provided with a contact-point 11, the batteries 6, 7 and current-reverser B, the line 5 connected with arm 14, and the line provided with receivers and connected with arm 8 and with a condenser C, substantially as described.

Signed at New York, in the county of New York and State of New York, this 8th day of September, A. D. 1897.

JOHN BURRY.

Witnesses:
RICHARD W. BARKLEY,
CHAS. A. BRODEK.