

No. 670,964.

Patented Apr. 2, 1901.

D. MURRAY.
TELEGRAPHY.

(Application filed Jan. 17, 1901.)

(No Model.)

2 Sheets—Sheet 1.

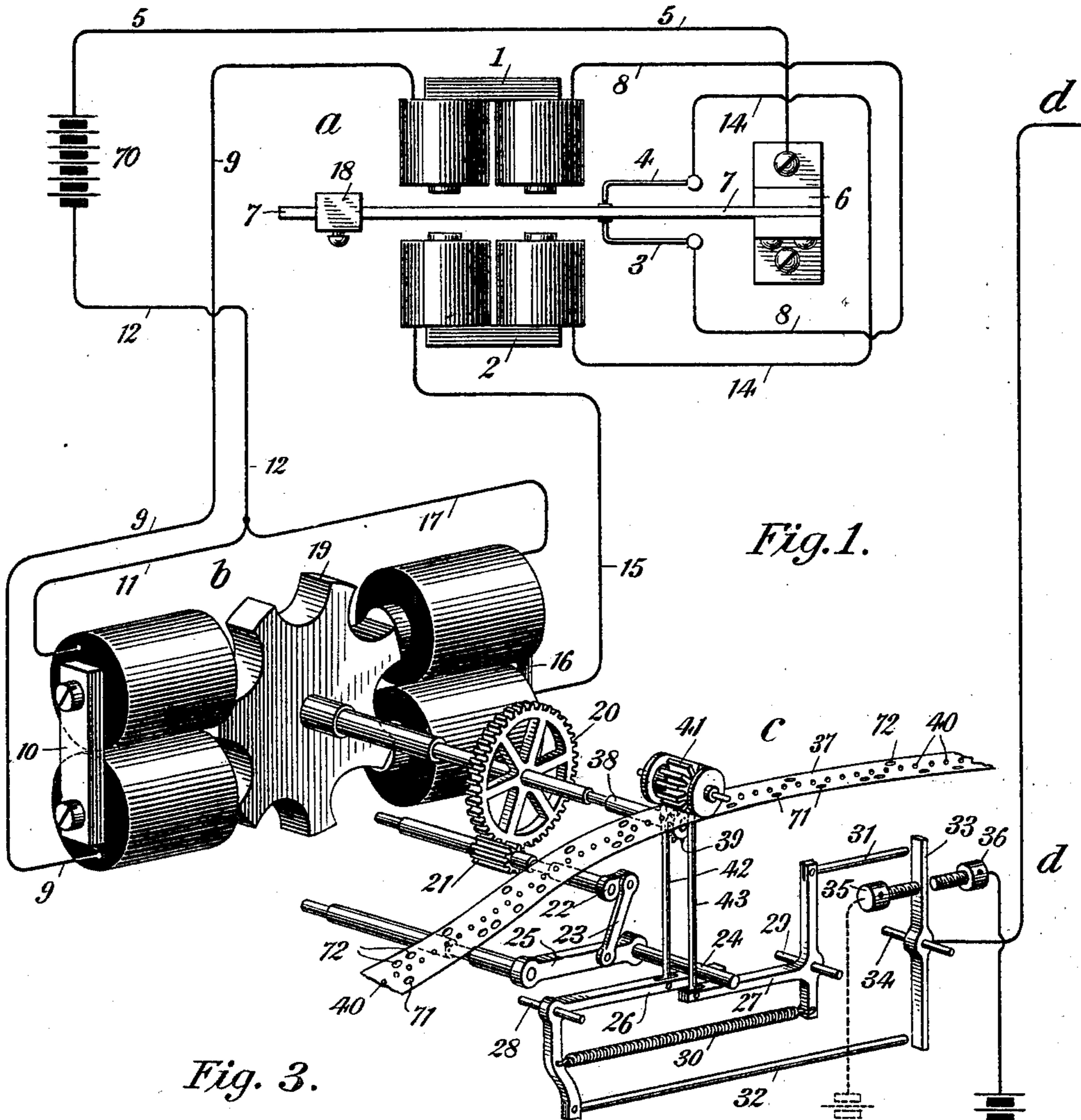
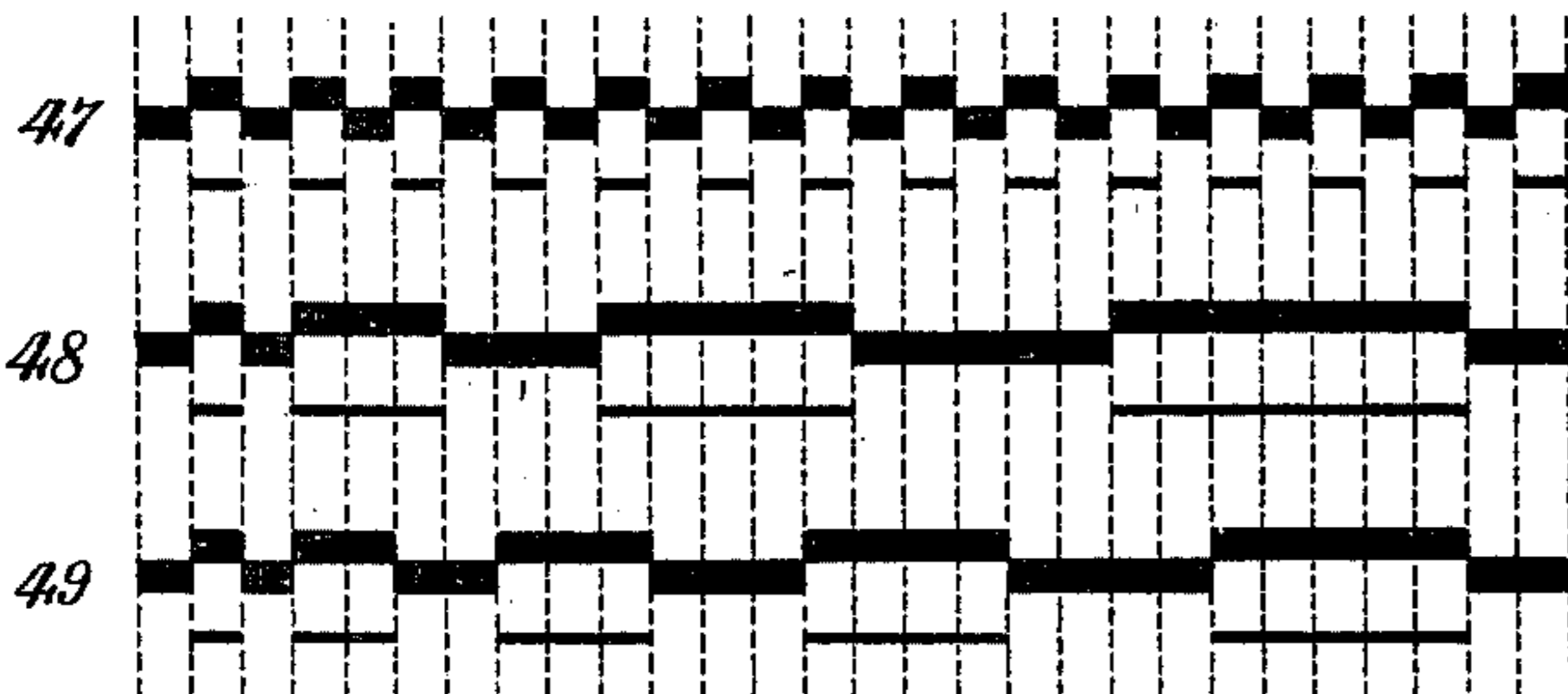


Fig. 1.

Fig. 3.



