

1,424,805.

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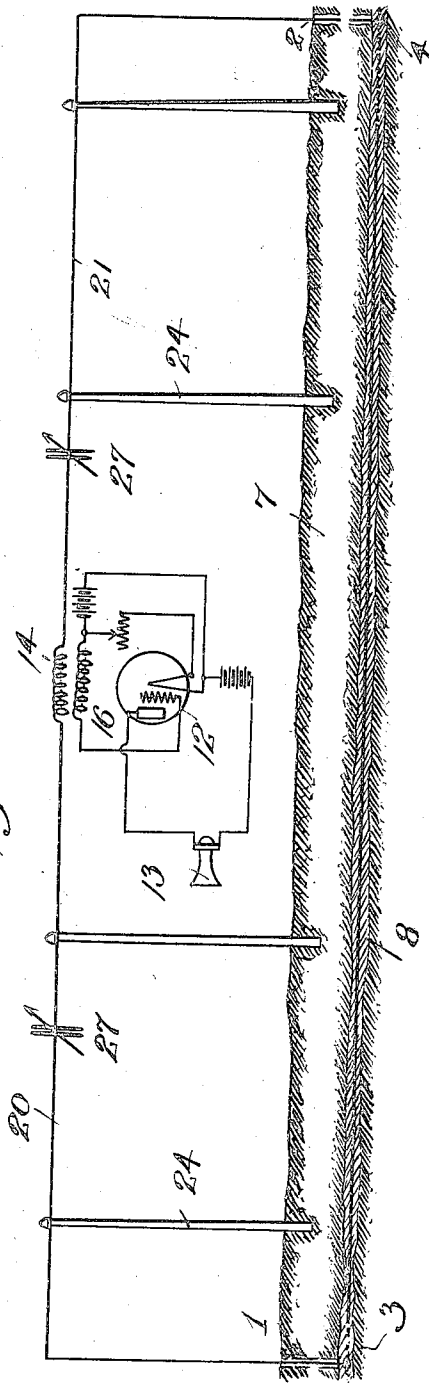


Fig. 2.

Inventor  
See de Forest  
By his atty Samuel J. Darby

# UNITED STATES PATENT OFFICE.

LEE DE FOREST, OF NEW YORK, N. Y.

## SUBTERRANEAN SIGNALING SYSTEM.

1,424,805.

Specification of Letters Patent.

Patented Aug. 8, 1922.

Application filed June 16, 1917. Serial No. 175,119.

*To all whom it may concern:*

Be it known that I, LEE DE FOREST, a citizen of the United States, residing at New York, in the county and State of New York, have made a certain new and useful Invention in Subterranean Signaling Systems, of which the following is a specification.

This invention relates to signaling systems and more particularly to electrical subterranean signaling systems.

The object of the invention is to provide an electrical subterranean signaling system which is simple in arrangement and efficient in operation.

Further objects of the invention will appear more fully hereinafter.

The invention consists substantially in the construction, combination, location and relative arrangement of parts, and the system employed, all as will be more fully hereinafter set forth, as shown by the accompanying drawing and finally pointed out in the appended claims.

Referring to the drawing:

Fig. 1 is a diagrammatic view of the subterranean transmission system embodying my invention.

Fig 2 is a similar view of a receiving system embodying my invention. The same part is designated by the same reference numeral wherever it occurs throughout the several views.

Referring to the drawing:

I designate at 7 the upper stratum of the earth's surface and at 8 a lower stratum of different conductivity from the surface stratum, and a considerable distance below the surface of the earth. At 1 and 2 I show borings from the surface down to the stratum 8 through which the lines 20, 21 extend, which lines are provided at their ends with metallic plates or bodies 3 and 4 respectively which are lowered through the wells 1 and 2 and make contact with the conducting layer 8. The lines 20 and 21 extend up through wells 1 and 2 and are in the form of insulated wire or cable.

Earth plates 3 and 4 are separated by a considerable distance which may be several miles, or even several hundreds of miles, and are connected to each other through the overhead lines or group of wires 20, 21, separated by suitable insulated poles 24.

