

No. 709,437.

Patented Sept. 16, 1902.

J. M. FELL.

APPARATUS FOR COMPOSITE SYSTEMS OF SIMULTANEOUS TELEGRAPHY AND TELEPHONY.

(Application filed Jan. 8, 1902.)

2 Sheets—Sheet 1.

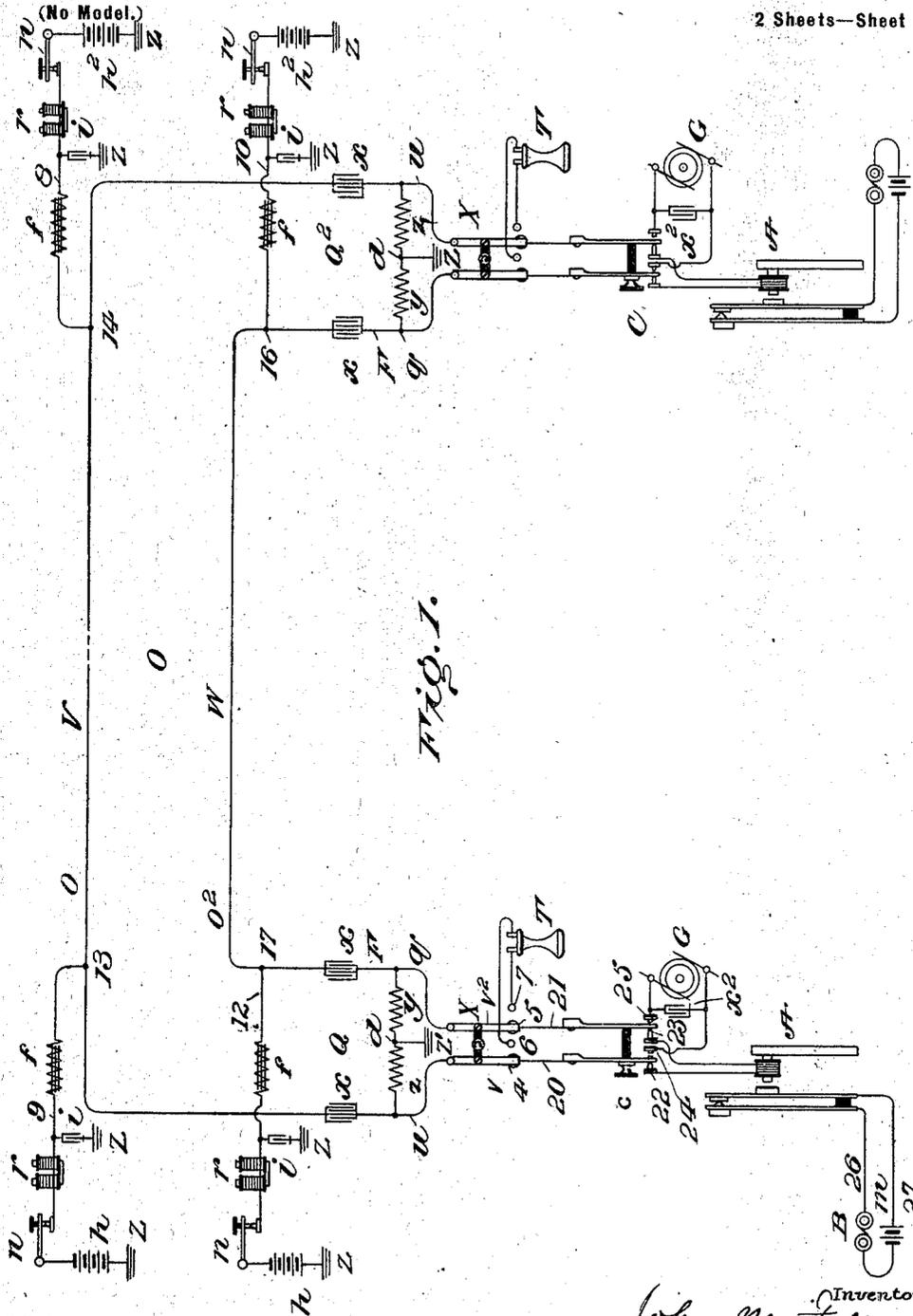


FIG. 1.