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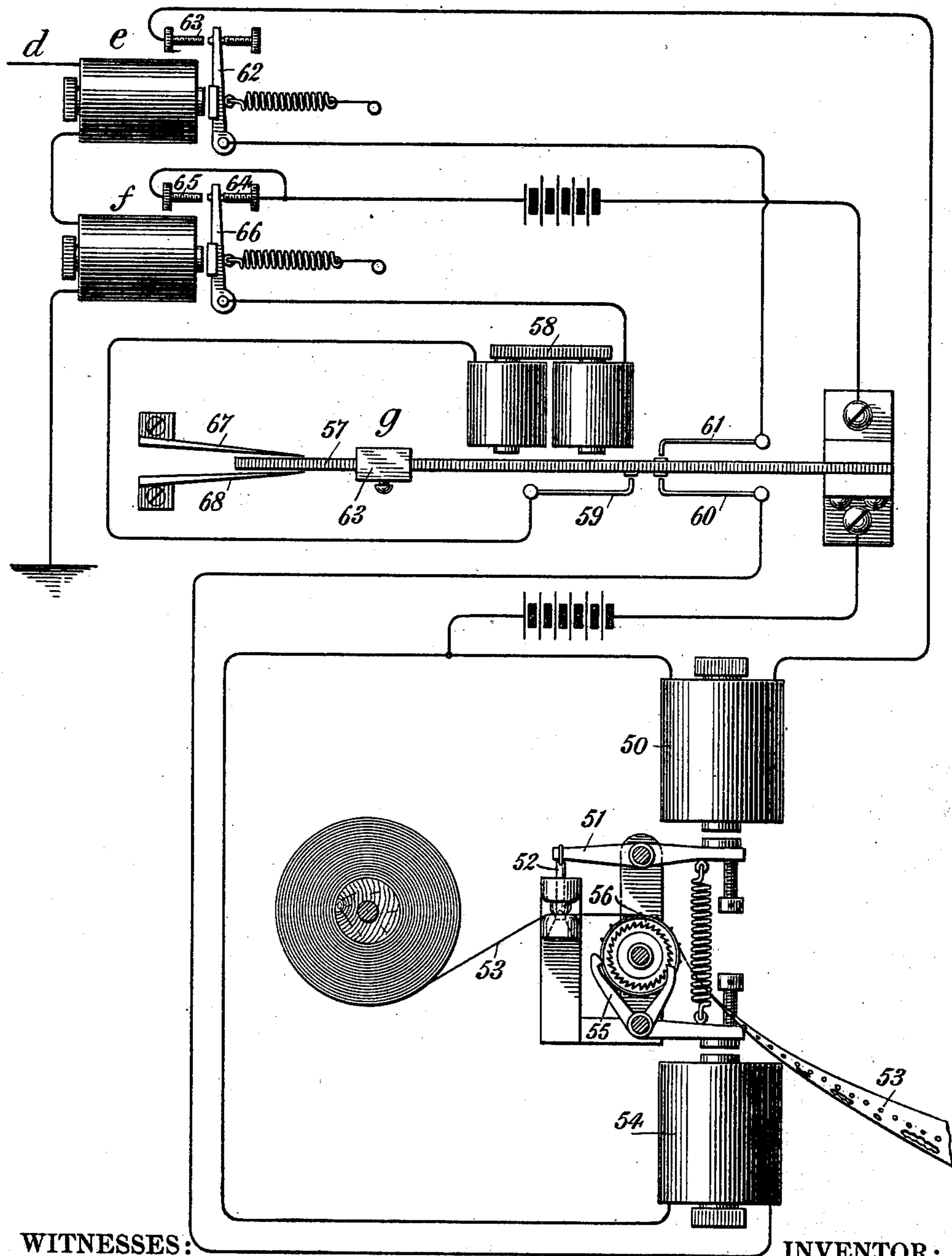
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2 Sheets—Sheet 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

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TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 670,964, dated April 2, 1901.

