J. J. VERMEER.

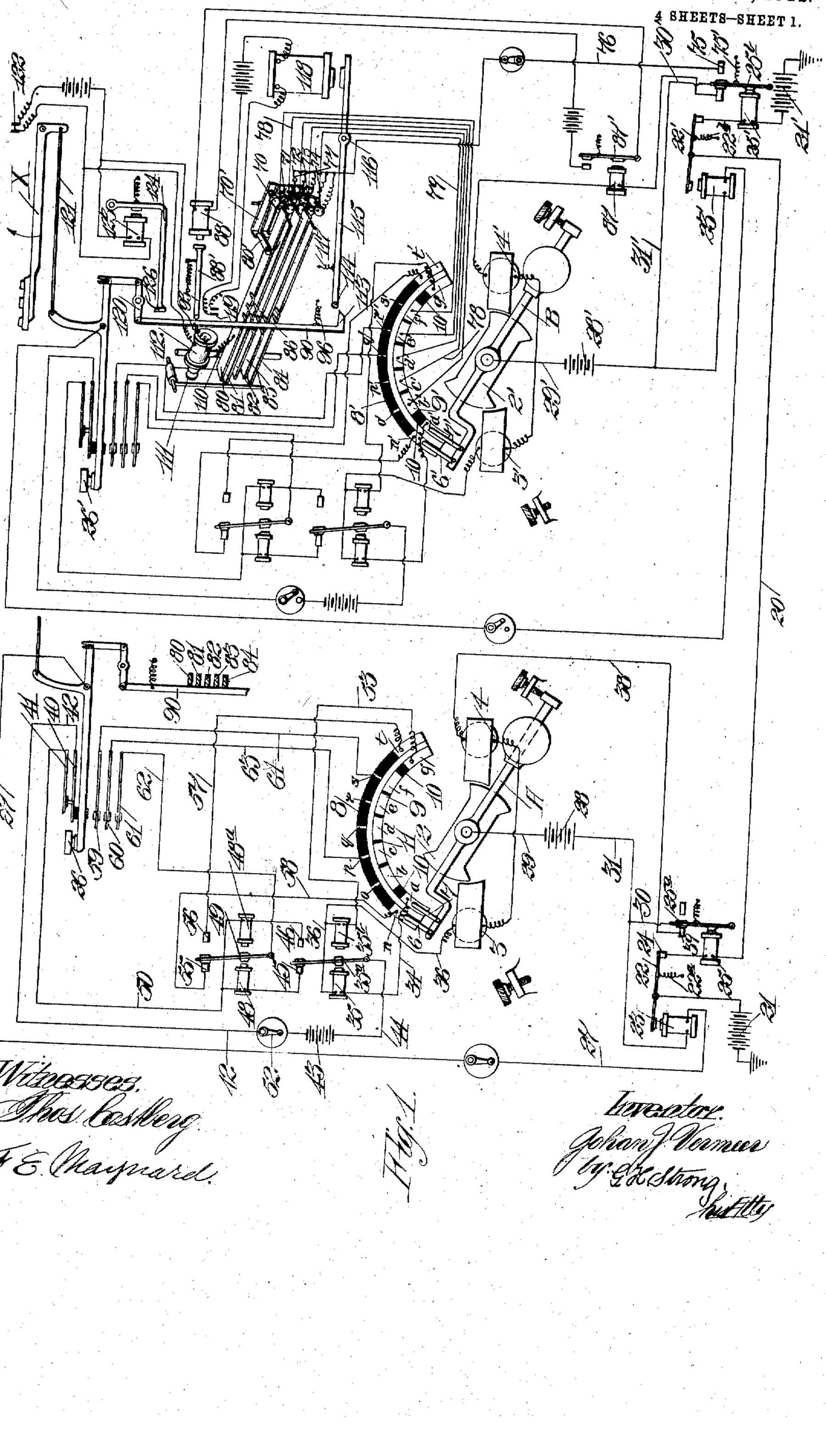
PRINTING TELEGRAPH.

APPLICATION FILED FEB. 9, 1910.

985,233.

Patented Feb. 28, 1911.

4 SHEETS—SHEET 1.



Witnesses.
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4 SHEETS—SHEET 2.

Fig. 2.

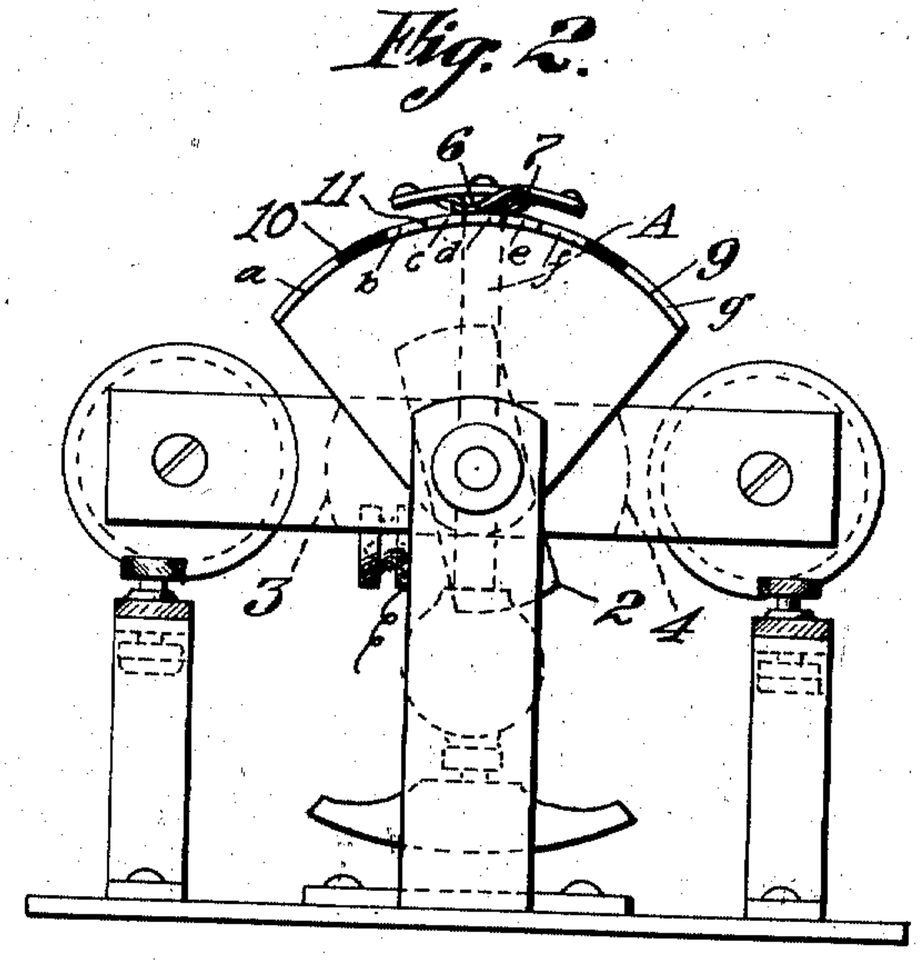
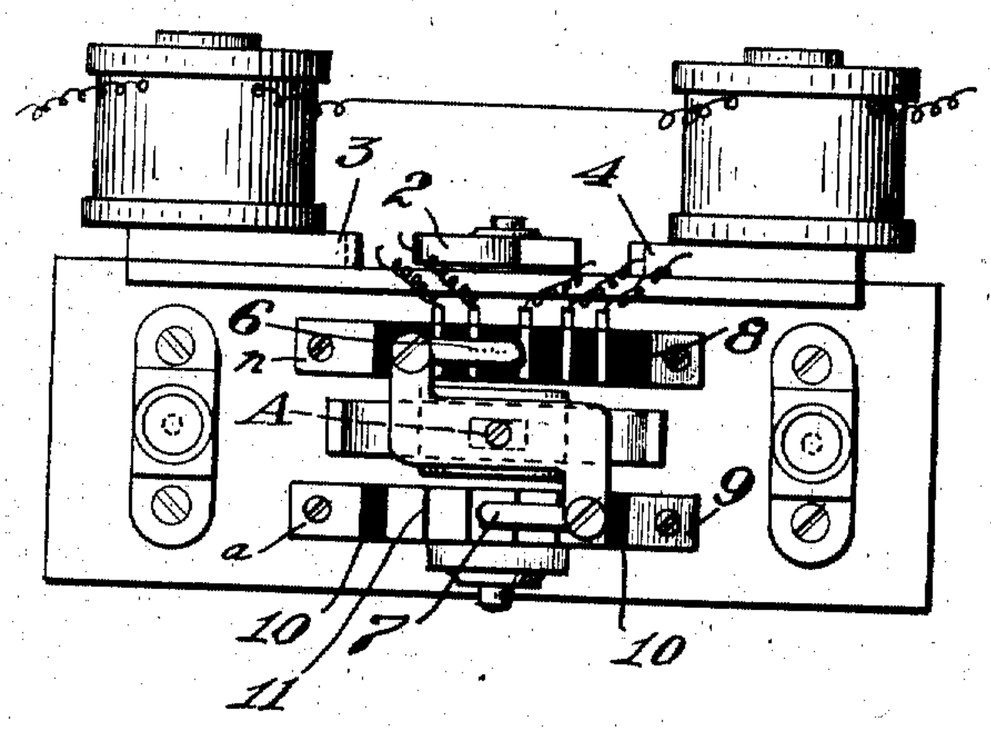


