(No Model.)

3 Sheets—Sheet 1.

H. MAHNKEN.

PRINTING TELEGRAPH.

No. 368,541. Patented Aug. 16, 1887.

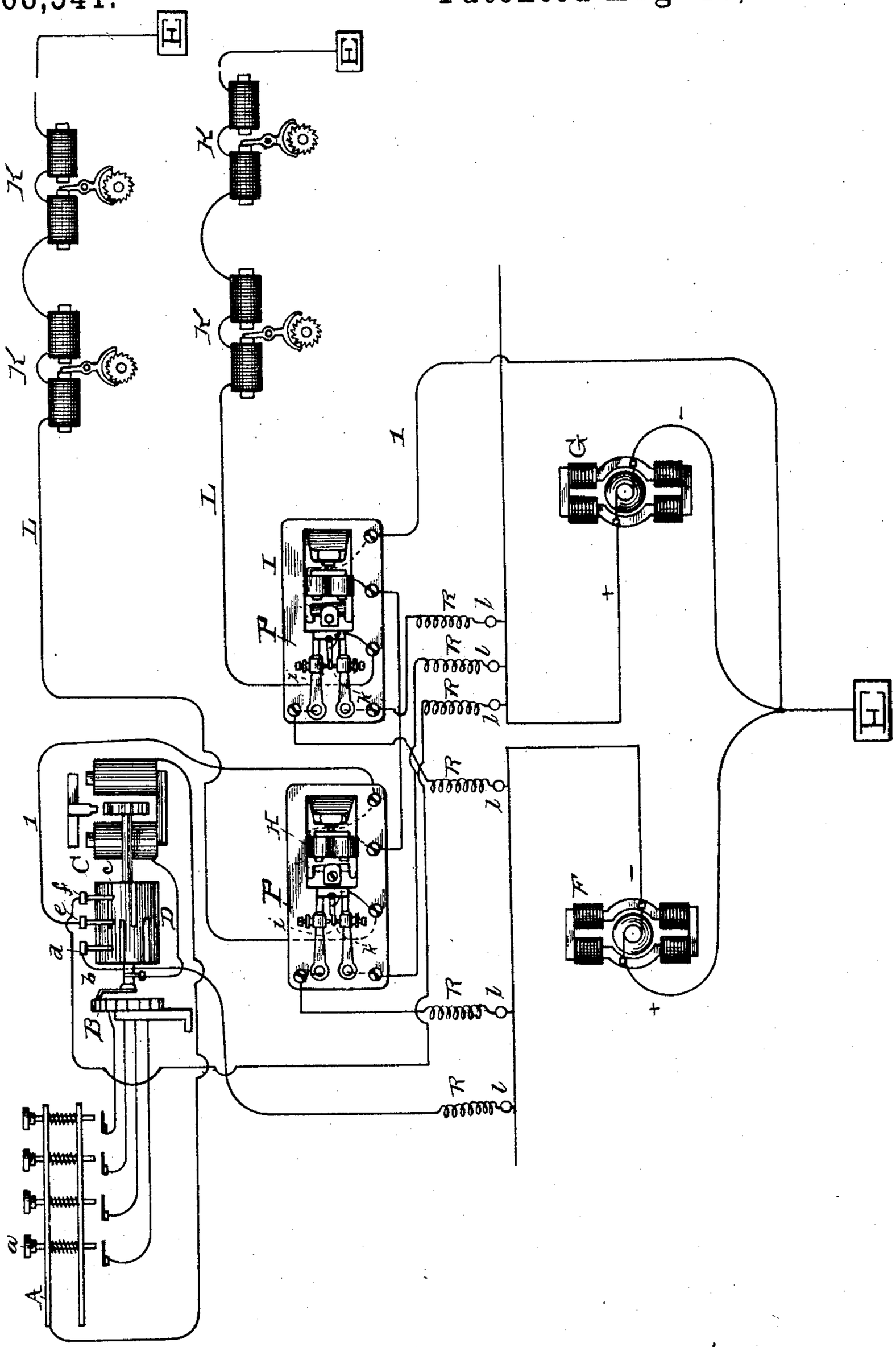

FIG. 1.

ATTEST:

E. C. Howland

Wm. Pelzer

INVENTOR:

Henry Mahnken.

By Dyer & Seely

Attys.

(No Model.) 3 Sheets—Sheet 2.

