No. 622,629.

Patented Apr. 4, 1899.

E. J. P. MERCADIER & H. R. J. PIERQUIN.

MULTIPLE TELEGRAPH.

(No Model.)

(Application filed Jan. 3, 1896.)

3 Sheets—Sheet 1.

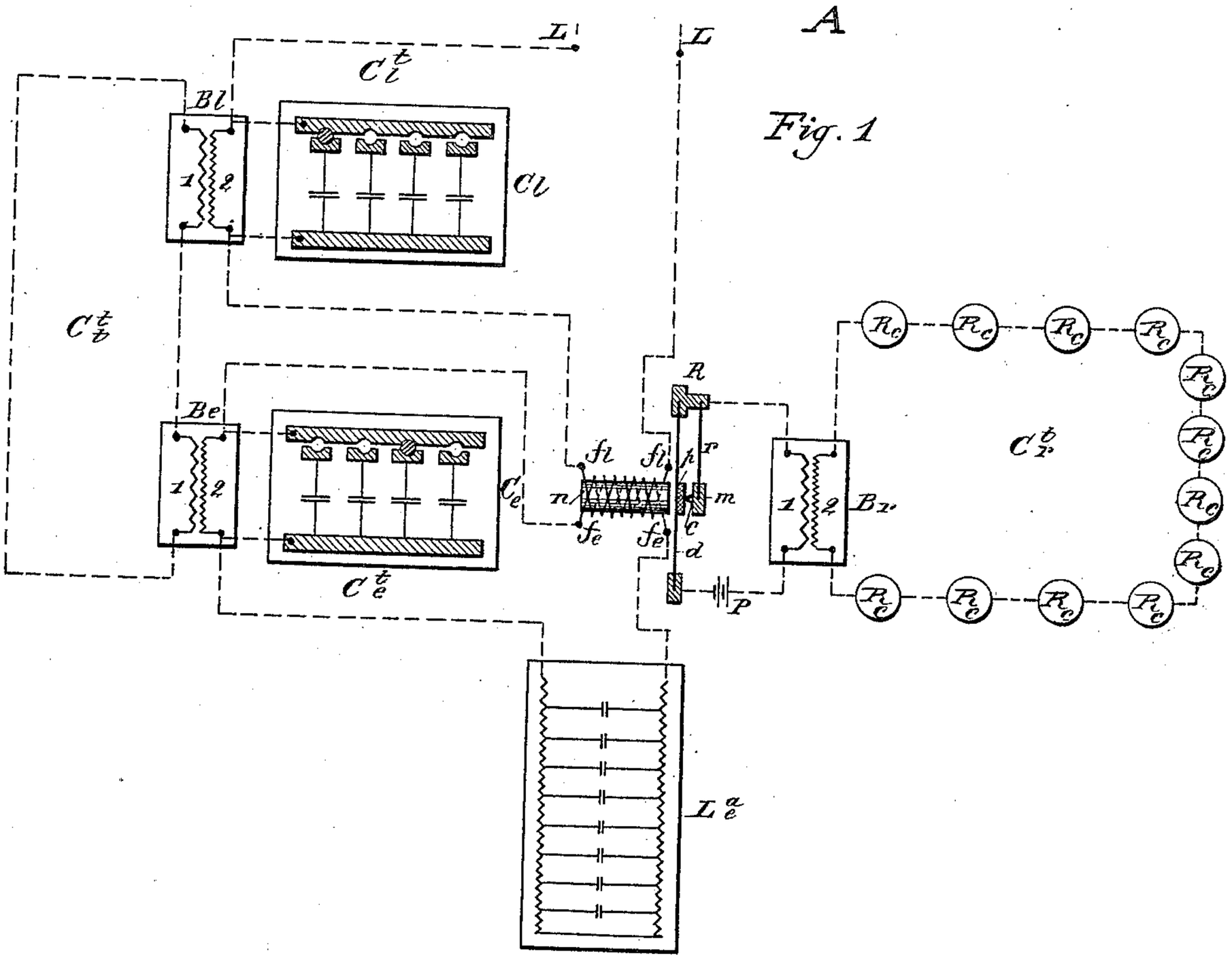

Fig. 1

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Fig. 2.