Fig. 1 represents the transmitting station, as above outlined and in the form shown is a telegraph transmitting station wherein any suitable source of current may be employed, such for example, as the alternating current dynamo 9. This generates alternating current preferably of sustained waves and of frequency low as compared with those now used in radio telegraphy, that is, from 500 to 25,000 per second. The current thus generated may be controlled in any desired manner, for example, by the Morse key 10, located in the field circuit 11, of the dynamo.

While I have shown the system as a telegraph system it is obvious that with but slight modification the system may be employed for telephone signals, and many of the improved apparatus well known in the art for use in connection with either of the telegraph or telephone systems, might be readily employed without departing from the scope of my invention as defined in the claims.

The earthed circuit is preferably attuned to the generator frequency by suitable means for example, the variable inductances 22, 23. I have discovered that for the frequencies above described the earth offers comparatively little impedance so that relatively large amounts of energy are radiated or sent out in the form of conduction currents so that great distances can be covered by this means of signaling, comparable even with those attained in radio communication with smaller amounts of energy at the transmitter. By this system I am enabled to avoid the interferences caused by atmospheric disturbances which so frequently interrupt aerial radial communication.

The problems of interferences between several stations are similar to those in the present radio art and are overcome in the same manner as in the present art for example, by tuning to resonance between stations. At the receiving station shown in Fig. 2 the source of alternating current 9 is replaced by a detector and telephone receiver for example, by the audion detector 12 associated with the overhead line 20, 21 by the transformer 14, 16 as shown. The receiver 13 is included in the usual audion receiving system well known in the art. In the receiving station the overhead line and earth return system should be tuned to the

frequency of the generator at the transmitting station in any desirable manner either by means of variable inductances as shown in Fig. 1, or by means of variable condensers 27, as shown in Fig. 2 or by both. It will be apparent, as shown, that it is preferable to have the earth plates 3 and 4 of the receiving system in the same stratum 8 as that in which the earth plates 3 and 4 of the transmitting system are buried.

Having now set forth the objects and nature of my invention and having shown and described a construction, embodying the principles thereof, what I claim as new and useful and of my own invention and desire to secure by Letters Patent is:

1. A system of electrical signalling comprising a pair of overhead base lines each formed between plates buried in the earth in substantially the same stratum of different conductivity from that of the earth's surface, and a signalling circuit associated with each of said base lines.

2. A system of electrical signalling comprising a pair of overhead base lines each formed between plates buried in the earth in substantially the same stratum of greater conductivity than that of the earth's surface, and a signalling circuit associated with each of said base lines.

3. A system of electrical signalling comprising a pair of overhead base lines each formed between plates buried in the earth in substantially the same stratum of different conductivity from that of the earth's surface, and a signal transmitting and a signal receiving system respectively associated with said base lines.

4. A system of electrical signalling comprising a pair of overhead base lines each formed between plates buried in the earth in substantially the same stratum of greater conductivity than that of the earth's surface, and a signal transmitting and a signal re-

ceiving system respectively associated with said base lines.

5. A system of electrical signalling comprising a pair of overhead base lines substantially parallel to each other, and widely separated, each of said base lines formed between plates widely separated and buried in the earth in substantially the same stratum and of different conductivity from that of the earth's surface, and a signalling circuit associated with each of said base lines.

6. A system of electrical signalling comprising a pair of overhead base lines substantially parallel to each other, and widely separated, each of said base lines formed between plates widely separated and buried in the earth in substantially the same stratum and of greater conductivity than that of the earth's surface, and a signalling circuit associated with each of said base lines.

7. A system of electrical signalling comprising a pair of overhead base lines substantially parallel to each other, and widely separated, each of said base lines formed between plates widely separated and buried in the earth in substantially the same stratum and of different conductivity from that of the earth's surface, and a signal transmitting and a signal receiving system respectively associated with said base lines.

8. A system of electrical signalling comprising a pair of overhead base lines substantially parallel to each other, and widely separated, each of said base lines formed between plates widely separated and buried in the earth in substantially the same stratum and of greater conductivity than that of the earth's surface, and a signal transmitting and a signal receiving system respectively associated with said base lines.

In testimony whereof I have hereunto set my hand on this 31st day of May, A. D. 1917.

LEE DE FOREST.