H. MAHNKEN.

PRINTING TELEGRAPH.

No. 368,541. Patented Aug. 16, 1887.

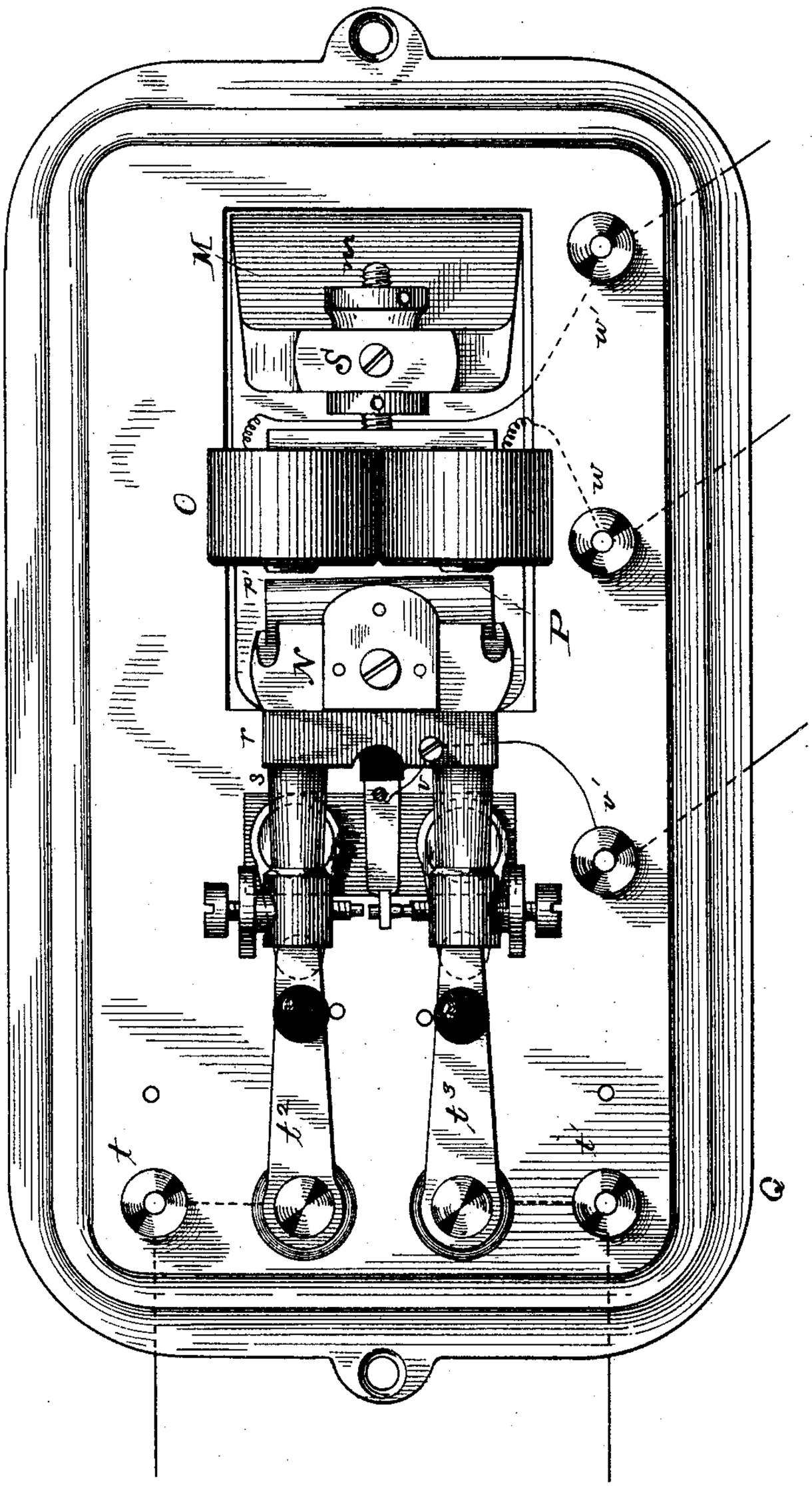

FIG. 2.

ATTEST:
E. C. Rowland.
Wm. Dyer

INVENTOR:
Henry Mahnken,
By Dyer & Seely
Attys.

(No Model.) 3 Sheets—Sheet 3.

H. MAHNKEN.

PRINTING TELEGRAPH.

