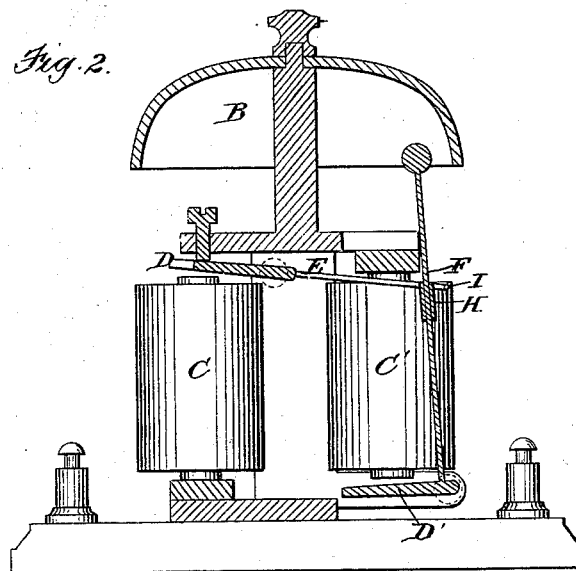
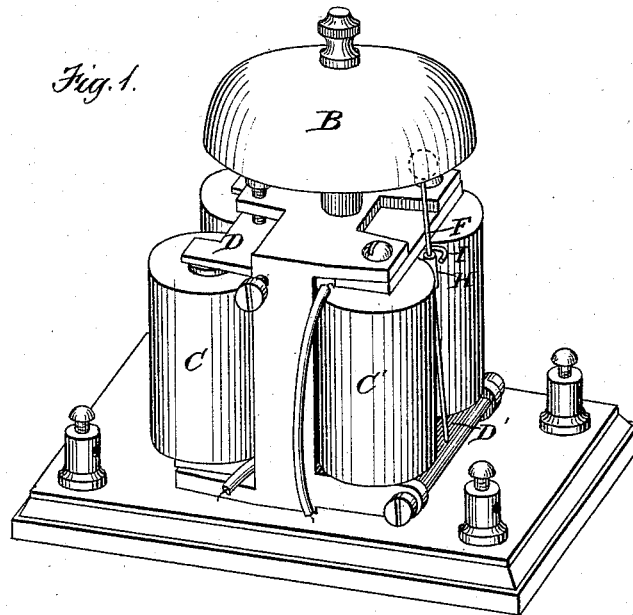


T. N. VAIL.  
Circuit and Signaling Apparatus for District Telegraph  
and Telephone Systems.

No. 219,188.

Patented Sept. 2, 1879.



*Witnesses.*

*Geo. W. Pierce,*  
*Robert Johnson*

*Inventor.*

*Theodore N. Vail*  
*by Alex. L. Hayes*  
*Atty.*

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Fig. 3.

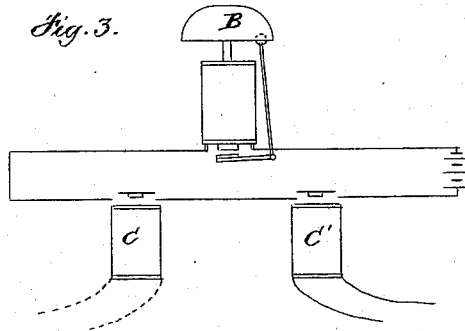


Fig. 4.