Fig. 3.



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4 SHEETS—SHEET 3.

Fig. 4.

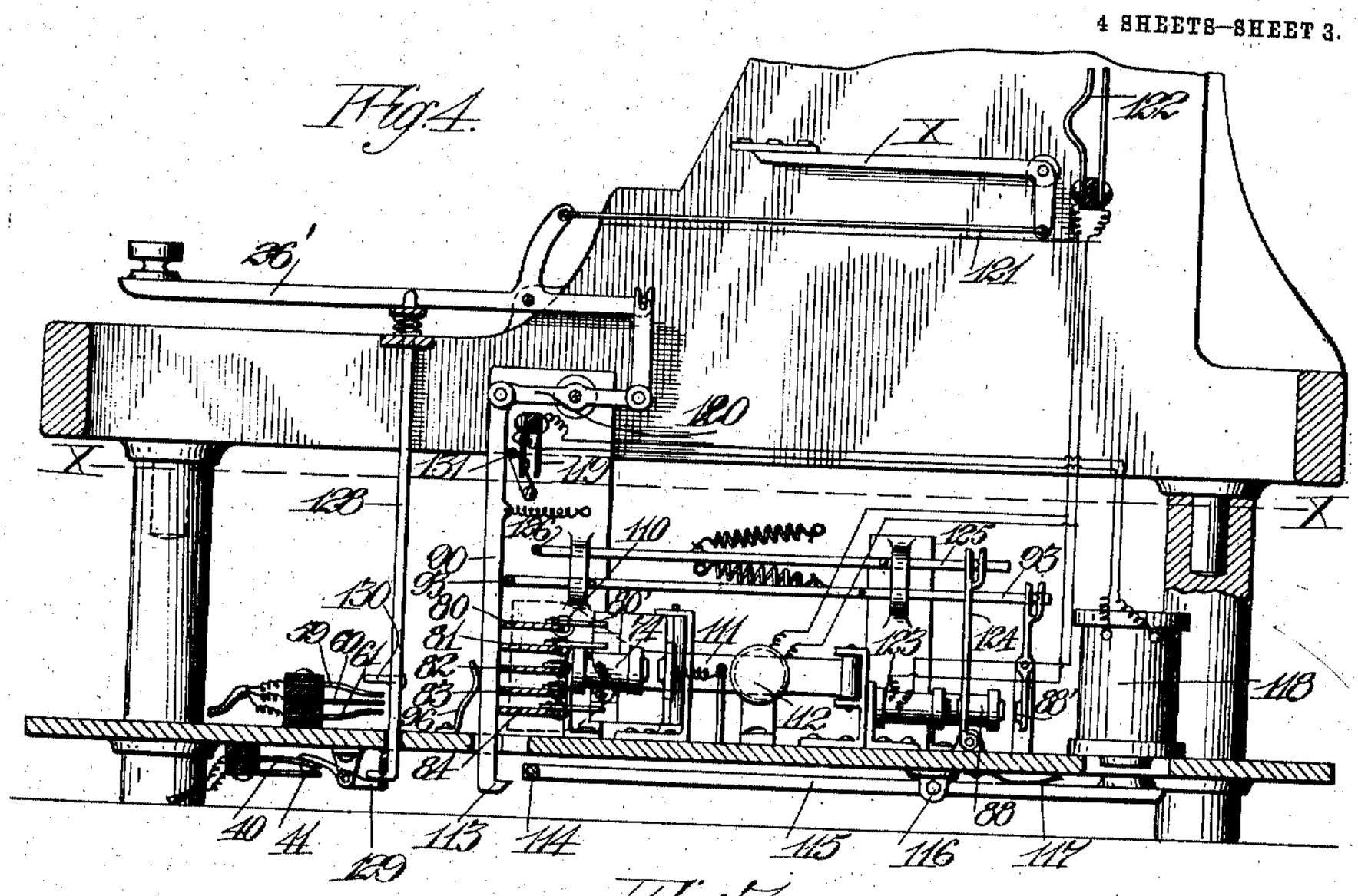
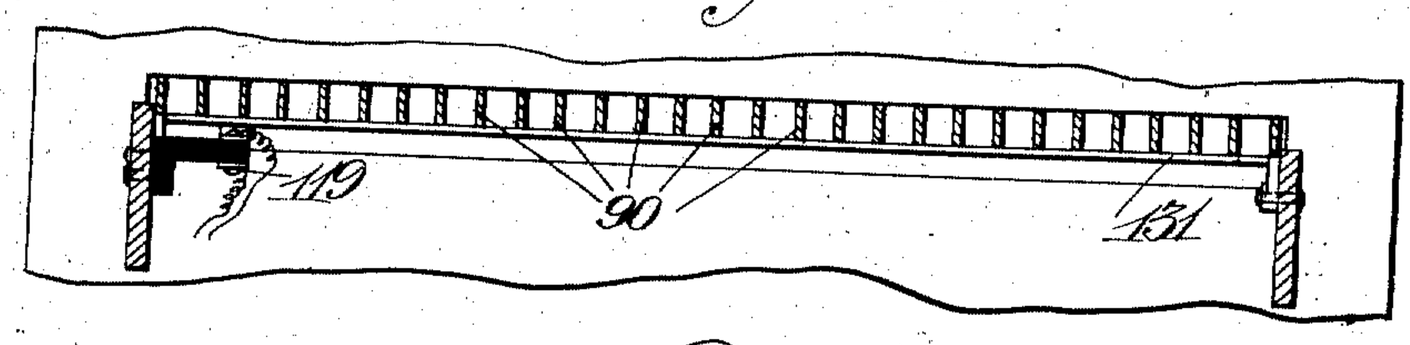


Fig. 7.