No. 368,541. Patented Aug. 16, 1887.

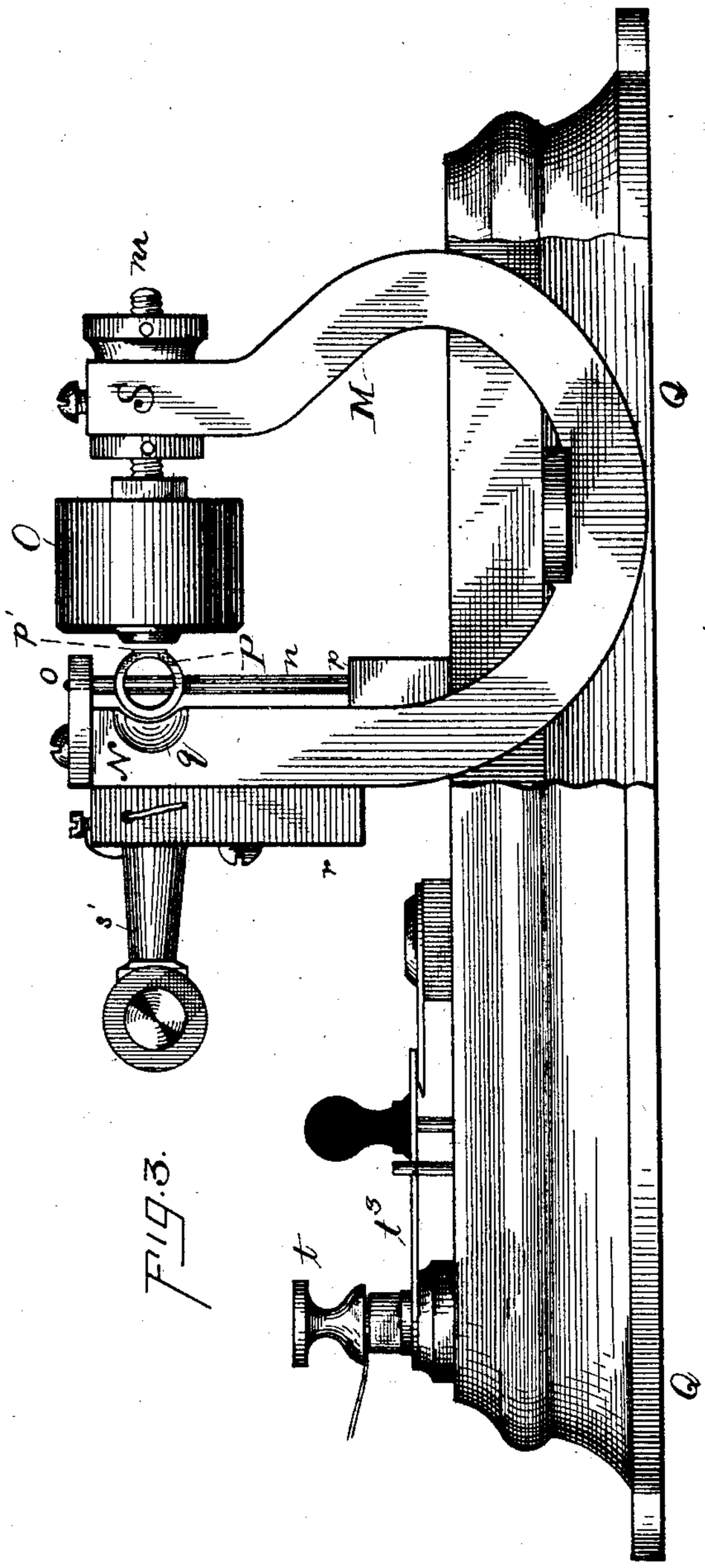

FIG. 3.

