No. 884,070. PATENTED APR. 7, 1908.

S. CABOT.

SPACE TELEGRAPHY.

APPLICATION FILED NOV. 13, 1905.

2 SHEETS—SHEET 1.

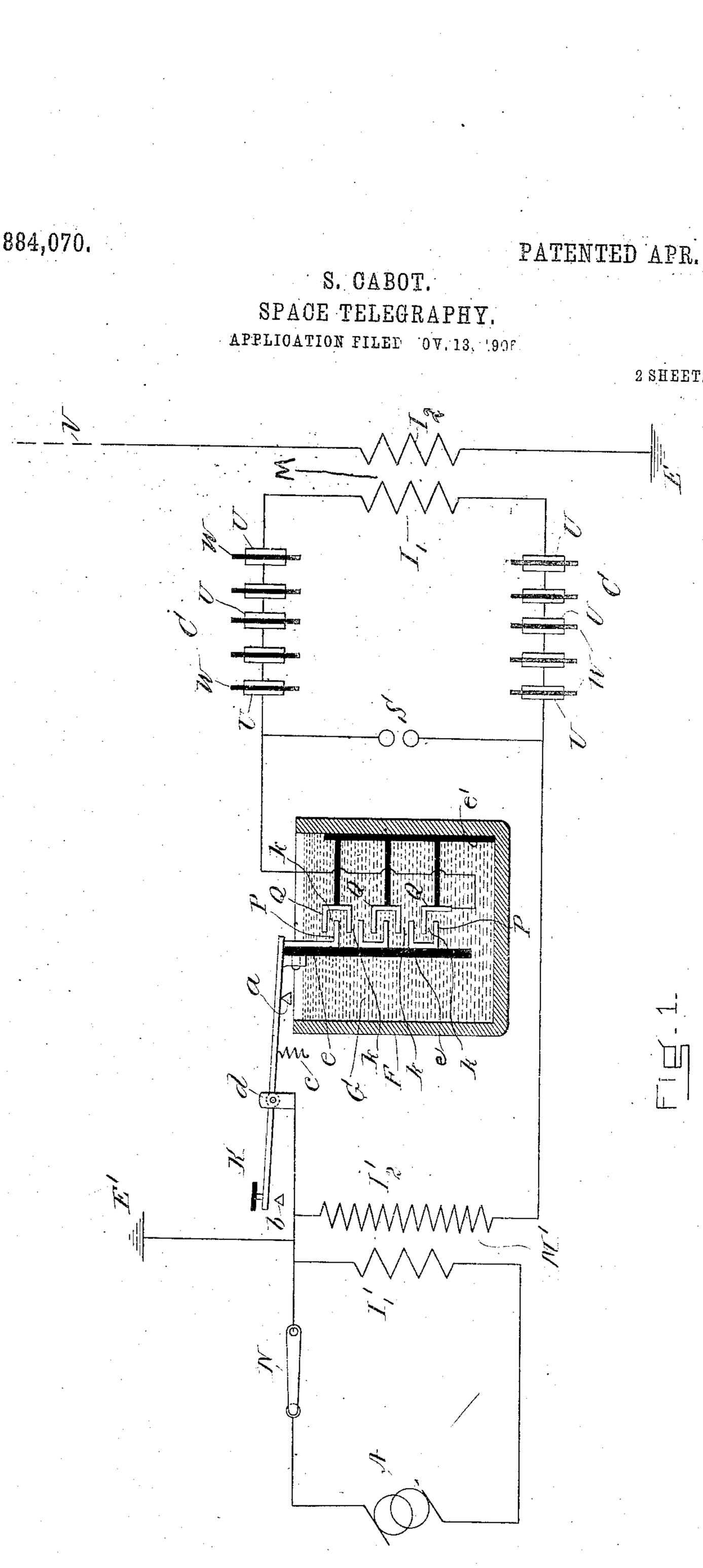

Fig. 1.

WITNESSES=

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Patrick J. Conroy.

INVENTOR=

Sewall Cabot

by Browne & Woodworth

Attys.