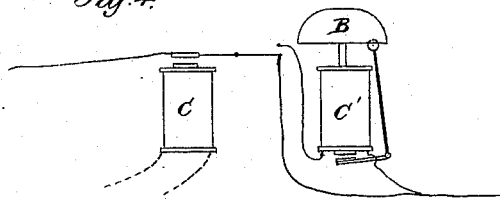
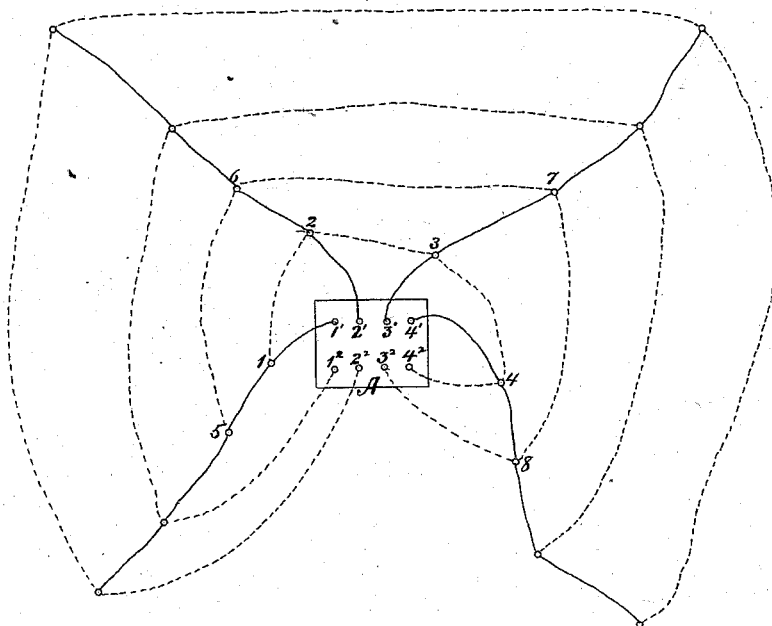


Fig. 5.



Witnesses.

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# UNITED STATES PATENT OFFICE

THEODORE N. VAIL, OF BOSTON, MASSACHUSETTS.

## IMPROVEMENT IN CIRCUITS AND SIGNALING APPARATUS FOR DISTRICT TELEGRAPH AND TELEPHONE SYSTEMS.

Specification forming part of Letters Patent No. **219,188**, dated September 2, 1879; application filed July 19, 1879.

### *To all whom it may concern:*

Be it known that I, THEODORE N. VAIL, of Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Improvement in Circuits and Signaling Apparatus for District-Telegraph and District-Telephone Systems, of which the following is a specification, reference being had to the accompanying drawings.

The object of this invention is to enable any station in a district-telegraph or district-telephone system to be signaled from the central office without causing the operation of the signal apparatus at any other station in the system; and to this end the invention consists in connecting the several stations to the central office by two independent series of circuits, one series of circuits being arranged so as to connect the several stations radially from the central office, and the other series of circuits being arranged in concentric circles having the central office as a common center and intersecting the radial circuits at the several stations in such a manner that no two circuits shall be common to two stations, and in the use of a device at each station for causing a signal or call from the central office to be produced at the station, which device cannot operate to cause the production of a signal or call unless the two independent radial and circular circuits, which intersect at the station, are simultaneously worked.

In the accompanying drawings, Figure 1 is a perspective view of a signal-instrument constructed, as before stated, for use with two circuits. Fig. 2 is a sectional view of the same. Fig. 3 is a diagram showing the manner of constructing a signal-instrument to be operated by two circuits in another way. Fig. 4 is a diagram of another form of signal apparatus operated by two circuits, and Fig. 5 is a diagram showing the manner of connecting several stations to a central office by means of radial and circular circuits.

This system may be applied to any number of stations; but, in order to avoid complexity in the diagram, I have shown the system as applied to sixteen stations only.

In this diagram, A is the central office, and 1<sup>1</sup> 2<sup>1</sup> 3<sup>1</sup> 4<sup>1</sup> are four circuits radiating from this

central office, and each circuit passing through four different stations in the system, and 1<sup>2</sup> 2<sup>2</sup> 3<sup>2</sup> 4<sup>2</sup> are four other independent circuits, each of which encircles the central office, and also connects four different stations to the same. The radial circuits are shown in full and the circular circuits in dotted lines.

It will be seen that each station is connected to the central office by two different and independent circuits, and that no two circuits are common to two stations, station 1 being connected to the central office by circuits 1<sup>1</sup> and 4<sup>2</sup>, station 2 by circuits 2<sup>1</sup> and 4<sup>2</sup>, station 3 by circuits 3<sup>1</sup> and 4<sup>2</sup>, station 4 by circuits 4<sup>1</sup> and 4<sup>2</sup>, station 5 by circuits 1<sup>1</sup> and 3<sup>2</sup>, and so on; and consequently, if the signaling apparatus for receiving calls or signals from the central office at each station is controlled by a device which cannot be operated from the central office unless the two circuits which intersect at the station are simultaneously worked, any station can be signaled without calling any other station in the system, upon the same principle that the exact location of a place upon the earth's surface is determined by the use of parallels of latitude and meridians of longitude.