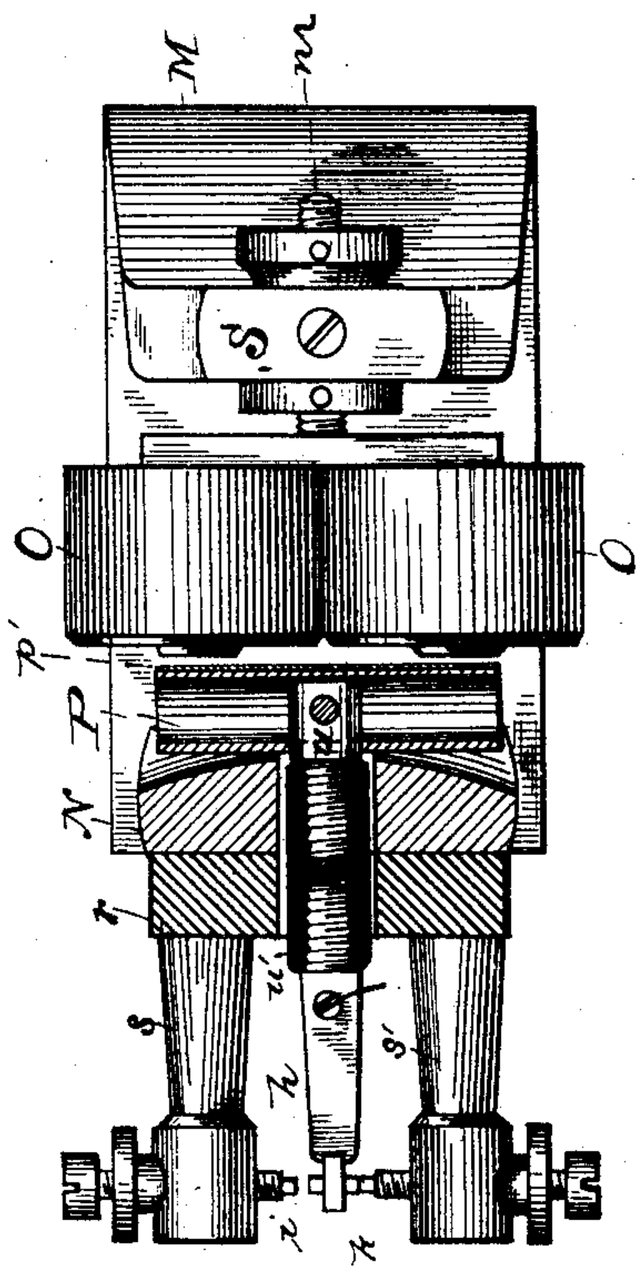

FIG. 4.

ATTEST:
E. C. Rowland
Wm. Dyer

INVENTOR:
Henry Mahnken,
By Dyer & Seely,
Attys.

UNITED STATES PATENT OFFICE.

HENRY MAHNKEN, OF BROOKLYN, ASSIGNOR TO THE COMMERCIAL TELEGRAM COMPANY, OF NEW YORK, N. Y.

PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 368,541, dated August 16, 1887.

Application filed February 1, 1887. Serial No. 226,121. (No model.)

To all whom it may concern:

Be it known that I, HENRY MAHNKEN, of Brooklyn, in the county of Kings and State of New York, have invented a certain new and useful Improvement in Printing-Telegraphs, of which the following is a specification.

The object I have in view is to produce a simple and efficient construction and arrangement of polarized relays and of connections therefrom to the mechanically-operated pole-changing transmitter of a printing-telegraph plant, to the sources of electrical energy, and to the type-wheel lines, so that a large number of such type-wheel lines may be practically supplied with rapid current vibrations by means of such relays and without the disadvantages arising from the use of a mechanically-operated pole-changer large enough to work all the lines, and without complication of contacts or the danger of cross-connections being formed between the circuit that operates the relay and the circuit that is controlled by it. The special form of polarized relay which I have devised for this purpose is a highly efficient instrument for all purposes for which relays or repeaters are employed, and the peculiar construction and arrangement of the permanent magnet, the armature, and the operating-coils or electro-magnet of such relay are highly efficient for producing motion by rapid current reversals, and are applicable to any use where motion is to be produced by polarized armatures.

In the accompanying drawings, forming a part hereof, Figure 1 is a view, principally in diagram, of apparatus embodying my invention; Fig. 2, a top view of the repeating-relay; Fig. 3, a side view of the same with the base partly broken away to show the permanent magnet throughout its length, and Fig. 4 a separate top view and partial horizontal section of the permanent magnet and the parts supported thereby.

With reference more particularly to Fig. 1, A is the key-board, having the keys *a*, as usual. The key-board is connected in a divided circuit with the "sunflower" B and the clutch-magnet C of the transmitter. The mechanically-rotated transmitting-cylinder D carries one set of pole-changing plates, *b c*, upon which bear the stationary contact-springs *d e f*.