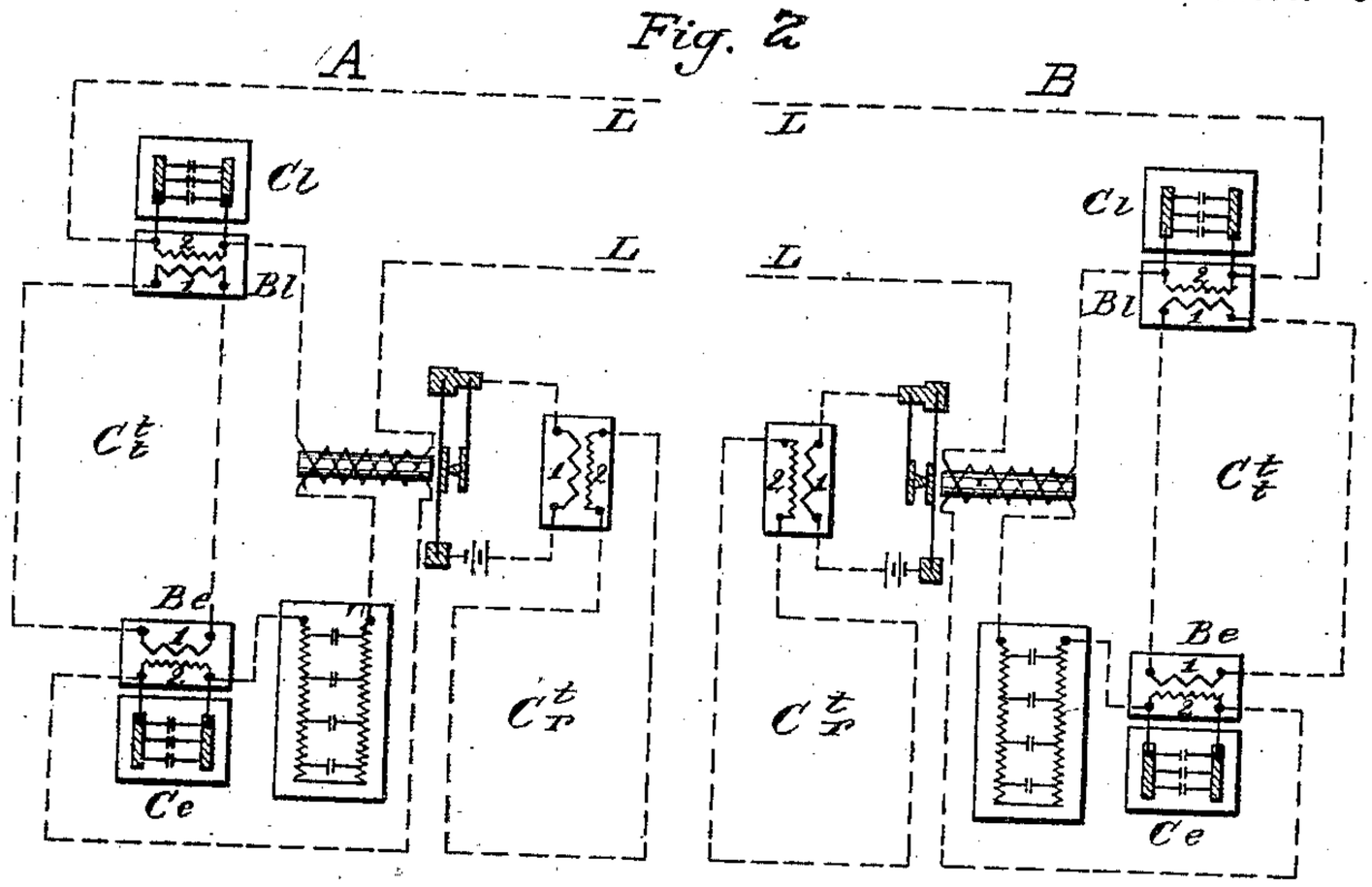