Witnesses

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2 Sheets—Sheet 2.

Fig. 2

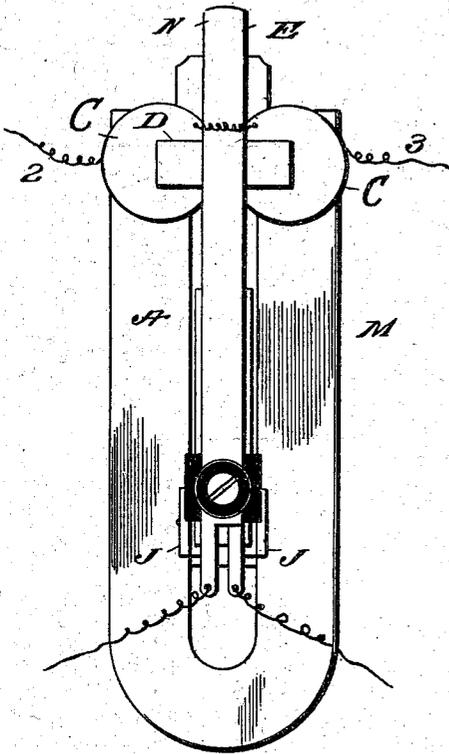
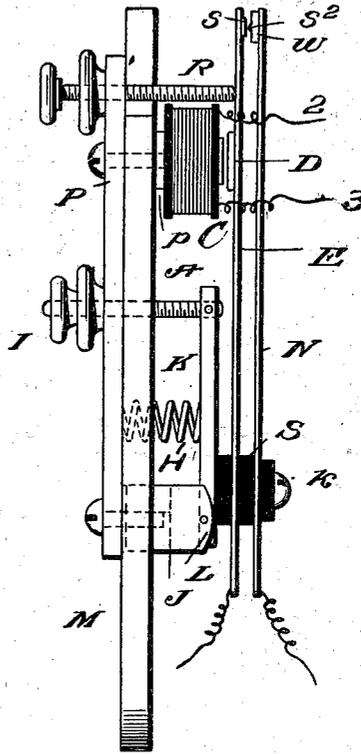


Fig. 3



Witnesses

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# UNITED STATES PATENT OFFICE.

JOHN M. FELL, OF ARLINGTON, NEW JERSEY, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

APPARATUS FOR COMPOSITE SYSTEMS OF SIMULTANEOUS TELEGRAPHY AND TELEPHONY.

SPECIFICATION forming part of Letters Patent No. 709,437, dated September 16, 1902.

Original application filed September 16, 1901, Serial No. 75,491. Divided and this application filed January 8, 1902. Serial No. 88,883. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN M. FELL, a resident of Arlington, New Jersey, have invented a new and useful Improvement in Apparatus for Composite Systems of Simultaneous Telegraphy and Telephony, which invention is fully set forth in the following specification.

In my pending application filed September 16, 1901, Serial No. 75,491, of which this is a division, I have described and claimed an improved vibratory current-relay particularly adapted for use in connection with systems for the simultaneous transmission of telegraphic and telephonic signals over the same circuit-conductors.

The invention forming the subject-matter of this application consists of a composite system of telephonic and telegraphic circuits and appropriate apparatus, including such a relay, whereby I obtain increased operative efficiency of the telephone-circuit without impairing that of the telegraphic circuits.

In the drawings which illustrate this specification, Figure 1 is a diagram illustrating a system of composite telegraphy and telephony embodying my invention. Fig. 2 is a plan view of a relay suitable for use in my improved system, and Fig. 3 is a side elevation of the relay.