F and G represent two dynamo-electric machines or other sources of electrical energy. The springs *d* and *f* are connected, respectively, with the negative pole of F and the positive pole of G, while from the spring *e* extends the line or circuit *l*, including the electro-magnet coils of two or more polarized repeating-relays, H I, and ending in the connection between the other poles of the dynamos. The relays H I are magnets having polarized armatures P, from which extend simple contact-arms *h*. The contact-arm of each relay-armature plays between a pair of simple stationary contacts, *i k*. The negative pole of the dynamo F is connected with all the contacts *i*, while the positive pole of the dynamo G is connected with all the contacts *k*. The other poles of the dynamos are connected together and to the earth, as shown, or to a metallic return. The type-wheel lines L L extend from the relay contact-arms *h*, each through the type-wheel magnets K of a number of printers, and then to earth or a metallic return. If the printers are instruments worked by one line, the printing-magnets will also be included in the same line-circuits, as will be well understood.

The revolution of the pole-changing transmitter will cause the armature P of the polarized relays to vibrate rapidly and the contact-arms *h*, carried thereby, to play between the contacts *i k*, throwing first a negative-current impulse and then a positive-current impulse upon each of the lines. In this way a large number of type-wheel lines can be operated from a mechanically-operated transmitter, whose moving parts will be small and light and can be run at a high rate of speed.

The connections from the poles of the dynamos F G to the relay-circuit and to the lines are made through resistances R, and each of these connections is protected by a fusible safety-catch represented in the form of screw-plugs by the circles *l*.

To be capable of responding to current reversals of great rapidity, I have devised a peculiar polarized apparatus of great sensitiveness and power. It comprises a heavy per-

manent horseshoe-magnet, M, the poles of which are marked N S. This, for cheapness and permanency, is preferably made of cast-iron, which, after being drilled and fitted as desired, is hardened throughout or at its ends only by the application of chemicals thereto while it is at a red heat. I heat the cast-iron to a bright-red heat and sprinkle prussiate of potash in the form of a powder over the iron, or I dip it when at a bright-red heat in a solution of saltpeter in water, and then permit the iron to cool. The solution may be made by adding one pound of saltpeter to one gallon of water. The hardened iron is then magnetized in the usual manner. I have found that in this way I can produce a permanent magnet of great strength and permanency, which it is very difficult to obtain from cast-steel. The cast-iron before being hardened is also readily drilled and cut for fitting and attaching it to the other parts of the instrument. Upon one of the poles of the permanent magnet M (shown as the south pole) is mounted, by an adjusting-screw, *m*, the electro-magnet O, which projects toward the north pole of the magnet M, and may be adjusted with relation to it by the screw *m*. P is the polarized armature. This is a light tube of soft iron which extends laterally across the north pole of the magnet M and between it and the poles of the electro-magnet O. The tubular armature P is secured to a spindle, *n*, which extends parallel with the north leg of the magnet, longitudinally thereof on its inner side, and is supported in plates *o p* at its ends, in which it turns freely, as shown. The magnet M has preferably a groove, *q*, in the face of its pole, in which the tubular armature plays, so that the pole partly incloses the armature and forms a magnetic field of considerable strength and uniformity, in which the armature vibrates. This groove is more shallow at its center than at its ends, as shown in Fig. 4, so as to hug the armature closely and still allow for its movement. The side of the armature P next to the poles of the electro-magnet O is preferably flattened a little, to permit the armature to approach such poles with more surface. The armature is limited in its movement by the contacts *i k*, which should be so adjusted that the armature will not strike the poles of the magnet O; but a strip, *p'*, of brass is secured to the flat face of the armature to prevent sticking should the armature touch either pole.