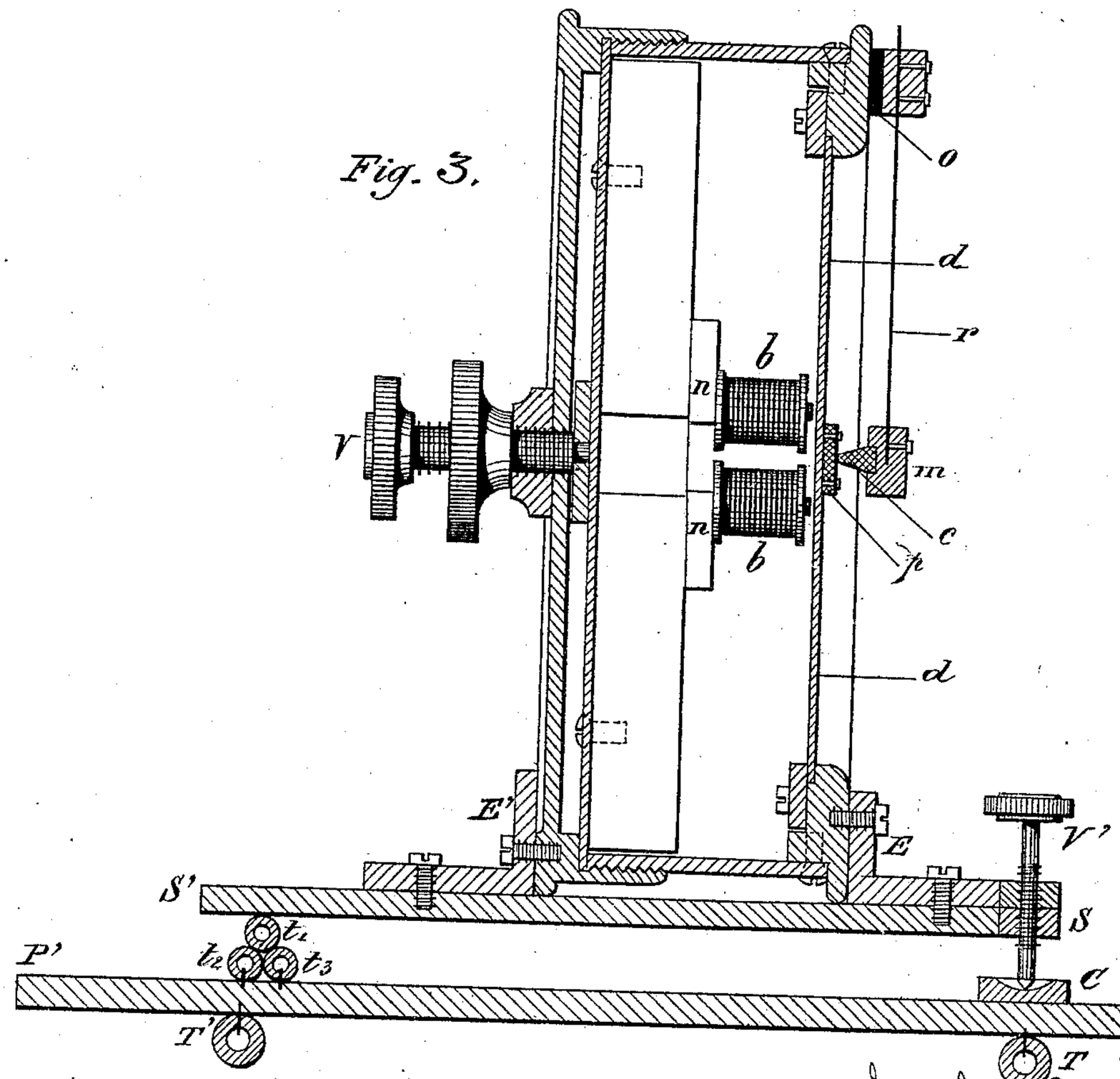