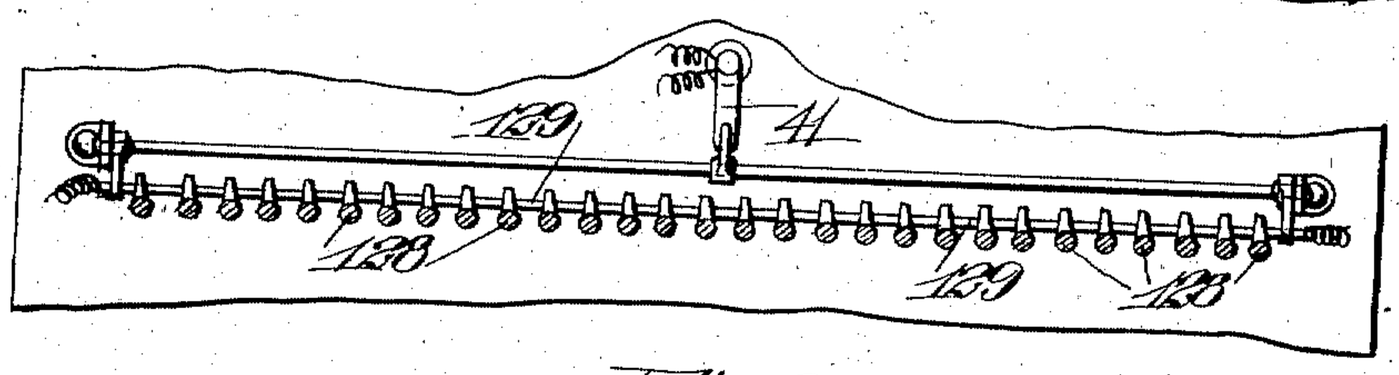


Fig. 8.

Witnesses.
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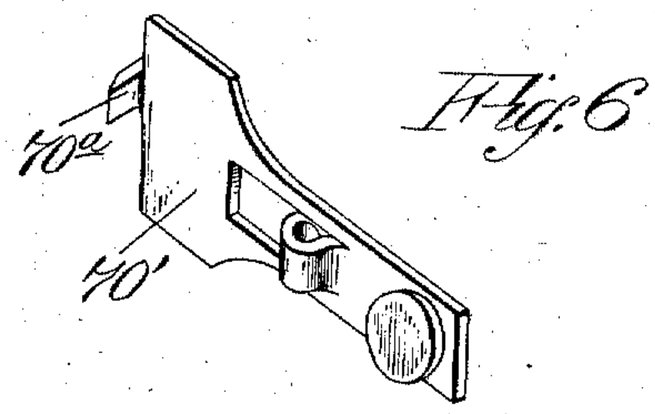

Fig. 6

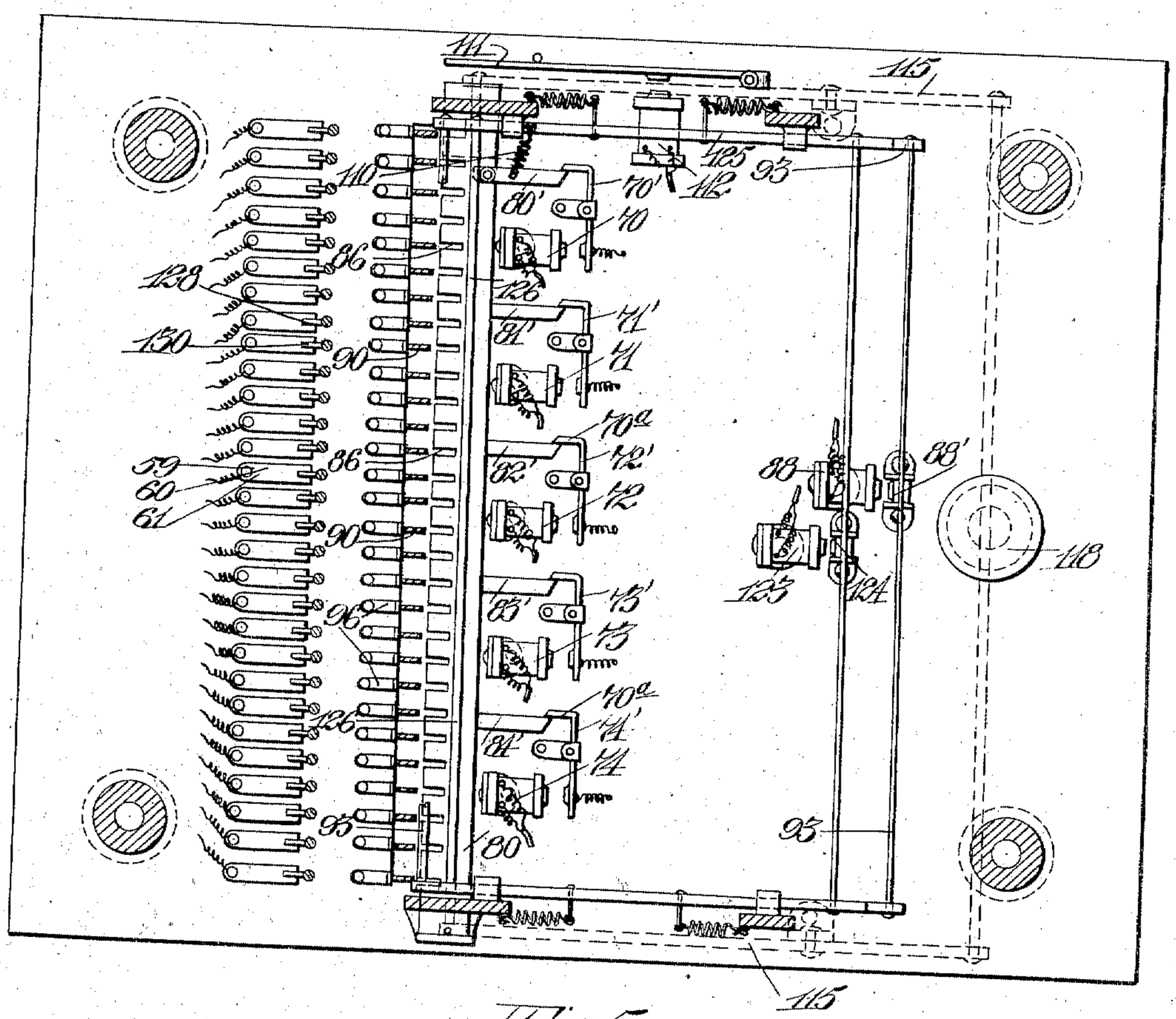

Fig. 5.

Witnesses.
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UNITED STATES PATENT OFFICE.

JOHAN J. VERMEER, OF OAKLAND, CALIFORNIA.

PRINTING-TELEGRAPH.

985,233. Specification of Letters Patent. Patented Feb. 28, 1911.

Application filed February 9, 1910. Serial No. 542,954.