By using the hollow armature a large inductive surface is provided, and the pole of the permanent magnet is farther removed from the poles of the electro-magnet at the same time that the armature is in close relation with each of these elements. This end is accomplished with an armature of the minimum weight, which can be vibrated with great rapidity. A heavy block, *r*, of insulating material is secured to the other side of the north pole of the magnet M, and upon this block *r* are mounted the arms *s s'*, carrying the contacts *i k*, which are connected with the poles of the dynamos F G through binding-posts *t t'* and hand-switches t^2 t^3. A screw-threaded stud, *u*, projects from the center of the tubular armature P back through the north pole of the magnet M, and upon this stud *u* is secured a section, *u'*, of insulating material, to which is attached the contact-arm *h*. The line-connection with the contact-arm *h* is made by a slack wire, *v*, which is connected with the binding-post *v'* by a wire passing from the insulation *r* to such post without coming in contact with or near the permanent magnet or any metal parts connected with the cores of the electro-magnet O. The coils of the electro-magnet O are connected with binding-posts *w w'*. All of the binding-posts are mounted on the base Q, of wood or other insulating material, which sustains the other parts of the instrument. It will be seen that the local relay-circuit, which is connected with the binding-posts *w w'* and includes the coils of the electro-magnet O, and the line-circuit connected with the binding-posts *t t' v'* and including the arm *h* and contacts *i k*, are kept separate on the instrument. The wires of the line-circuit are not brought near any metal parts with which the wire of the local relay-circuit might become crossed; hence no cross connection can occur on the instrument between the two circuits.

What I claim is—

1. In printing-telegraphs, the combination, with a pole-changing transmitter, of two or more polarized relays operated thereby and two or more type-wheel lines controlled by such polarized relays, the local and line circuits on such relays being protected against cross-connection, substantially as set forth.

2. In printing-telegraphs, the combination, with a circuit-controlling transmitter, of two or more polarized relays operated thereby and having armatures of great inductive force and lightness, current-reversing contacts controlled by such armatures, and two or more type-wheel lines upon which current reversals are produced by such relays, substantially as set forth.

3. In printing-telegraphs, the combination, with a transmitter, of a relay vibrating a simple contact-arm between stationary contacts, two sources of electrical energy connected by opposite poles with such stationary contacts, and a type-wheel line connected with said vibrating contact-arm, the local and line circuits on such relay being protected against cross-connection, substantially as set forth.

4. In printing-telegraphs, the combination, with a pole-changing transmitter, of two or more polarized repeating-relays operated thereby and having armatures of great inductive force and lightness, simple contact-arms vibrated by such armatures between simple stationary contacts, two sources of electrical energy connected by opposite poles with each pair of stationary contacts, and two or more type-wheel lines upon which current reversals

are produced by such polarized relays, the local and line circuits on such relays being protected against cross-connection, substantially as set forth.

5. In printing-telegraphs, the combination, with a pole-changing transmitter, of two or more polarized repeating-relays operated thereby and having armatures of great inductive force and lightness, simple contact-arms vibrated by such armatures between simple stationary contacts, two sources of electrical energy connected by opposite poles with each pair of stationary contacts, resistances and safety-catches in circuit with such connections, and two or more type-wheel lines upon which current reversals are produced by such polarized relays, the local and line circuits on such relays being protected against cross-connection, substantially as set forth.

6. The combination, with the permanent magnet having a recessed pole, of an electro-magnet mounted on the other pole of said permanent magnet and projecting toward said recessed pole and a centrally-pivoted hollow or tubular vibrating armature located between the core ends of the electro-magnet and the recessed pole of the permanent magnet and partly inclosed by said recessed pole, substantially as set forth.

7. The permanent magnet having a lateral groove or recess in one face, made of less depth at the center of the magnet, and a hollow or tubular armature vibrating in such groove, the pivotal center of the armature being located at the shallow point of the groove, substantially as set forth.

8. The combination, with the electro-magnet, the permanent magnet, and the vibrating armature, of a contact-arm carried by such armature and connected therewith by insulating material, substantially as set forth.

9. The combination, with the electro-magnet, the permanent magnet, and the vibrating armature mounted together, of a contact-arm carried by such armature and connected therewith by insulating material, posts carrying stationary contacts insulated from all metal parts, circuit-connections with the contact-arm and stationary contacts, and other circuit-connections with the electro-magnet coils, said circuits being protected against cross-connection, substantially as set forth.

10. The combination, with the horseshoe permanent magnet, the elcctro-magnet mounted on the inner side of one pole, and the vibrating armature mounted on the inner side of the opposite pole thereof, of a block of insulating material supported by the latter pole of the permanent magnet, posts carrying stationary contacts supported by such block, and a contact-arm playing between such stationary contacts and connected with the vibrating armature by a section of insulating material, substantially as set forth.

This specification signed and witnessed this 25th day of January, 1887.

HENRY MAHNKEN.

Witnesses:
F. C. ROSS,
C. BLAUVELT.