Fig. 3.



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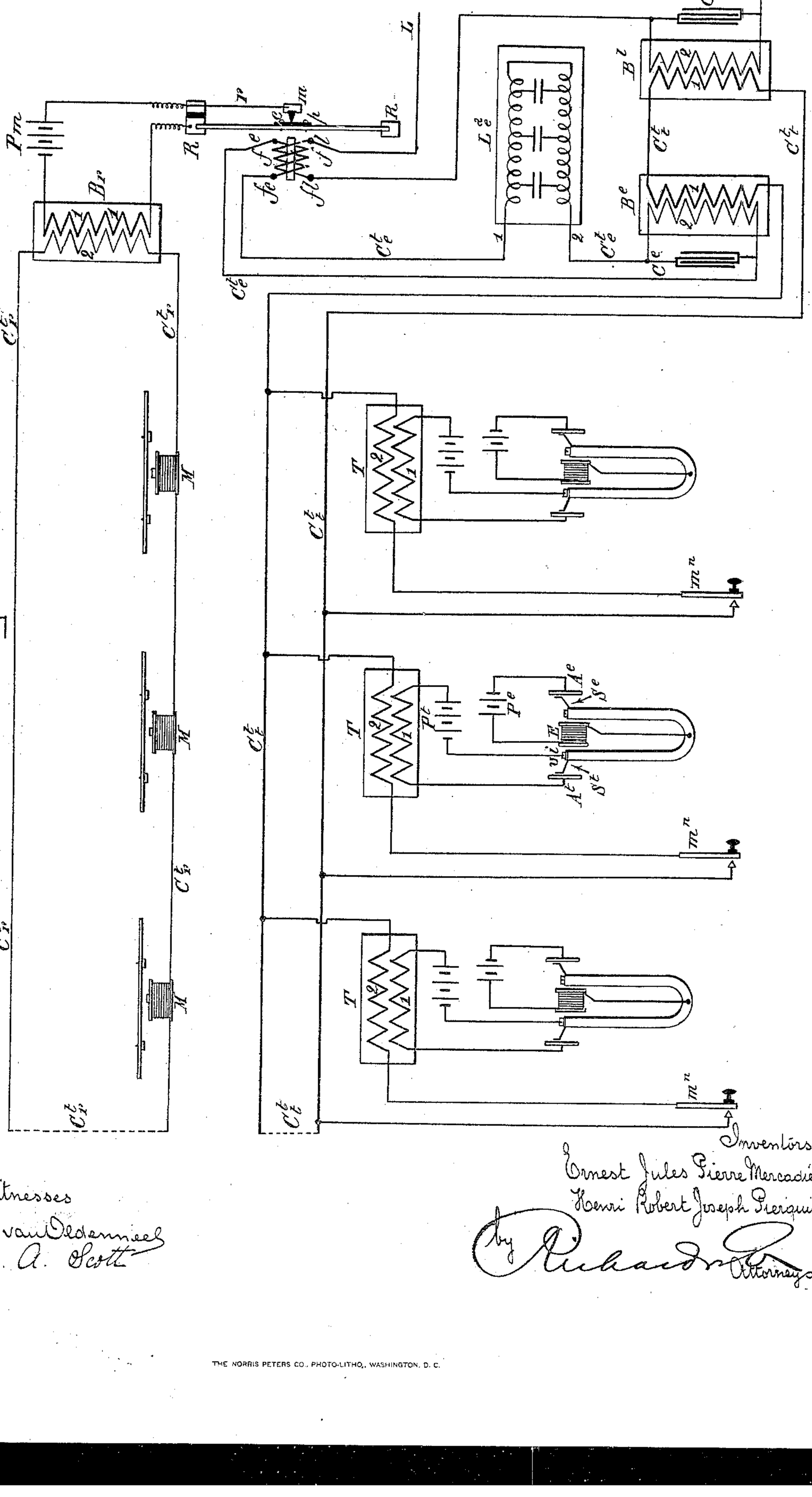

UNITED STATES PATENT OFFICE.

ERNEST JULES PIERRE MERCADIER AND HENRI ROBERT JOSEPH PIERQUIN,
OF PARIS, FRANCE.

MULTIPLE TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 622,629, dated April 4, 1899.

Application filed January 3, 1896. Serial No. 574,218. (No model.)

To all whom it may concern:

Be it known that we, ERNEST JULES PIERRE MERCADIER and HENRI ROBERT JOSEPH PIERQUIN, citizens of the French Republic, residing at Paris, France, have invented certain new and useful Improvements in Multiple Telegraphs, of which the following is a specification.

This invention relates to a combination of the following apparatus in a system of multiple telegraph by the employment of alternate or undulatory vibration currents.

Our apparatus comprises—

First, two joint induction-coils whose primary wires are in the transmitting-circuit, which contains twelve vibrating transmitters. The secondary wires of these coils are shunted by graduated condensers.

Second, a telemicrophonic translator composed of a telephone whose electromagnet bears two wires and of a carbon microphonic contact on a spring. The translator is in the same circuit with twelve monotelephonic receivers or indicators as previously patented by E. J. P. Mercadier, (United States Patent No. 447,194, of February 24, 1891,) which are adjusted with the corresponding twelve vibrating transmitters.

Third, an artificial telegraph-line so arranged that the secondary wire of the second induction-coil connects with that line and one of the wires of the electromagnet on the translator, while the secondary wire of the first induction-coil connects with the other wire of the electromagnet on the translator and with the telegraph-line which connects the two corresponding stations.