To all whom it may concern:

Be it known that I, JOHAN J. VERMEER, a subject of the Queen of the Netherlands, residing at Oakland, in the county of Alameda and State of California, have invented new and useful Improvements in Printing-Telegraphs, of which the following is a specification.

My invention relates to telegraphic transmitters, and pertains especially to a printing telegraph adapted to be used on any system including the common single line closed circuit system, employing a type-writing keyboard at the sending end and a type-printing or equivalent arrangement at the receiving end for recording the messages, impulses, or other signals sent.

The invention consists of the arrangement of parts and the details of construction which which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a diagrammatic view, showing the sending and receiving mechanisms and circuits. Fig. 2 is a side elevation of the pendulum mechanism. Fig. 3 is a plan view of the same. Fig. 4 is a longitudinal section showing the printing mechanism and connective parts. Fig. 5 is a plan section on line X—X, Fig. 4. Fig. 6 is a perspective view of a comb magnet latch. Fig. 7 is a plan section showing the circuit closing mechanism 119. Fig. 8 is a similar view showing the circuit closing mechanism 40—41.

Referring to Fig. 1, it will be understood that the apparatus is adapted to send from or receive at either end of the line, and a description of the sending machine will answer in great part for a description of the receiving machine. In the present case I shall simply describe, and chiefly illustrate, the sending from one end and the receiving at the other.

In the diagrammatic view of Fig. 1, the sending mechanism is represented at the left hand side of the drawing, and the receiving mechanism at the right.

Each machine employs a pendulum member which is represented at A at the sending station, and B at the receiving station. Each of these pendulums is suitably mounted for oscillation, and they carry respective armatures 2 and 2′ swinging between opposed connected magnets 3—4, 3′—4′. The pendulum A carries a pair of contacts 6—7, Fig. 3, operating over two commutator segments 8—9. Likewise pendulum B carries two contacts or brushes 6′—7′ operating over a pair of commutator segments 8′—9′. It is understood that the segments 8—9 stand side by side, with the pendulum working between them, as shown in Figs. 2 and 3. The commutator segments 8—8′, Fig. 1, are the sending segments, and the commutator segments 9—9′ are the receiving segments.

The receiving segment 9 of the sending machine is divided off into seven independent, insulated and electrically conductive portions *a*, *b*, *c*, *d*, *e*, *f* and *g*; the end portions *a* and *g* being separated from the others by the wider insulations 10, and the intermediate portions *b*, *c*, etc., of the commutator, by the thinner insulating strips 11. Similarly with the receiving segment 9′ of the receiving machine. (It is to be understood that the so-called "receiving segment" of the sending machine is inoperative as to sections *b*, *c*, *d*, *e*, and *f*, and only operative as to the end sections *a* and *g* when sending messages, as will more clearly appear later. The same is true of the "sending segment" of the receiving machine when the latter is receiving messages.) The complementary sending segment 8 of the sending machine is also divided into seven electrically conductive portions *n*, *o*, *p*, *q*, *r*, *s* and *t*, but the parts *o*, *p*, *q*, *r* and *s* are relatively much narrower than the conductive parts *b*, *c*, *d*, *e* and *f* of the segment 9; each section *o*, *p*, etc., being insulated from the others by an intermediate body of suitable insulating material, like hard rubber.

The conducting sections *o*, *p*, *q*, *r*, *s* of the sending segment 8 stand in radial planes approximately midway of the conducting sections *b*, *c*, *d*, *e*, *f* of the receiving segment 9, and usually these sections *o*, *p*, *q*, *r*, *s* are only about one-tenth of the width of the opposed conducting sections *b*, *c*, *d*, *e*, *f* on segment 9. It is understood that the same division occurs with the segments 8′—9′ of the receiving machine.

The end sections *a*, *g*, and *n*, *t* of the segments 8—9 are simply for the purpose of

preparing the line to send the character, and for holding and starting the pendulum at the end of its stroke; the sending of all the characters over the line being accomplished through the closing of certain circuits as the brush 6 passes over one or the other of the thin metal strips *o*, *p*, *q*, *r*, *s*, and the brush 7′ of the receiving machine passes over similar wide metallic sections *b*′, *c*′, *d*′, *e*′, *f*′, of its segment 9′, as will be explained later.

By means of the segments divided as here shown, I am able to transmit over a single main line all the letters of the alphabet, numerals and symbols usual or necessary in the transmission of messages.

The manner of effecting the various selections to produce the desired results in the sending and receiving machines is accomplished by a system of electrical wiring, as follows: 20, Fig. 1, represents the main line of an ordinary single line closed circuit system having the gravity batteries or equivalent 21—21′ at each end of the line and connecting ground wires. The battery 21 has one terminal connected with the armature 22 of the transmitter 23. 22 is one member of a switch, of which the other member is 24, which latter connects with the local relay 25, then with the main line 20; through the armature 22′ of the receiving machine to relay 25′, and through the battery 21′ with the ground, to return. Springs 22ª—22ᵇ hold switches 22—24, 22′—24′ normally closed, so I have a normally closed main line circuit with the two relays 25—25′ in series.

The end section *a* of the segment 9 is connected by a wire 34 with the magnet 35 which controls the armature switch member 35ª; the other terminal of the lower switch magnet 35 is connected by a wire 36 with the pendulum magnet 3; the other terminal of magnet 3 is connected with the opposite pendulum magnet 4; the two magnets 3—4 being in series; and the other terminal of magnet 4 is connected by wire 38 with a contact point 39, which latter is normally in contact with the armature 25ª of the relay 25. When the line is closed, as shown, a circuit will be made through the armature 25ª of the local relay, through wires 30 and 31 to the main local battery 28; thence through wire 29 to pendulum A, and by brush 7 to section *a* of the segment 9 whenever the pendulum is swung to its limit in that direction. A circuit is thus completed to energize the pendulum magnets 3—4 and hold the pendulum to one side. Breaking the circuit deënergizes magnets 3—4, allowing pendulum A to swing by gravity and bring brush 7 over the section *g*, whereupon another circuit is similarly established through the magnets and wire 53, magnet 35ᵇ, wires 36—38, contact 39, armature 25ª, wires 30—31, local battery 28, wire 29 and pendulum A, thus again holding the pendulum. Each time a sending key 26 is depressed, this action of breaking and reëstablishing a circuit takes place.

Since a normally closed main line circuit is employed, the circuit through magnets 3—4 will be closed so that the armature 2 will be attracted in the manner shown, and cause the pendulum to stand and remain at an angle with the brushes 6—7 resting on their corresponding segments 8—9 and sections *a*—*n* so long as the circuit is unbroken. The breaking of this normally closed circuit is accomplished by the depression of a key 26 on the keyboard.

The key 26 is electrically connected by a wire 27 with one terminal of the transmitter 23; the other terminal of this transmitter is connected with the main local battery 28 by wire 31, and the other terminal of battery 28 is electrically connected by a wire 29 with the pendulum A, as before described.