Application filed January 17, 1901. Serial No. 43,571. (No model.)

To all whom it may concern:

Be it known that I, DONALD MURRAY, a subject of the Queen of Great Britain, residing in the city of New York, county and State of New York, have made certain new and useful Improvements in Telegraphy, of which the following is a specification.

This invention is an improvement upon the well-known Wheatstone transmitter employed in automatic telegraphy and certain modifications of my page-printing telegraph.

The object of the invention is to adapt the transmitter to the requirements of my printing-telegraph system shown and described in United States Letters Patent No. 653,936, dated July 17, 1900.

The improvement consists in locating the "prickers" or projecting pins designed to pass through holes in the perforated tape side by side and moving them automatically in unison or simultaneously instead of alternately, as in the Wheatstone case. By this means I am enabled to transmit current impulses of unit duration or any odd or even multiple thereof, whereas the Wheatstone transmitter has capacity for transmitting unit impulses and any odd-number multiple thereof only. In said patent the transmitting apparatus shown and described consists of metal brushes making electrical contact on the periphery of a revolving wheel through perforations in a paper tape. According to my improvement I employ a Wheatstone transmitter further modified in the manner about to be described and driven at a uniform rate by a suitable motor. Wheatstone transmitters are operated by clockwork with a fan-regulator. This is inconvenient, as the clockwork requires frequent winding. I prefer to employ a modification of an electric pendulum-motor generally known as the "La Cour phonic wheel." This has the advantage of running at a very uniform rate which is practically independent of the amount of current.

The accompanying drawings illustrate my invention.

Figure 1 shows the apparatus employed at the transmitting-station, and Fig. 2 shows the apparatus employed at the receiving-station for perforating the receiving-tape. Fig. 3 is a comparison of the current-signals sent

by the ordinary Wheatstone transmitter and by my improved modification of it.

In Fig. 1, *a* is a vibrator which operates the motor *b*, which in turn drives the modified Wheatstone transmitting apparatus *c*, thereby sending current impulses over the main line *d*. The vibrating reed 7 of the vibrator *a* is driven by the two electromagnets 1 and 2, each operated by a local circuit alternately under the control of the break-points 3 and 4. These operate on the familiar buzzer principle, each magnet breaking its own circuit on the opposite side of the reed. The current to drive the vibrator and motor comes from any suitable source, as 70, along the wire 5, vise 6, reed 7, contact-spring 3, wire 8, vibrator-magnet 1, wire 9, motor-magnet 10, and wires 11 and 12 back to the source of current. This energizes the magnet 1, which attracts the reed 7, breaking the contact with spring 3 and making contact with spring 4. The current then goes from the reed 7 by the contact-spring 4 through wire 14, vibrator-magnet 2, wire 15, motor-magnet 16, and wires 17 and 12 back to the source of current. The result is that the motor-magnets 10 and 16 receive alternate impulses, the rate being determined by the rate of vibration of the reed. This rate can be varied by shifting or varying the weight 18. The toothed iron armature 19 is started by being spun around by hand, and the alternating impulses in the motor-magnets then keep it revolving at an extremely uniform rate. By suitable gearing 20 and 21 this armature operates the small crank 22 and pitman-rod 23, which gives an oscillating motion to the rod 24, fixed in the end of the crank 25. The bell-crank levers 26 and 27, pivoted at 28 and 29, press up against the rod 24 under the action of the spring 30. The oscillations of the rod 24 are thus communicated by means of the levers 26 and 27 to the rods 31 and 32. These simultaneously strike the top and bottom of the contact-bar 33, which is pivoted at 34 and is free to oscillate between the contact-points 35 and 36. The rods 31 and 32, striking the contact-bar 33 simultaneously, neutralize each other's action and no definite result follows. This is what happens when the transmitter is running empty or without perforated tape. Under the con-