Referring to Fig. 1, V and W represent the two main conductors of a metallic telephone-circuit O, extending between two stations Q and Q<sup>2</sup>, and severally constitute the main conductors of two independent ground-return telegraphic circuits *oo*<sup>2</sup> in a manner well understood to those skilled in the art. The said two telegraphic circuits are both provided at each end with grounded instrument branches or extension-conductors 8 9 and 10 12, respectively, each containing a source of current *h*, a sending-key *n*, a receiving instrument *r*, and an electromagnetic resistance or impedance-coil *f*. The said impedance-coils act to smooth the telegraphic currents, so that they will not be liable to disturb the telephonic part of the system, and they also tend to prevent the telephonic currents from being short-circuited to earth at Z through the neighboring telegraphic branches. As-

sociated with each telegraphic extension there is also a branch to earth through a condenser *z*, the latter serving to protect the telephone-receivers from disturbance due to self-inductive discharge from the relays *r* and generally to aid the condensers *x* in graduating the telegraphic signal-currents and in dissipating the static charge of the line. The several earth connections of the system are all indicated by the same reference-letter Z. The telephone-loops F at the stations Q Q<sup>2</sup>, respectively, are joined to the main conductors at the points 13 17 and 14 16 outside of the impedance-coils *f*, so that the said impedance-coils shall be always interposed between the telegraphic and telephonic instruments. Condensers *x* are placed at both ends of each line conductor between said conductor and the corresponding conductor of the telephone loop, and a bridge *d*, containing resistance-coils *y* and *z*, with a ground connection between them, unites the two loop-conductors *u* and *q* between the said condensers and the telephone instruments. The condensers *xx* serve to exclude the telegraphic currents from the telephonic loops F in a well-known manner. Each terminal telephone-loop may be completed through the call-signal-receiving relay A, the call-signal-transmitting appliances G, or the speaking-telephone apparatus T alternatively, and a switch X and key *c* control these connections. The switch X is a two-bar switch and has two positions. When the line is at rest, the two switch-bars *v v*<sup>2</sup> are in connection with the contact-buttons 4 and 5, respectively, and the telephone-circuit continues by conductors 20 and 21 to the signaling-key *c* and associated apparatus; but by turning the said switch to its second position, where its bars are brought into connection with the contact-buttons 6 and 7, the key and signal apparatus are disconnected from the loop, which is then switched to a connection with the telephone apparatus T. The signaling-key *c* establishes normal connection through its back or resting contact-stops 22 and 23 with the relay A, controlling the local circuit *m*, and the signal-receiving instrument B, included there-

in, but when depressed acts to cut off the said relay and to connect the loop-conductors with the terminals of the alternating-current generator G, which terminals are brought to the front contact-stops 24 and 25 of the said key. A condenser  $x^2$  is preferably bridged between the conductors of the generator G to aid in graduating or rounding off the call-current.

10 Referring to Figs. 2 and 3, illustrating a vibratory current-relay suitable for use in the composite system above described, which relay in this instance is the same as that which forms the subject of my pending application above referred to, M is a U-shaped permanent magnet having polar projections  $p$ , fitted with electromagnetic coils or helices C, which by their terminal wires 2 3 may be connected in an electric circuit. D is the armature attached to the vibratory spring or spring-bar E and held thereby in front of the pole-pieces, the said spring being at one end secured to the supporting-block S. The spring E, as shown, extends a short distance beyond the attachment of the armature and at a point substantially midway between its end and the center of said armature rests against the end of the stop-pin R, which is adjustably carried by the magnet or by a base-plate P, secured thereto. The armature D is normally under the attractive influence of the magnet pole-pieces P, but is prevented from coming into contact with them by the said stop R. The supporting-block S may consist of plates of non-conducting material held together by a screw  $k$ . It is advantageous to make the said supporting-block adjustable, and for this purpose it is mounted upon the link-piece K, which is pivoted at L in the pedestal J, and at the other end is provided with the adjusting-screw I, a compression-spring H being arranged to press against the inferior surface of said link-piece. The said pedestal and compression-spring may both be attached to the base-plate P, while the adjusting-screw I may pass through a hole in the said plate. By means of the adjusting-screw I and by reason of the pressure of the spring H the link-piece K, and with it the block S, may be slightly turned on the pivot L, thus varying the tension of the armature-spring E with respect to the pull of the permanent magnet M, or, as it may be stated, thus adjusting the force of the spring against the force of the magnet, so as to make the armature D more or less sensitive to variations in the pull of the magnet arising from the action of electrical currents flowing through the electromagnetic coils C. A comparatively light spring-bar N also has one end attached to the supporting-block S. It extends parallel to the armature-spring E to the end thereof, and its inertia is increased by providing it with a weight  $w$  at its outer end. The springs E and N carry the local-circuit-relay points  $s$  and  $s^2$ , respectively, on their proximate surfaces, and these points, constituting the sep-