When the sending key 26 is standing normally in the up position shown in Fig. 1, it will close two contacts 40 and 41, Figs. 4 and 8, as described later. A wire 42 connects the contact member 40 with a local battery 43, and a wire 44 connects the other terminal of the battery with the armature 35ª of the magnets 35—35ᵇ. This armature 35ª coöperates with one or the other of a pair of contacts 45 or 46 to close a circuit leading to one or the other of a pair of magnets 48—48ª, which latter control an armature 49. The other terminals of the magnets 48—48ª are connected by wire 50 back to the contact member 41. Thus a secondary local circuit is normally closed through battery 43, and the purpose of this local circuit is to prepare another circuit through the transmitter 23, this latter circuit when closed energizing the transmitter and deënergizing the pendulum magnets, allowing the pendulums to swing. This is done as follows: A switch 52 on wire 42 is closed, as shown, when the machine is sending. Armature 49 swings between a pair of contacts 55—56. Contact 55 is connected by a wire 58 to section *n* of sending segment 8, and contact 56 is connected by a wire 57 with the opposite end section *t*. It will thus be seen that the function of the switch magnets 35—35ᵇ is to throw the switch member 35ª from one contact 45 to the other 46, and vice versa; that this again completes the circuit for one or the other of the switch magnets 48—48ª which in turn controls the movement of the armature switch member 49. The armature 49 is connected by a wire 62 with a spring contact member 61 arranged to be brought

into electrical connection with a key 26 whenever the latter is depressed, and so close a circuit through the transmitter 23 to break the line circuit, as I will now describe.

As seen in Fig. 1, there are two contacts 59—60 interposed between the contact 61 and key 26, but for the present I will only refer to contact 61, and will later explain what the contacts 59—60 are for. Suffice it to say that when the sending key 26 is depressed, the three spring contact members 59, 60 and 61 are closed, bringing the key and all the contacts into electrical connection, and a new circuit, called the transmitter circuit, is made, which breaks the normally closed line circuit 20. In breaking the line circuit the local relay 23 becomes inert. This in turn breaks the pendulum magnet circuit, thereby freeing the pendulum and allowing it to swing to the other side. Depressing key 26 closes the circuit through contacts 59—60—61, wire 62, armature 49, contact 55 and wire 58 which connects with the end section *n* of the sending segment 8; from thence the circuit passes through the brush 6, pendulum, wire 29, battery 28, wire 31, through the transmitter 23, wire 27, and back to the key 26, thus making a complete circuit, and energizing the transmitter 23. The moment the transmitter becomes energized the armature 22 is attracted and the line circuit is broken at 24. When the line circuit is broken the relay 23 becomes inert, and the armature 25^a breaks the pendulum magnet circuit at 39, freeing the pendulum and allowing it to swing by gravity to the other side. The real effect of breaking the line circuit is the simultaneous deënergizing of both relays 25 and 25′. The deënergizing of the relay 25′ in the receiving machine breaks the pendulum magnet circuit of the pendulum B, freeing this also, so that the two pendulums A and B are simultaneously freed and swing in unison to the other side of the segment where they are held by the magnets 3—4 and 3′—4′ until released again. As before described, on depression of the key, the three spring contacts 59—60—61 are pressed together, closing the transmitter circuit, causing the breaking of the line circuit and at the same time the pendulum magnet circuit, freeing the pendulums. The moment, however, that the brushes leave the end sections *n*—*a*, or *g*—*t* this transmitter circuit is broken and the line closed again, so that when the brushes contact with the opposite end sections *g*—*t*, or *n*—*a*, a new pendulum magnet circuit will be established, again energizing the pendulum magnets 3—4 and holding the pendulum in this new position. If the pendulum has swung to the right, this circuit will pass through the end segment *g*, wire 53, and through the switch magnet 35^b, then through wire 36 and the pendulum magnets 3—4, wire 38, contact 39, the armature 25^a, wires 30 and 31, battery 28, wire 29, through the pendulum and brushes, completing the circuit, thus energizing the pendulum magnets, also the switch magnet 35^b, and attracting the armature 35^a to connect this with the contact 46.

When pressure is taken off the key, and this is released and returned to normal position, the two contact members 40—41 will again be closed and a new circuit will be made through the switch magnet 48^a to attract armature 49, making a connection at 56 and preparing a new transmitter circuit which, however, is not completed until the key is depressed again. From this it can be seen that the function of the switch magnets 35—35^b is to prepare the circuit of one or the other of the switch magnets 48—48^a, and that these again prepare the transmitter circuit which is closed by the key 26 to the main line, this, in turn, causing the breaking of the pendulum magnet circuit and releasing the pendulums.

As I have said before, the sending of all the characters on the line is accomplished through the closing of certain circuits, as the brush 6 of the sending segment in the sending machine passes over one or the other of the thin metal strips *o*, *p*, *q*, *r*, *s*, and the brush 7′ of the receiving segment of the receiving machine passes over similar wide metallic sections *b*′, *c*′, *d*′, *e*′, *f*′. It must be understood that after the pendulums have left the end sections and sweep across the segments, one or more circuits are made with the local transmitter, causing the transmitter to break the line circuit. These breaks in the line naturally affect the relay 25′ at the other end of the line, causing in turn circuits to be made in the receiving machine which momentarily energize one or more of five small magnets 70—71—72—73—74, and cause a character at X to print, corresponding to the character of the depressed key 26.

The manner in which these magnets 70—71—72—73—74 are controlled, and the corresponding type-bar X operated, will now be described: The number of keys on the keyboard will correspond to the number of type-bars X, and the usual number of keys and type-bars of a standard keyboard, of the machine which I use, is thirty-two, being sufficient for all the characters, numerals, carriage-return, spacing, etc., employed. Therefore, there must be thirty-two different combinations with the five electrical divisions of the commutators, and with the five magnets 70—71—72—73—74, to operate thirty-two different type-bars X. A list of these combinations would be as follows, it being understood that the numerals 1, 2, 3,

4, 5 in this list correspond to sections *o*, *p*, *q*, *r*, *s*, in the sending machine, and the sections *b'*, *c'*, *d'*, *e'*, *f'*, in the receiving machine:

0	1—3—5
1	1—4—5
2	1—4
3	1—5
4	1—3
5	2—3—4—5
1—2	2—3—4
1—2—3	2—3—5
1—2—3—4	2—3
1—2—3—4—5	2—4—5
1—2—3—5	2—4
1—2—4—5	2—5
1—2—4	3—4—5
1—2—5	3—4
1—3—4—5	3—5
1—3—4	4—5

These combinations, except the first (0), are utilized through the medium of one or more contacts placed between the contact member 61 and the corresponding key 26. For instance, by referring to Fig. 1, I have shown two contacts 59—60 which in this case, as will be shortly pointed out, refer to the combination "2—5", and we will assume that this combination "2—5" stands for the letter "A". Therefore, assuming that the key 26 shown in Fig. 1, with its two contacts 59—60, represents the key "A", I will now trace out the manner in which the type-bar X of the letter "A" in the receiving machine will print its character when the "A" key 26 in the sending machine is depressed:

It will be observed that the contact 60 connects by wire 63 with the segment section *p* which is known as No. 2 section, and the contact 59 connects by wire 64 with the segment section *s* which is known as No. 5 section. All these contacts 59—60—61, are adapted when the key 26 is depressed to be brought into electrical interconnection, so that the key will be in series with all these contacts. In depressing the sending key 26, the three spring contacts 59—60—61 are pinched together and a circuit made through the lower contact 61 which energizes the transmitter 23 and breaks the line, releasing the pendulums, as we have already described. This pendulum releasing circuit, or transmitter circuit, as I have called it before, is broken, however, the moment brush 6 leaves the end section *n*; thus again reëstablishing or closing the main line circuit. But as the brush 6 sweeps across its segment toward the other end *p* the main line circuit is broken twice as the brush 6 passes over sections *p* and *s*, in the following manner: The circuit controlled by section *p* passes from battery 28 through wire 31, transmitter 23, wire 27, key 26, contact 60, wire 63, section *p*, brush 6, pendulum A, wire 29, to battery. The closing of this circuit is but momentary, and breaks the instant the brush leaves section *p*. The second circuit through *s* is closed over the same route, except that the current now passes through contact 59 and wire 64, instead of contact 60 and wire 63. These two circuits made through sections *p* and *s* react through the line, and wide sections *c'*—*f'* of the receiving segment 9' in the receiving machine in the following manner: At the same time that the brush 6 on pendulum A connects with section *p* to break the line circuit, the brush 7' on pendulum B is contacting with section *c'* of the receiving segment 9' of the receiving machine to close a circuit which will energize magnet 72 which is the second magnet in series. Likewise, when the brush 6 of pendulum A passes over section *s* the brush 7' of pendulum B will be passing over the relatively wider section *f'* and close a corresponding circuit to the magnet 74 which is the fifth in series. The way in which these circuits through magnets 71—74 are closed is as follows: When the brush 6 is on contact *p* the line circuit is broken at this moment so that the relay 25' in the receiving machine is inert, allowing its armature 25^b to contact with the contact member 75 by reason of the action of the spring 75'. The contact of the armature 25^b with contact 75 closes a circuit which flows from the battery 28' through wire 31', relay armature 25^b, contact 75, wires 76 and 77, magnet 71, wire 78, section *c'*, brush 7', pendulum B, and wire 29', back to the battery 28'. Energizing this magnet 71 acts on certain selective mechanism which will be described shortly. The moment the brush 6 of pendulum A passes section *p* the transmitter circuit is again broken and the line closed, energizing the relays and breaking the circuit at 75 through magnet 71 by the attraction of the armature 25^b by the relay 25'. Similarly, when brush 6 of pendulum A contacts with section *s* the line circuit is again broken and a magnet circuit established through magnet 74 and section *f'*; the circuit being traced from battery 28', wire 31, armature 25^b, contact 75, wire 76, magnet 74, wire 79, section *f'*, brush 7', pendulum B, wire 29', to battery 28'. This circuit is again broken as soon as the brush 6 of pendulum A passes over section *s*.

The operation of the selective mechanism to select the type-bar X corresponding to the magnets 71—74, and print, is as follows: Referring to Fig. 5, where the magnets 70—71—72—73—74 are seen in plan, it is observed that these magnets have respective armatures 70'—71'—72'—73'—74', and each of these armatures has a corresponding latch member 70^a adapted to control the movements of a series of selector combs or rack-bars 80—81—82—83—84, through the engagement and disengagement of the latches 70^a with the corresponding projections 80'—

81′—82′—83′—84′, on the respective bars 80—81, etc. Each one of these bars has a number of slots 86 along its front edge corresponding to the number of keys 26 of the keyboard. Each one of these slots is just large enough to permit a locking lever 90, Fig. 2, to enter when permitted. There is one of these locking levers 90 connected with each key 26′ and corresponding type-bar X (of the receiving machine), and whenever one of these levers 90 enters a series of registering slots 86 in all the five bars 80—81—82—83—84, the character corresponding to the depressed key 26 of the sending machine will print, as will be seen shortly.

The several bars 80—81—82—83—84 are normally pulled in one direction and in opposition to the retaining means 70ª by suitable means, as the springs 110. Energizing any of the magnets 70, etc., will attract its corresponding armature 70′—71′, etc., releasing its corresponding hook 70ª from the respective projection 80′ or 81′, whereupon the spring 110 will throw the bars 80 or 81, etc., so released, in one direction. These bars are suitably mounted for reciprocation in suitable guides in the machine frame, and whenever a bar is pulled over by its coil spring it moves until it strikes the armature plate 111 on the magnet 112. It is by means of this armature 111, as I will point out later, that the bars are pushed back in opposition to the springs 110 to engage the bars with the latches 70ª.

Arranged in the pendulum magnet circuit of the magnets 3′—4′ is a magnet 87, and whenever the pendulum magnets are energized, magnet 87 will also be energized and attract its armature 87′. This armature 87′ controls a circuit through a magnet 88, and magnet 88 acts on a normally retracted, spring-actuated armature 88′ which connects with and operates a slidable frame 93. This frame 93 is supported in brackets and extends across and in the path of the series of locking bars 90, so as normally to prevent any of these locking bars 90 from entering the slots 86 in the rack-bars 80—81, etc., until the pendulum arrives on one or the other of the end sections of the segments and closes the pendulum magnet circuit; this pendulum magnet circuit, as we have seen, closing the circuit through the magnets 87 and 88. Thus, assuming that one or more of the rack-bars or combs 80—81, etc., have been moved to bring a vertical line of slots 86 in these bars into juxtaposition with a corresponding locking bar 90, and further assuming the pendulums to be swung to the limit of their stroke in either direction so as to close the pendulum circuits, the frame 93 will be moved so as to release the locking bars 90, and one of the bars 90 corresponding to the letter on the key depressed will enter its registering line of slots 86 by reason of the action of a suitable spring 96; there being one of these springs 96 for each bar 90.

The engagement of the bar 90 in a series of slots 86 carries the lower hooked end 113 of the bar forward underneath a rod 114 carried by a rocking frame 115 which is fulcrumed at 116. A spring 117 acts on the frame 115 to carry the rod 114 normally above and out of the path of the hooks 113. This rocking frame 115 is operated by a magnet 118, Fig. 2, the circuit of which is closed at 119 by the inward rocking of the bar 90. The moment this circuit is closed through magnet 118, frame 115 is rocked, pulling down on the hook 113 of the bar 90 which is engaged with the slots, and this acts on a bell-crank 120 to rock the inner end of a key member 26′ in the receiving machine, pulling on a rod 121 which connects with a corresponding type-bar X to print the desired character. This type-bar X at the moment of printing closes another circuit at 122 which is in a circuit with the magnet 123, and this magnet 123 acts on an armature 124 which in turn acts on a sliding frame 125. This frame 125 has a cross-bar 126 which pushes out the locking bar 90 to disengage it from its slots 86, thereby breaking the printing circuit through magnet 118. At the same time that magnet 123 is energized, the magnet 112 which is on the same circuit is energized, and its armature 111 is attracted to push back all the combs or rack-bars 80—81, etc., which have been thrown forward, and cause all these rack-bars again to be caught by their latches 70ª.

From the foregoing, it will be understood that to print the character "A" which I have before assumed to be represented by the combination "2—5" and the spring contacts 59—60 which connect to the sections *p*—*s* and act through sections *c′*—*f′* and magnets 71—74, that two bars are released in the traverse of the brushes 6—7′ across their segments, and the moment that the pendulums reach the end of their stroke on the reëstablishment of the pendulum magnet circuits, the character "A" on its corresponding type-bar X will be printed; and after printing, all the parts, except the pendulums, will be returned to normal initial position ready for the next selection.

It makes no difference which way the pendulums swing, except that they both always swing in the same direction and practically at the same rate of speed, and simultaneously. However, exact synchronism between the two pendulums is not necessary, since the sending sections *o*, *p*, *q*, *r*, *s*, are only about one-tenth of the width of the receiving sections *b′*, *c′*, *d′*, *e′*, *f′*, thereby making up for any loss of time in starting or movement between the two pendulums.

