(No Model.)

R. M. HUNTER.

ELECTRICAL TRANSMISSION OF POWER.

No. 514,228. Patented Feb. 6, 1894.

FIG. 1

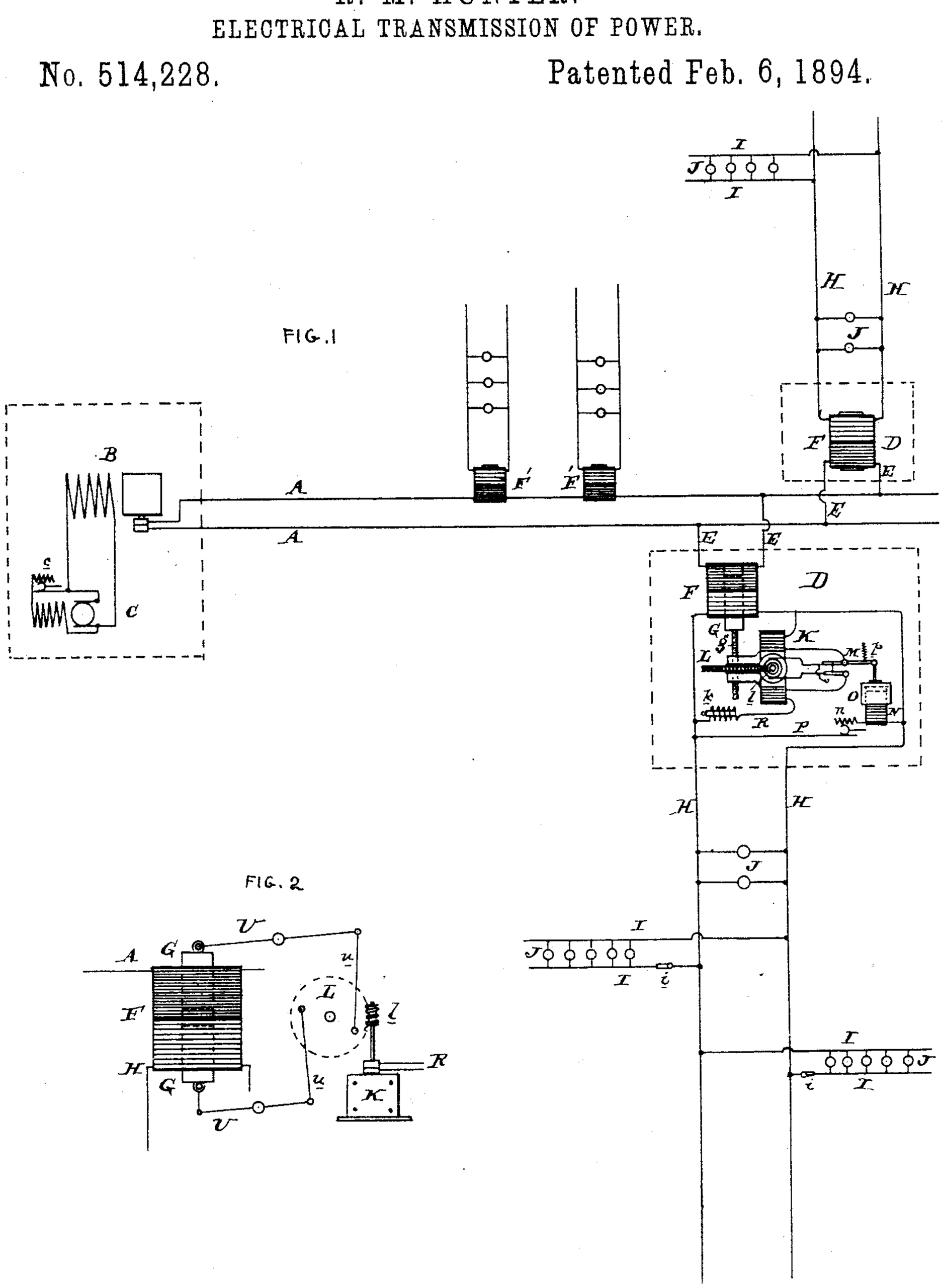

FIG. 2

Attest

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ELECTRICAL TRANSMISSION OF POWER.

SPECIFICATION forming part of Letters Patent No. 514,228, dated February 6, 1894.

Application filed November 18, 1889. Serial No. 330,729. (No model.)

To all whom it may concern:

Be it known that I, RUDOLPH M. HUNTER, of the city and county of Philadelphia and State of Pennsylvania, have invented an Improvement in Electrical Transmission of Power, of which the following is a specification.

My invention has reference to improvements for the electrical transmission of power, and consists of certain improvements which are fully set forth in the following specification and shown in the accompanying drawings which form a part thereof.