5 trol of the paper tape 37 the action is as fol-
 lows: The armature-shaft 38 carries at its ex-
 tremity a small star-wheel 39, which feeds
 the tape along at a uniform rate by engaging
 10 with the central line of perforations 40. The
 fluted roller 41 serves to keep the tape en-
 gaged with the star-wheel 39 and to hold the
 tape down against the upward thrust of the
 prickers 42 and 43. On each side of the cen-
 15 tral line of perforations in the tape a series
 of holes 71 and 72 is punched to govern the
 occurrence and duration of the current im-
 pulses. These holes are so arranged that two
 are never in line with one another across the
 20 tape. The consequence is that only one of
 the two prickers 42 and 43, which are inter-
 mittently thrust against the lower surface of
 the tape by the spring 30 and the oscillating
 cranks 26 and 27, can enter a perforation in
 25 the tape at one time. Let us assume that
 pricker 43 enters a perforation in the tape,
 pricker 42 being therefore stopped in its up-
 ward progress by a non-perforated portion of
 the tape. Pricker 43 passing through a per-
 30 foration, the crank-lever 27 will rise under
 the influence of the spring 30, and rod 31 will
 be thrust against the top of the contact-bar
 33, which will be tilted over to the contact 36,
 where it will remain until it is tilted back to
 35 contact-point 35 by a corresponding action of
 rod 32 when pricker 42 enters a hole in the
 tape. The bar 33 therefore remains resting
 against contact-point 35 or 36 until thrust
 over to the opposite contact-point as the re-
 40 sult of one or other of the prickers 42 43 en-
 tering a hole in the tape. The result is that
 current flows for definite intervals from either
 the positive or negative batteries 44 or 45 by
 way of the contacts 35 or 36, contact-bar 33,
 45 and the main line *d* to the receiving-station.
 By omitting one of the batteries—say 44—the
 apparatus will transmit simple makes and
 breaks of current instead of reversals.

50 In the ordinary Wheatstone transmitter
 the crank 25 is so arranged that it oscillates
 the bell-crank levers 26 and 27 alternately
 instead of simultaneously, as is done in the
 improved arrangement just described. The
 result is that in the ordinary Wheatstone
 55 transmitter when it is running empty the
 rods 31 and 32 strike the bar 33 alternately.
 Consequently it oscillates regularly between
 the contacts 35 and 36, sending short positive
 and negative impulses alternately to the main
 60 line or makes and breaks, if only one battery
 is employed. The effect of the perforated
 tape in the ordinary Wheatstone arrange-
 ment is to suppress one or more of these alter-
 nations. The ordinary Wheatstone transmit-
 65 ter is, in fact, a small alternating-current gen-
 erator and the signals are transmitted by
 suppressing one or more of the half-waves of
 a complete alternation. This is shown clearly
 in Fig. 3. Line 47 shows the alternating-cur-
 rent impulses generated by an ordinary
 Wheatstone transmitter running empty with
 the corresponding dot-signals which these

currents record. Line 48 shows that the only
 signals that it is possible to build up out of
 this alternating current are signals or spaces 70
 of one, three, five, seven, &c., units dura-
 tion—that is to say, odd-number multiples of
 the unit or dot current. In the page-printing
 system of telegraphy described in my said Pat-
 ent No. 653,936 it is necessary to be able to 75
 transmit current impulses or spaces of one,
 two, three, four, five, or more units duration—
 that is to say, even-number, as well as odd-
 number, multiples of units. This is shown in
 line 49 of Fig. 3. This arrangement of signals 80
 is obtained, as already explained, by getting
 rid of the alternating character of the Wheat-
 stone transmitter by making the prickers 42
 and 43 and the bell-crank levers 26 and 27 re-
 ciprocate together instead of alternately. 85
 Under the arrangement shown in Fig. 1 a per-
 foration on the right-hand side of the tape
 starts a current-signal, and it continues until
 it is stopped by a perforation on the left-hand
 side of the tape, and vice versa. Any integral 90
 multiple of the unit-current or unit-space can
 thus be transmitted.