There might be a difference of one-eighth of an inch in the relative travel of the two pendulums without any adjustment being necessary. A single swing of the pendulums in either direction completely across the segments causes the character to print, depending on the key depressed.

From this description of the character "A" with its two selective sections *p*—*s*, *o'*—*f'*, and magnets 71—74 and corresponding bars 81—84, it will be manifest that each character, except that represented by the first combination "0", it will have as many spring contacts, similar to the contacts 59—60, interposed between its key and its respective contact 61 as there are impulses in the particular combination. Thus, the combinations from "1" to "5" of the preceding chart would have one contact corresponding to a contact 59 or 60, each of these contacts connecting with a respective section *o*, *p*, *q*, *r*, *s*. Likewise a character employing five sections will have five spring contacts similar to the contacts 59—60 arranged between its key 26 and contact 61, and these five contacts will be connected with all five of the sections *o*, *p*, *q*, *r*, *s*; and likewise all the magnets 70—71, etc., and all the bars 80—81, etc., will be utilized to actuate its corresponding type-bar X.

The notches 86 in the rack-bars or combs 80—81, etc., are so disposed that a lengthwise shifting of one or more of these bars in one direction following the depression of any key on the keyboard, will allow only a single set of slots to register vertically to admit a single locking lever 90 corresponding to the character of the key depressed, into its slots.

It is understood that while there are only five magnets 70—71—72—73—74, and five combination-forming combs 80—81—82—83—84, for a keyboard employing not to exceed thirty-two keys, there are, however, as many notches 86 in the combs as there are keys on the keyboard, these notches being judiciously staggered, so that whenever frame 95 moves to allow the locking levers 90 to approach the combs, only one locking lever 90 will enter a set of registering notches.

For the character represented by the combination "0" there will not be any contacts like 59 or 60 between that particular key 26 and the contact 61, but the key which corresponds to the first combination "0" will, when depressed, contact immediately with its corresponding contact 61; there being a special contact 61 for each key. This will operate on the transmitter 23, as we have already seen, to release the pendulum and allow it to swing across the commutator segments, but without closing any circuits through any of the sections *o*—*p*, *b'*—*a'*, etc., until the brush 6 comes on to the end section *t* or *n*, as the case may be, when immediately the pendulum magnet circuits are cut in to hold the pendulum in place. But following the pendulum coming to rest after the depression of the key corresponding to the character for the first combination "0", the magnet 87 is energized just as when any other key of the keyboard is depressed and then released and the pendulum magnet circuits again closed. Since the first or "0" combination has no connection with, or control of, any of the five magnets 70—71—72—73—74, none of the combs 80—81—82—83—84 move; and the notches in all these combs are so arranged that when all the combs 80—81, etc., are held against their springs 110 by the latches 70ª, there will be one set of notches 86 in vertical register directly in front of the locking lever 90 which corresponds to type-bar X of the first or "0" combination. Whenever the combs are thus locked there is always this set of slots ready to receive its locking bar 90, whenever the detaining frame 95 allows the spring-pressed levers 90 to move in against the combs. Of course, whenever any other key on the keyboard other than that which stands for the first or "0" combination is depressed, some one or more of the combs are released; and all the notches 86 in the combs are so disposed that no two lines of notches will ever be brought into register at the same time that the retaining frame 95 is moved to let the locking levers 90 move in against the combs. Hence, when the first or "0" combination key is depressed and the pendulums swing in the manner shown and come to rest again and are held by the reëstablishment of the pendulum magnet circuits, the frame 95 will be reciprocated and the lever 90 corresponding to the first or "0" combination of the type-bar X will swing into its line of notches 86 in the combs, and that particular type-bar X will fly up, print, close switch 122, energize magnet 123, and throw back the releasing frame 126, thereby breaking the circuit of switch 119, and returning the parts to initial position.

From the foregoing description it will be seen that by means of the segments divided into fifths, and by energizing one or more of the magnets 70—71—72—73—74, and employing the rest of the selective mechanism shown, I am able to transmit over a single line all the letters of the alphabet, numerals or other symbols usual or necessary in the transmission of messages; making thirty-two combinations with the five commutator sections and five magnets. If a greater number of combinations is needed, I simply make the segments with six or seven or more conducting sections *o*, *p*, *q*, and *a*, *b*, *c*, etc., combining these various sections in substantially the manner previously described; the number of sections corre-

sponding to the number of magnets 70—71, etc., and combs 80—81, etc.

The contacts 40—41, 59—60, etc., previously referred to, are shown in their relative position to the keys in Figs. 4 and 8. Each key 26 or 26′ carries a rod 128 having a foot-piece bearing on a side rail of a rocking frame 129, which latter extends across the machine and operates the contacts 40—41, no matter which key is depressed. Each rod 128 has a pin 130 to engage is corresponding set of contacts 59—60, etc.

In Fig. 7 is shown how the circuit is closed at switch 119: All the levers 90 are adapted, when rocked forward, to hit a rocking frame 131 which extends across the machine and closes switch 119, no matter which lever 90 is moved.

Having thus described my invention, what I claim and desire to secure by Letters Patent is—

1. In a printing telegraph, the combination of a plurality of sending keys, a plurality of corresponding printing members, a single line wire, and means including commutator segments and gravity actuated brushes movable over said segments whereby on the depression of a key a corresponding printing member is operated, said segment sections being of less number than the number of keys and capable of a number of permutations equal to the number of keys.

2. In a printing telegraph, the combination of a plurality of sending keys and a corresponding number of printing members, a single line wire, electrical mechanism controlled by the keys whereby on the depression of a particular key a corresponding one of said printing members will be operated, said mechanism including a commutator segment having a number of sections less than the number of keys, a gravity actuated brush traversing said sections, and means by which on the depression of a key a circuit passes through one or more of said sections or the traverse of the brush over the segment.

3. In a printing telegraph, the combination of a plurality of sending keys and a corresponding number of printing members, a single line wire, electrical mechanism controlled by the keys whereby on the depression of a particular key a corresponding one of said printing members will be operated, said mechanism including a commutator segment having a number of sections less than the number of keys, a gravity actuated brush traversing said sections, means by which on the depression of a key a circuit passes through one or more of said sections on the traverse of the brush over the segment, a correspondingly divided segment at the receiving end of the line, and a brush traversing the same, with a selective mechanism controlled by said last-named brush and its sections to control the movements of said printing members.

4. In a printing telegraph, the combination of a sending key, a commutator segment divided into a plurality of conducting sections, a brush traversing the segment, means including a gravity actuated pendulum controlled by the key for causing the brush to traverse the segment, a single line wire, means controlled by the brush for sending impulses over said wire, and printing mechanism controlled by the impulses sent over said line wire.

5. In a printing telegraph, the combination of a sending key, a commutator segment divided into a plurality of conducting sections, a brush traversing the segment, means including a gravity actuated pendulum controlled by the key for causing the brush to traverse the segment, a single line wire, means controlled by the brush whereby on the traverse of the brush across said segment in one direction a plurality of successive impulses will be sent over the line wire, and mechanism operative through the medium of the plurality of impulses for reproducing a single character corresponding to said sending key.