In my applications, Serial No. 241,729, of June 18, 1887, Serial No. 254,672, of November 9, 1887, and Serial No. 328,877, of October 31, 1889, are described systems for the distribution of electricity by the employment of induction coils which are adapted to convert the high tension line currents into low tension currents for energizing the translating devices. My present application, Case No. 122, relates to the same general art but comprehends certain improvements in the means for regulating the induced currents produced.

In carrying out my invention I provide a generator of any suitable construction for producing currents of alternately increasing and decreasing potential, or alternating currents of high electro motive force, and convert such currents by the employment of transformers or induction coils into currents of substantially the same periods but of lower potential for local distribution. The fine wire coils of the local distributing transformers may be in series or parallel with the line circuit and the coarse wire of the said transformers arranged to feed separate local circuits. The local transformers may be in separate central stations for different districts and supply current to distributing mains and local house circuits as set out in my application of 1889 above specified, or each of the transformers or induction coils may be in separate houses for local distribution without the employment of any central station except that where the current is generated. The transformers have movable cores which may be inserted or removed with respect to the coils so as to increase or decrease the magnetic capacity of the transformer, and preferably the regulation is performed automatically by causing the current in the local circuit to control through suitable devices the movement of said magnetic core of the transformer. Or if desired, the core may remain stationary and the same general mechanism as hereinafter described may be employed to cut into or out of circuit any desired amount of the wire of the transformer, either of the primary or secondary coil. By this means any variation in the demand in the local circuit or distributing mains will automatically cause a regulation in the production of the induced current by the transformer. When the apparatus is regulated in this way the resistance to the line current in the primary of the transformer may be reduced and a saving result from the reduction in current in the line necessary to overcome the resistance of the line and transformer coils.

I do not confine myself to any particular arrangement of local or line circuits nor to any particular detail of construction or type of transformer, the generator of the primary current of alternately increasing or decreasing potential. It is not essential that the currents in the line circuit shall take the negative sign because they may be produced as set out in my application Serial No. 85,897, filed February 23, 1883, or as set out in Letters Patent No. 389,974, dated September 25, 1888, in which they are of the same sign but of alternately increasing and decreasing potential. Likewise interrupted line currents may be used if desired as set out in my application of June, 1887, hereinbefore specified.

In the drawings:—Figure 1 is a diagrammatic plan view showing the relative arrangement of the electric circuits and their connections, and Fig. 2 is a plan view of a modified arrangement of the regulating apparatus of the transformer.

A are the line wires or circuits and receive current from the generator B, preferably an alternating current dynamo, and the current generated is regulated by the exciting dynamo C and regulator *c*.

E are branch circuits leading from different parts of the wires A and include the primary or fine wire coils of the induction coil or transformers F. The coarse wire of these

transformers connect with distributing mains H and thence with local circuits I including translating devices J of any suitable construction. If desired these transformers may deliver directly into the local circuits. The transformers are provided with movable cores extending within the coils, which cores may be made in single or double parts, and are movable within the coils so as to increase or decrease the magnetic capacity of the transformer.

In Fig. 1 the core G is connected with a screw threaded rod or shaft *g* which is moved by a worm wheel L acting as a stationary nut, which worm wheel is rotated by a worm *l* on the shaft of the electric motor K which is in a shunt circuit across the mains H. This motor may have a hand regulator *k* and also a reversing switch M which is operated by an enveloping core O and helix N, which helix is in a shunt circuit P across the mains H, and is provided with a regulator *n*. It will now be understood that if the demand on the transformer was decreased the current in the motor circuit E would be increased thereby starting the motor that it may withdraw the core to reduce the current in the local circuits. When this is accomplished, and the current is in accordance with the demand, the reversing switch opens the motor circuit. If now there is an increased demand on the local circuits, the spring *p* overcomes the attraction of the core O and the switch M is reversed causing the core G to be moved into the coils of the transformer F.

The motor K and the switch actuating devices for controlling the direction of its rotation are preferably in shunt relation with the local circuits L. The operation of the device O N is dependent upon the fact that when strong currents of alternating polarity are sent through the helix N there is a tendency to throw off the ring core O causing it to be moved upward away from the helix. This tendency is availed of to make the switch shift when the current in the mains H H becomes in excess of the demand in the local circuits and translating devices. The mains H would ordinarily extend through the streets, and the local circuits I having translating devices J would extend into the houses. J may represent lamps, or motors or any other suitable translating device. The local circuits I may be provided with switches *i* so that any local circuit may be cut out without interrupting those remaining and each translating device may have its own switch as is customary.

In my improved system it is evident that the cores of the induction coils in the distributing stations might be operated by hand in place of an electric motor K, indications to the operator in charge being given by any suitable meter arranged in or across the mains H.