The current impulses generated as de-
 scribed pass over the main line *d* through the
 relays *e* and *f*, Fig. 2, at the receiving-sta- 95
 tion to ground. The action of the receiving
 mechanism is identical with that already fully
 described in my said Patent No. 653,936.
 Briefly, the action of the receiving apparatus
 there described is as follows: 50 is an electro- 100
 magnet which operates the punching-lever 51,
 which depresses the punch 52, thereby per-
 forating the paper tape 53. 54 is an electro-
 magnet which feeds the tape forward step by
 step by operating an anchor-escapement 55 105
 and motor-driven star-wheel 56. This punch-
 ing and spacing mechanism is controlled by
 the vibrator *g*, consisting of the vibrating
 reed 57, driven by the electromagnet 58 on
 the usual buzzer principle, breaking its own 110
 circuit at the contact-spring 59. As the reed
 vibrates it makes alternate contacts with the
 contact-springs 60 and 61. When the reed
 makes momentary contact with spring 60, the
 circuit of the spacing-magnet 54 is closed and 115
 the paper tape 53 is advanced a step by
 means of the anchor-escapement 55 and the
 star-wheel 56. When the reed 57 makes con-
 tact with the spring 61, the punching-magnet
 50 is energized and a hole is punched in the 120
 tape, provided the tongue 62 of the relay *e* is
 closed on its front contact 63. The main-line
 signals thus control the operation of the
 punching-magnet 50. In order that the reed
 57 may vibrate in unison with the rate of the 125
 arriving current-signals, a governing-relay *f*
 is provided. The back and front contacts of
 this relay 64 and 65 are electrically united, so
 that the relay-tongue 66 only momentarily
 breaks the local circuit of the vibrator-mag- 130
 net 58 in crossing over at the beginning and
 end of the main-line signals. As the main-
 line signals arrive at a uniform rate and as
 they consist of unit currents and spaces or

multiples thereof, the relay-tongue 66 breaks the vibrator-circuit at uniform unit intervals or multiples thereof. There are thus two break-points in the same circuit—namely, 5 that controlled by the relay-tongue 66 and that of spring 59. If the two breaks continuously occur together, then the magnet 58 gets full impulses of current. If, on the other hand, owing to a variation between the rate 10 of vibration of the reed 57 and the rate of the arriving signals the two breaks occur more or less alternately—that is to say, if they get out of step with one another—then less current gets through the vibrator-magnet circuit, the impulses are clipped, and the 15 amplitude of vibration of the reed 57 is reduced. Resilient limiting-stops 67 and 68 are provided. The reed 57 when vibrating between limiting-stops graduated in the manner shown varies its rate of vibration in accordance with the amount of current traversing the circuit of the vibrator-magnet 58. The two interfering break-points in the same 20 circuit control the amount of current, and so control the rate of vibration of the reed and keep it in substantial harmony with the rate of the arriving current impulses.

What I claim, and desire to secure by Letters Patent, is—

1. In an automatic transmitter the combination of a suitable tape having two parallel 30 lines of perforations arranged in alternation, means for uniformly advancing said tape, a circuit-closing device or switch and means for causing said switch to throw upon the line 35 current impulses of unit duration or integral multiples thereof, either odd or even, consisting of two coincidently-moving rods, located in line with said perforations respectively, and a motor-driven actuating device 40 for reciprocating said rods coincidently within limits established by said perforated tape.

2. In a telegraph system a main line, an automatic transmitter, arranged to direct upon said line current impulses of unit duration 45 or integral multiples thereof, a phonic wheel propelled by electromagnets for driving said transmitter, a vibrating reed and a local circuit supplying current impulses to said magnets, an electromagnetic tape-perforating device at the receiving-station and means for 50 maintaining unison between said transmitter and perforator.

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Witnesses:

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