6. In a printing telegraph, the combination of a normally closed main line, a relay at each end of the line, a transmitter circuit controlling each relay, a key, means by which on the depression of the key the transmitter circuit may be established one or more times and correspondingly break the main line circuit, said means including a pendulum hung to swing by gravity, means for holding it at an end of its stroke against gravity, and circuit making and breaking devices operated by the swinging pendulum; and printing means and selective mechanism at the receiving end of the line by which a character is recorded corresponding to the key depressed on the passage of these impulses over the main line.

7. In a printing telegraph, the combination of a swinging pendulum carrying a brush, a segment divided into a plurality of insulating sections, a keyboard having a number of keys in excess of the number of said sections but which sections permit of a number of permutations and combinations corresponding to the number of keys, electrical means for combining these sections to form permutations to correspond to the keys, means by which on the depression of a key one or more of said sections so combined will permit of currents passing through the sections on the traverse of said brush over said sections, printing mechanism, and means controlled by the currents passing through said sections for operating the printing mechanism.

8. In a printing telegraph, a sending machine and a receiving machine, each machine

having a swinging pendulum with a brush on each pendulum, a sending segment divided into a plurality of conducting sections over which the brush on the sending pendulum swings, a receiving segment divided into a corresponding number of conducting sections over which the brush on the receiving pendulum swings, said sections on the receiving segment being longer than the sections on the sending segment, whereby the brush on the receiving pendulum is in contact longer with a section than is the brush on the sending pendulum in contact with its corresponding section, a series of sending keys greater than the number of the sections of either segment, a corresponding number of printing devices, and electrical connections controlled by the keys and said sections whereby on the depression of any key a corresponding printing device is operated.

9. In a printing telegraph, a sending machine and a receiving machine, each machine having a swinging pendulum with a brush on each pendulum, a sending segment divided into a plurality of conducting sections over which the brush on the sending pendulum swings, a receiving segment divided into a corresponding number of conducting sections over which the brush on the receiving pendulum swings, a series of sending keys greater than the number of the sections of either segment, a corresponding number of printing devices, and electrical connections controlled by the keys and said sections whereby on the depression of any key a corresponding printing device is operated.

10. In a printing telegraph, a sending machine and a receiving machine, each machine having a swinging pendulum with a brush on each pendulum, a sending segment divided into a plurality of conducting sections over which the brush on the sending pendulum swings, a receiving segment divided into a corresponding number of conducting sections over which the brush on the receiving pendulum swings, a series of sending keys greater than the number of the sections of either segment, a corresponding number of printing devices, and electrical connections controlled by the keys and said sections whereby on the depression of any key a corresponding printing device is operated, said last-named connections including in the sending machine a transmitter circuit having means for making and breaking the line, and a switch controlled by the key for making and breaking the transmitter circuit.

11. In a printing telegraph, the combination of a sending machine having a plurality of sending keys, and a receiving machine having a number of printing members corresponding to the sending keys, a single line wire, and means including a segment in each machine having a number of insulated conducting sections less than the total number of keys and a gravity actuated pendulum carrying brushes which move over the conducting sections, with suitable electrical connections, for reproducing by said printing members the characters corresponding to any of said keys depressed.

12. In a printing telegraph, the combination of a sending key, a printing member, two pendulum members each having a brush and a commutator segment over which each brush moves, a normally closed main line, relays at the ends of the main line, pendulum magnet circuits with means controlled thereby for holding the pendulums at the ends of their respective segments, and means by which on the depression of the key the pendulums are released and one or more impulses are sent over the line to actuate the printing member.

13. The combination of a key, a pendulum having a brush, a commutator divided into a plurality of sections over which the brush moves, a single line wire, a transmitter circuit controlling the impulses over the line, printing mechanism with means controlled by the main line impulses to actuate it, and means controlled by the key and commutator sections to open and close the transmitter circuit.

14. In a printing telegraph; the combination with a main line, of a pendulum hung to swing by gravity, electro-magnetic means for holding the pendulum at an end of its stroke against gravity, a key, electro-magnetic connections for controlling the release and detention of the pendulum, mechanism operated through the swinging movement of the pendulum to send impulses over the line, and means for recording said impulses.

15. In a printing telegraph, the combination with a main line, of a pendulum hung to swing by gravity, electro-magnetic means for holding the pendulum at an end of its stroke against gravity, a key, electro-magnetic connections for controlling the release and detention of the pendulum, mechanism operated through the swinging movement of the pendulum to send impulses over the line, selective mechanism operative by the impulses, and printing mechanism controlled by said selective mechanism.

16. In a printing telegraph, the combination with a main line, of a pendulum hung to swing by gravity, electro-magnetic means for holding the pendulum at an end of its stroke against gravity, a key, electro-magnetic connections for controlling the release and detention of the pendulum, mechanism operated through the swinging movement of the pendulum to send impulses over the line, said last-named means including a commutator segment divided into a plurality of conducting sections, a brush on the pendu-

lum swinging over said sections, and circuits completed through said sections and brush and controlled by the key, a corresponding pendulum, brush and commutator sections at the opposite end of the line, means for controlling the movement of the second-named pendulum by the impulses over said line, recording mechanism, and electrical means controlled by the last-named pendulum, brush and commutator to operate the recording mechanism.

17. In a printing telegraph, the combination with a main line, of a pendulum hung to swing by gravity, electro-magnetic means for holding the pendulum at an end of its stroke against gravity, a key, electro-magnetic connections for controlling the release and detention of the pendulum, mechanism operated through the swinging movement of the pendulum to send impulses over the line, said last-named means including a commutator segment divided into a plurality of conducting sections, a brush on the pendulum swinging over said sections, and circuits completed through said sections and brush and controlled by the key, a corresponding pendulum, brush and commutator sections at the opposite end of the line, means for controlling the movement of the second-named pendulum by the impulses over said line, recording mechanism, electrical means controlled by the last-named pendulum, brush and commutator to operate the recording mechanism, and a selective mechanism including said last-named electrical means.

18. The combination of a line, a relay at each end, a transmitter circuit at one end controlling impulses over the line, and a pendulum circuit at the other end controlled by the line, a swinging pendulum at each end of the line, each pendulum having a brush and a commutator segment over which each brush operates, electro-magnetic means for controlling the movements of the sending pendulum, means by which the sending pendulum in sweeping across its segment causes one or more circuits to be made through the local transmitter circuit to break the line, means by which these breaks in the line similarly affect the receiving pendulum, and recording mechanism controlled by the mechanism at this end of the line.

19. In a printing telegraph, the combination of a segment divided into a plurality of insulated conducting sections, a swinging pendulum having a brush in swinging contact with said sections, a sending key, a transmitter circuit, a main line, electro-magnetic means controlled by the key for releasing and for holding the pendulum at an end of its stroke, circuits completed through one or more of the segment sections and through the key, means by which on the depression of the key the pendulum is released and one or more impulses sent over the line, and selective mechanism at the opposite end of the line actuated by said impulses.

20. In a printing telegraph, the combination of a segment divided into a plurality of insulated conducting sections, a swinging pendulum having a brush in swinging contact with said sections, a sending key, a transmitter circuit, a main line, electro-magnetic means controlled by the key for releasing and for holding the pendulum at an end of its stroke, circuits completed through one or more of the segment sections and through the key, means by which on the depression of the key the pendulum is released and one or more impulses sent over the line, selective mechanism at the opposite end of the line actuated by said impulses, and printing mechanism operative by said selective mechanism.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JOHAN J. VERMEER.

Witnesses:
L. H. ZIMMERMANN,
W. G. HITE.