The graduated condensers and the artificial line are so regulated that the vibrating induction-currents generated in the secondary wire of the first induction-coil pass through the translator without vibrating the receivers or indicators of the station which transmits the signals. The currents travel forth on the line and set the translator and monotelephonic receivers of the station at the other end in vibration. The latter station may operate in the same manner, so that the signals sent simultaneously by the two stations cross each other on the line without confusion or neutralization. Thus a system of multiplex telegraphy is produced by which twelve telegrams can be sent and received over the same line either way and simultaneously.

We will now describe the action of the various apparatus, proceeding step by step in chronological order.

In the drawings, Figure 1 is a diagrammatic view of the system at one station. Fig. 2 is a similar view of the two stations. Fig. 3 shows one of the translators in sectional detail. Fig. 4 is a diagram showing how the vibrators are connected up in the system.

In the drawings the transmitters, Fig. 4, may be vibrators of any kind whatever. We use, preferably, tuning-forks, which are kept in motion by electromagnets E and batteries *pe* in a circuit which is completed when the steel wire S*e* touches the platinum plate A*e*. Only three vibrators are illustrated, which give the following notes: B (third octave,) C (fourth octave,) and C-sharp (fourth octave.) There are really twelve of them in musical divisions of ascending scale of one-half tone. These vibrators produce vibrating currents by the aid of batteries *pt* whenever the wires S*t*, attached to the vibrators by insulated screws *vi*, touch the platinum plates A*t*, and thus close the circuit which comprises the primary wires 1 of the induction-converters T.

When operating the keys *mn* in using the Morse alphabet, the vibrating induction-currents which are generated in the secondary wires 2 of the converters T traverse altogether the primary wires 1 of the two joint induction-coils B*e* B*l*, which take part in the transmitter-circuit C*tt*. Then new vibrating induction-currents are generated simultaneously in the secondary wires 2 2 of the coils B*e* and B*l*, which are shunted by the graduated condensers C*e* and C*l*. The vibrating induction-currents of coil B*l* pass through the wire *fl* of the electromagnet of the telemicrophonic translator R and travel forth afterward on the telegraphic circuit formed by lines L and 2 or by line L and the earth, Fig. 4; but at the same time the vibrating induction-currents of coil B*e* pass through the wire *fe* of the electromagnet of translator R and through the artificial line L*ae*, which latter form a closed circuit C*te*.

By regulating the graduated condensers C*e* and C*l* and the artificial line properly the vibrant induction-currents from the coils B*e* and B*l*, which pass simultaneously, but in opposite direction over the wires *fe* and *fl* of translator R, have at all times the same energy and run. The action of the currents is neutralized on the diaphragm *d* of the translator R. The diaphragm does not vibrate. The microphonic carbon contact *m*, attached to spring *r*, remains in position against the carbon disk *p*. No variation of current results in the circuit created by the insulated spring *r*, the contact *mp*, the diaphragm *d* of translator R, the microphonic battery *pm*, and the primary wire 1 of the induction-coil B*r* of the microphone. This precludes vibrant induction-currents in the secondary wire 2 of this coil B*r* and in circuit C*tr*, comprising the monotelephone-receivers B (third octave,) C (fourth octave,) and C-sharp (fourth octave,) Fig. 4, and nine similar ones not appearing in this figure. They are shown connectedly under R*c* in Fig. 1. Their diaphragms are arranged in a manner to give the same sounds as produced by the diaphragms of the twelve vibrators, which are in the transmitting-circuit C*tt*, Figs. 4 and 1. Thus by these means the vibrating currents transmitted by coil B*l* from one station cause no vibration in the receivers of that station, but reach by the telegraphic line L L, Fig. 1, the station A, and traverse the secondary wire 2 of coil B*l* of the latter station and the wire *fl* of its translator R without neutralization of force. The diaphragm *d* of the translator vibrates immediately, also the microphone of the translator and the receiving monotelephones R*c*, Fig. 1, so that each of them reproduces the same sounds as the vibrant transmitter with which it is tuned in accordance with the scale which the corresponding key *mn* gives, Fig. 4.

It is manifest that station B, Fig. 2, can transmit simultaneously twelve telegrams to the receivers at station A and that station A can at the same time under like conditions send twelve telegrams to station B. These two stations can therefore exchange simultaneously twenty-four telegrams—*i.e.*, twelve telegrams can travel one way and twelve the other. This precisely is the purpose indicated in the introduction of the present specification.