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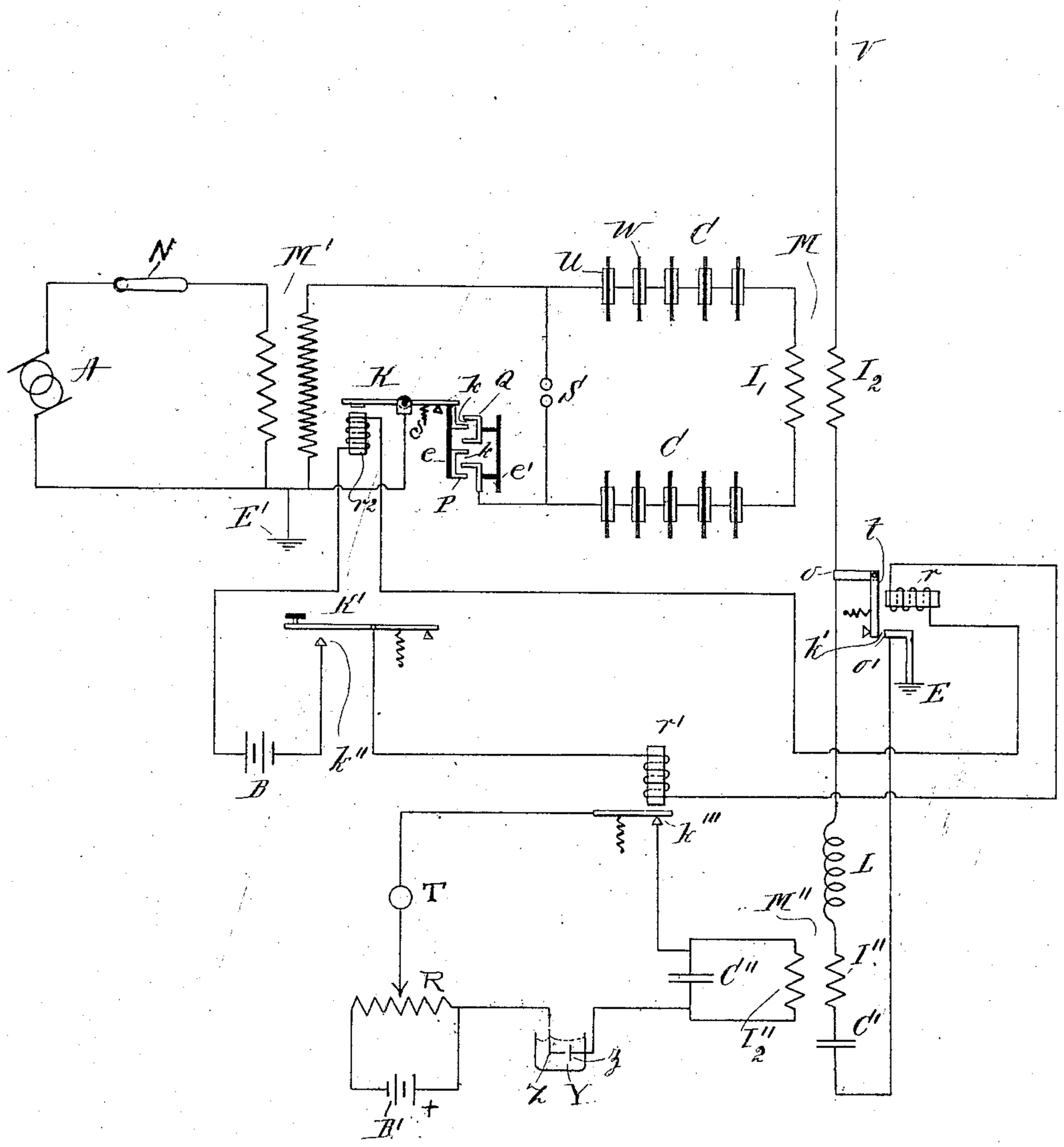

Fig. 2.

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UNITED STATES PATENT OFFICE.

SEWALL CABOT, OF BROOKLINE, MASSACHUSETTS, ASSIGNOR TO STONE TELEGRAPH AND TELEPHONE COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MAINE.

SPACE TELEGRAPHY.

No. 884,070. Specification of Letters Patent. Patented April 7, 1908.

Application filed November 13, 1906. Serial No. 343,205.

To all whom it may concern:

Be it known that I, SEWALL CABOT, a citizen of the United States, and a resident of Brookline, in the county of Norfolk and State of Massachusetts, have invented a new and useful Improvement in Space Telegraphy, of which the following is a specification.

My invention relates to space telegraphy and more especially to systems in which a large amount of electrical energy is radiated in form of electromagnetic signal waves.

The object of my invention is to produce a high power wireless telegraph system, in which the current which energizes the sonorous circuit is controlled by means of a suitable high potential key or switch placed in the circuit which connects the secondary winding of a high potential transformer with said sonorous circuit, and in which the sonorous circuit may be provided with a plurality of serially connected condensers of large capacity.