In Fig. 1 D D represent several local distributing stations having the induction apparatus or transformers located at them for supplying the current to the separate districts, and all of said districts may be operated indirectly from the distant generating plant B, at a central station common to all of the various distributing stations. The induction coils or transformers while preferably in multiple by the branch circuits E, may have their fine wire coils in series in the line A as shown at F′ in Fig. 1. While I have shown the automatic regulating apparatus upon one transformer or induction coil only, it is to be understood that similar regulating apparatus would be employed with all of the transformers for each distributing station D.

In place of the regulator shown in Fig. 1 it may be modified as shown in Fig. 2 in which two cores G are employed, one for the fine wire coil and one for the coarse wire coil and made movable to or from each other so as to be capable of being inserted into or withdrawn from both coils simultaneously and to equal degrees. To do this I connect the cores of soft iron G with levers U having links *u* hinged to the worm wheel L actuated by the electric motor as in the case of Fig. 1. By rotating the motor in either direction the cores are moved into or out of the coils and vary the magnetic capacity of the transformers. This method of regulation is excellently adapted for municipal distribution as the induction generating apparatus at the local distributing stations are large and material variations in their duty are not likely to be sudden.

I do not confine myself to the minor details of construction in the regulating devices as they may be modified in many ways without departing from the spirit of my invention.

The apparatus for and method of transmitting alternating currents or currents of varying potential and converting them into currents of lower potential by converters either in series or parallel at a distance from the generating station is not broadly claimed in this application as the same forms subject matter of my application hereinbefore referred to and my applications Serial No. 85,897 filed, February 23, 1883, Serial No. 325,958, filed October 4, 1889, and Serial No. 327,632, filed October 21, 1889.

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

1. The combination in an apparatus for the electrical transmission of energy of a generator for currents of alternately increasing and decreasing potential, line circuits conveying said currents to a distance, a secondary induction coil or transformer having its fine wire coil in circuit with the line, and its coarse wire coil in a local distributing circuit, a movable soft iron core for said induction coil or transformer, and means to insert or remove said core with respect to the coil.

2. In an apparatus for transmission of elec-

trical energy, the combination of a generator for supplying current of alternately increasing and decreasing potential, line circuits leading from said generator, induction coils or transformers having their fine wire coils in connection with the line circuits in parallel and their coarse wire coils in connection with a distributing circuit, local circuits containing translating devices connected to the distributing circuit, and electro magnetic devices for varying the magnetic capacity of the induction coils or transformers.

3. The combination of two separate districts provided with electric circuits for distributing current; a distributing station for each of said districts; an induction coil or transformer in each of said stations and having its coarse wire coil in circuit with the distributing circuits; circuits including the fine wire coils in electrical connection with a source of electric energy of current of alternately increasing and decreasing potential and automatic devices for varying the magnetic capacity of the said induction coils or transformers.

4. The combination of two separate districts provided with electric circuits for distributing current; a distributing station for each of said districts; an induction coil or transformer in each of said stations having its coarse wire coil in circuit with the distributing circuits; circuits including the fine wire coils in parallel with each other and in electrical connection with a source of electric energy of current of alternately increasing and decreasing potential, and automatic devices for varying the magnetic capacity of the said induction coils or transformers.

5. The combination of a source of electric energy of alternately increasing and decreasing potential; an induction coil or transformer having its fine wire coils in circuit with said source of electrical energy and having a core made of one or more movable parts formed of magnetic material; a local or distributing circuit in connection with the coarse wire coil of the induction coil; and mechanical power devices for moving the core or parts thereof within or without the coils for varying the magnetic capacity of the transformer, and means to control the mechanical power devices governed by the current flowing in the distributing circuit.

6. The method for the transmission of electrical energy which consists in generating high tension currents of alternately increasing and decreasing potential and supplying same to a line circuit, subdividing and converting said high tension currents into low tension currents by induction, energizing separate translating or current consuming devices by said low tension induced currents, and varying the magnetic capacity of induction to regulate the generation of the induced low tension currents in accordance with the demand.

7. The method for the transmission of electrical energy which consists in generating high tension currents of alternately increasing and decreasing potential and supplying same to a line circuit, subdividing and converting said high tension currents into low tension currents by induction, energizing translating or current consuming devices by said low tension induced currents, and automatically varying the magnetic capacity of induction to regulate the generation of the low tension currents and maintain a substantially constant current flowing through the translating devices notwithstanding variations in the resistance due to varying the number of translating devices in circuit.

8. The method of transmitting electrical energy which consists of supplying to a line circuit currents of high tension and alternately increasing and decreasing potential, converting said currents into currents of low potential by induction, supplying such induced currents to translating devices, and automatically regulating the induced current generated by varying the magnetic capacity of induction whereby the generation of current in volume is self regulated in accordance with the demand.

In testimony of which invention I have hereunto set my hand.

RUDOLPH M. HUNTER.

Witnesses:
ERNEST HOWARD HUNTER,
S. T. YERKES.