We can now supplement the description of the principal apparatus mentioned.

The vibrating transmitter of which we make use and which we call "electrodiapason (electric tuning-fork) has been sufficiently described before.

The induction-converters T, which are inserted into the transmission-circuit C*tt*, Fig. 4, are coils with joint primary and secondary wires of low resistance.

In the two joint induction-coils B*e* and B*l* secondary wire 2 2 is long and fine, and its resistance is four hundred to five hundred times greater than the resistance of the primary wire of the same coil.

The two graduated condensers C*e* and C*l*, which shunt the coils B*e* and B*l*, are ordinary condensers of one microfarad, which may be divided into tenths. Their capacity can be modified at will, and the self-induction of the secondary wires of the coils B*e* and B*l*, as well as of the circuits comprised, can be adjusted similarly. This is indispensable for regulation of currents.

The artificial telegraph-line L*ae* is formed by a box containing resistance-coils combined with condensers whose resistance and total capacity can be so varied that they represent the resistance and capacity of the real telegraph-line L L, on which the signals are sent.

The telemicrophonic translator R must be very sensitive, because it has to transmit electric waves coming over a line of great length and of such high capacity to the receiving apparatus. It consists, Fig. 3, of a wooden base S S′, on which it is held by an iron knee or in some other appropriate way. By means of a screw V*l* run through the wooden base the apparatus can be inclined more or less. The apparatus proper is an ordinary large telephone, on the coils *b* of which two parallel wires are rolled. On the diaphragm *d* of this telephone a disk of carbon *p* is attached. Opposite this disk *p* is another carbon contact *c*, supported by a metallic elastic lever *r*, which hangs on the highest part of the instrument. This lever consists of a flat slim spring provided at its lower part with a certain weight *m*, which renders it like an elastic pendulum, and the carbon contact *c* is attached to the weight. This pendulum is electrically insulated from the other parts of the mechanism by ebonite plates, on which the suspension-point O is located.

In order to annul the effects of external vibration on the translator, a rubber tube *t*, fixed on the wooden base S S, Fig. 3, rests on two other rubber tubes t^2 t^3, parallel to each other and fixed on a board P P′, which is placed on a solid table by means of two other rubber tubes T T*l*. (This table is not represented in Fig. 3.) The point of the screw V*l* in turning rests at the bottom of a hollow in the metallic piece C.

By means of an adjustment effected by the screw V*l* as sensitive a microphonic contact can be obtained as may be desired. The effect is powerful, because the pendulum remains almost motionless, while the diaphragm of the translator vibrates under the influence of the current.

The monotelephonic receivers are shown connectedly in the upper part of Fig. 4. They are represented by their electromagnets, under which steel disks are attached tuned B (third octave) C (fourth octave) and further on in graduation of half-tones until A-sharp (fourth octave) is reached. Each disk vibrates only when receiving currents whose number is equal to the number of vibrations

of the corresponding tones. It is useless to describe these apparatuses further. They are the monotelephones already patented by E. Mercadier. (United States Patent No. 447,194, of February 24, 1891.)

We claim as our invention—

1. In a system of multiplex telegraphy produced by the employment of alternate or undulatory vibrating currents, in combination with the vibrators or tuning-forks an equal number of induction-converters, the two joint induction-coils whose primary wires are in circuit of the secondary wires of the converters, the graduated condensers shunting the secondary wires of the coils, and the telemicrophonic translator having its wires connected with said secondary wires of the joint induction-coils as specified above.

2. In combination with the vibrators or tuning-forks, an equal number of induction-converters controlled by said vibrators, the two joint induction-coils whose primary wires are in circuit with secondary coils of the converters, the graduated condensers forming shunts for the secondaries of said joint coils, a telemicrophonic translator, an artificial line in the circuit of the secondary wire of one of the joint induction-coils and of which circuit one of the coils of the translator forms a part, substantially as described.

3. In combination with the two induction-coils, the graduated condensers arranged as shunts to the said induction-coils, a telemicrophonic translator, an artificial line in the circuit of one of said coils which also includes the telemicrophonic translator, and the monotelephonic receivers in the microphonic circuit of the translator, the receivers and transmitters being equal in number, substantially as described.

In testimony whereof we have signed this specification in the presence of two subscribing witnesses.

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HENRI ROBERT JOSEPH PIERQUIN.

Witnesses:
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JULES FAYOLLET.