arable terminals of the local circuit which is to be controlled by the relay, are normally held by the pressure of the lighter spring in contact with each other. When alternating currents of appropriate frequency traverse the electromagnetic coils C, they produce variations of the magnetic field which act upon the armature D, throwing it and the spring E, to which it is attached, into vibration. By reason of the stop R the spring-bar E vibrates with a node at the point where the said stop impinges upon the said spring, the vibrations of that part of the spring which is beyond the stop R toward the outer end being the reverse of those between R and the supporting-block S. Good results have been obtained by placing the stop R about half an inch from the center line of the coils C, with a spring extending about the same distance beyond the said stop, the contact-point  $s$  being placed quite near to the end of said spring, as shown. The fundamental periodicity of vibration of the spring N is very much lower than that of the spring E, partly because it is lighter than the said spring E and partly because such weight as it has is unequally distributed, being massed at  $w$ . Thus the two springs are of diverse inertia, and when, therefore, the armature and the spring E, to which it is attached, are vibrated by the changes in the field of the magnet M and the relay-point  $s$  pulled away from the point  $s^2$  the lighter spring N cannot promptly follow the vibrations of the said armature-spring, so that the contact between the said points is broken or becomes so delicate that its resistance is greatly raised, with the consequence that the local circuit normally closed through said points is opened or substantially opened, causing the operation of any suitable signal device included in such local circuit.

In the system shown in Fig. 1 and above described though my call-relay is in normal connection with the working circuit and though the induced currents or electrostatic discharges which are due to the operation of the telegraphic circuits pass through its electromagnetic coils the said relay is not operated or disturbed by them, since they are comparatively slow and infrequent, and therefore cannot move the armature D so fast as to cause the separation of the relay-points  $s$   $s^2$ . Alternating currents having a frequency of approximately three hundred periods per second and a potential of twenty volts have been found suitable for the operation of the relay A, and I employ in association with said relay a generator G, constructed to develop such currents. The said frequency is sufficiently high to be without apparent effect upon the instruments of the telegraphic circuits and can be transmitted to considerable distances without being seriously attenuated by the conditions of the line, while at suitable potentials for signaling an alternating current of this or similar frequency has no

objectionable inductive effect on neighboring parallel circuits.

Having thus described the invention, I claim—

- 5 1. In a system of composite and simultaneous telegraphy and telephony, the combination of a metallic or double-conductor telephone-circuit; two independent earth-return telegraphic circuits having for their line conductors the two main conductors respectively  
10 of the said metallic circuit; and impedance devices or electromagnetic resistances interposed between the instruments of the said telephone-circuit, and the two telegraphic circuits respectively; with call-signal apparatus  
15 connected with the telephonic circuit comprising a generating and transmitting device at one telephone-station adapted to develop and transmit alternating call-currents of such  
20 potential and frequency as to be obstructed by the said impedance devices; and a signal-receiving relay at another telephone-station responsive only to said alternating call-currents of appropriate frequency.
- 25 2. In a system of composite and simultaneous telegraphy and telephony, the combina-

tion of a metallic or double-conductor telephone-circuit; two independent earth-return telegraphic circuits having for their line conductors the two main conductors respectively  
30 of the said metallic circuit; and impedance devices or electromagnetic resistances interposed between the instruments of the said telephone-circuit, and the two telegraphic circuits respectively; with call-signal apparatus  
35 connected with the said telephonic circuit at the stations thereof, and comprising a generating and transmitting device at each telephone-station adapted to develop and transmit  
40 alternating call-currents of such potential and frequency as to be obstructed by the said impedance devices; and a signal-receiving relay at each station responsive only to said alternating call-currents of appropriate frequency, substantially as set forth. 45

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

JOHN M. FELL.

Witnesses:

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