The telephones may be placed in either the circular or radial circuits, and be connected in the same in any desired manner, and any desired manner of operating the signal-bells or annunciators at the central office may be adopted.

An open-circuit system is used with the signal apparatus represented in the drawings; but, if it is desirable, the closed-circuit system may be used, as it is obvious that the signal apparatus can readily be adapted to this closed-circuit system, or be adapted to be operated by variations in the strength of the currents or changes in their direction without departing from the principle of my invention, and that said signaling apparatus may be constructed in many different forms.

A convenient form of signal apparatus is one in which a bell-hammer operated by a magnet in one circuit is prevented from striking the signal-bell so as to give a signal except when a catch has been released by a magnet in the other circuit.

In the accompanying drawings, Figs. 1 and 2 represent a signal-bell constructed according to this principle.

B is the signal-bell, and C C' are two electro-magnets, one magnet, C, being placed in one circuit—say the radial circuit—and the other magnet, C', being placed in the other circuit—say the circular. These magnets are placed side by side upon a suitable support, but have their armatures D D' upon opposite ends. Each of these armatures is pivoted to the support, and is provided with a suitable retracting-spring, so that the armature vibrates when the circuit through the magnet is closed and broken.

The hammer-lever F of the signal-bell is attached to the armature D' of the magnet C', and a lever, E, at right angles to the hammer-lever, and provided at its extremity with a hook, I, which extends beyond the hammer-lever and encircles it, is attached to the vibrating armature D of the other magnet, C.

Upon the hammer-lever is a projection, H, which, when the armature D is away from the poles of the magnet C, strikes against the hook I, when the bell-hammer is made to vibrate by the action of the magnet C', and prevents the hammer from striking the bell; but when the armature D is attracted by its magnet C the hook I is lifted out of the way of the projection H, so that the hammer will be able to strike the bell and give a signal when the hammer-lever is operated by the magnet C'.

It will thus be seen that with this apparatus a signal cannot be given unless both of the circuits are simultaneously closed.

Instead of operating the signal-bell directly by the current from the central office, it can be operated by an electro-magnet placed in a local circuit, which is opened or closed in any desirable manner when the two circuits which intersect at the station are simultaneously worked. A convenient manner of accomplishing this result is shown in Fig. 3.

It will be seen from that diagram that the circuit from the local battery through the magnet of the signal-bell will not be completed unless the armatures of both the magnet C and C' are simultaneously attracted.

Another method of operating the signal-bell by the simultaneous action of two magnets is shown in Fig. 4. In this arrangement the signal-bell magnet C' is cut out of its circuit unless the circuit is closed through the magnet C.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a district-telegraph or district-telephone system, two series of independent circuits from the central office, one series being arranged radially from the central office, and

the other series being arranged in concentric circles having the central office as a center and intersecting the radial circuits at the several stations in the system, so that every station is connected to the central office by two different circuits, and no two circuits are common to two stations, substantially as and for the purpose set forth.

2. In a district-telegraph or district-telephone system, a device operated from the central office for causing the production at each station of a signal from the central office, which device will become operative to produce a signal only when two independent circuits passing through said device are simultaneously worked, substantially as and for the purpose set forth.

3. The combination, substantially as and for the purpose set forth, in a district-telegraph or district-telephone system, of two series of independent circuits from the central station, one series being arranged radially from the central office, and the other series being arranged in concentric circles having the central office as a center and intersecting the radial circuits at the several stations, and a device at each station operated from the central office for causing the production at each station of a signal from the central office, which device will become operative to cause the production of a signal only when the radial and the circular circuit, which intersect at the station, are simultaneously worked.

4. A device operated from the central office for causing the production at each station of a signal from the central office, consisting of two electro-magnets operated in independent circuits, one magnet acting to move a lever, which, when moved to its full extent, causes the production of a signal, and the other magnet operating a stop, which prevents the said lever from moving to its full extent, but which stop can be released by said magnet, so as to permit said lever to move so as to cause the production of a signal, substantially as and for the purpose set forth.

5. The combination of the signal-bell B, the magnets C C' in independent circuits, the vibrating armatures D D', the hammer-lever F, provided with a projection, H, and the lever E, provided with a hook, I, substantially as and for the purpose set forth.

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

THEODORE N. VAIL.

Witnesses:

ALEX. L. HAYES,  
J. W. G. BUCKLEY.