In the drawings which accompany and form a part of this specification I have illustrated in diagram two arrangements of apparatus and circuit connections whereby the hereinbefore mentioned objects may be carried into effect.

In the drawings Figure 1 represents a space telegraph transmitting system and Fig. 2 represents a combined transmitting and receiving system.

A represents a source of vibratory current such for example as an alternating current generator, which is connected through the switch N with the primary $1'_1$ of the high potential transformer M′, which preferably is a closed magnetic circuit transformer. The circuit S C I_1 C, which includes the spark gap S, the condensers C C and the primary I_1 of the oscillation transformer M, is a sonorous circuit. The secondary I'_2 of the transformer M′ is connected to the sonorous circuit through the intermediary of the series contact switch or key K, which, as shown, is provided with a light rod *e* of insulating material carrying the contact members P. The contact members P cöoperate with the contact members Q supported by the insulator *e*′. Although not necessary, the contact members P and Q may be immersed in an insulating fluid such as the oil G contained in the vessel F. The front and back stops *a* and *b* are so adjusted that when the key K, which is pivoted at *d*, is maintained by the spring *c* on its front contact *a*, the separation of the several coöperating members P and Q at the points *k* is not sufficient to permit the potential developed at the terminals of the secondary I'_2 to break down the insulation at said points and thereby charge the condensers C C. However, when the key is brought against its back stop *b*, the potential developed at the terminals of the secondary of the transformer M′ is sufficient to rupture the dielectric separating the several members P and Q at the points *k* and thereby charge the condensers C C. The condensers C C by discharging across the gap S develop electrical oscillations in the sonorous circuit and the energy of said oscillations is translated to the elevated conductor V by the transformer M, the secondary of which is included in said elevated conductor, and radiated in the form of electromagnetic waves.

It will be obvious that any number of contact members P and Q may be employed, and that the number employed will depend upon the potential developed at the secondary of the transformer M′, while said potential, other things being equal, will depend upon the length of the spark gap S. By way of example, if the length of said gap is one inch and if the terminals thereof are separated by air at ordinary pressure, the potential necessary to cause sparking at said gap will be about 75000 volts. In such case the separation of the members P and Q at the points *k* may be one-eighth of an inch and a sufficient number of the members P and Q may be employed to provide eight gaps *k*. There will then be a discontinuity in the intermediate circuit which includes the secondary of the transformer M′ and the members P and Q, of one inch of dielectric which as shown in Fig. 2 may be air, and, inasmuch as a much greater difference of potential is required to break down a series gap one inch in length and consisting of a plurality of smaller gaps than is required to break down a gap of equal length between two terminals, such as the spark gap S, no discharge will take place across the several juxtaposed members P and Q. If the stroke of the key is adjusted to one-thirty-second of an inch, a larger

number of contact members P and Q would be employed. Preferably the insulating rod *e* and the movable contact members P are made as light as possible so as not to interfere with rapid signaling, and preferably when the key is down on its back stop the members P and Q are not brought into contact, but are separated by say one-thirty-second or one-sixty-fourth of an inch at the several points *k*.

Various attempts heretofore have been made to control by means of Morse keys large amounts of energy in the primary power circuits, such as the circuit A N I'_1, of wireless telegraph transmitting systems, but so far as I am aware these attempts have not been successful on account of the large amperage developed in said circuits. By means of the present invention I provide a means for controlling the current supplied to the sonorous circuit in that part of the system in which the amperage is small and the potential correspondingly greater. It will be obvious to those skilled in the art that many embodiments of my invention may be devised without departing from the principle thereof as above set forth, and it is to be understood therefore that the diagrams shown in Figs. 1 and 2 are not to be considered as limitations of my invention, but merely as conventional illustrations of the principle involved therein.

I prefer, as shown in Fig. 2, to operate the key K or series contact switch by means of a magnet r^2 controlled by an ordinary Morse key K′ such as used in wire telegraphy. The circuit which includes said magnet and battery B and which is closed at the point k'', may also include the magnets *r* and *r′*. In this case the magnet r^2 or its spring *c* may be so constructed and arranged that the armatures of the magnets *r* and *r′* will be attracted before that of the magnet r^2. By depressing the key K′ the armature *t* is attracted thereby closing the contact *k′* and short-circuiting the terminals of the receiving system between the points *o o′* across which there exists a practically zero difference of potential when oscillations are created in the elevated transmitting conductor system V I_2 E. The conductor *o′* E is a conductor having practically zero impedance so that when the contact *k′* is closed the points *o o′* have practically zero potential to earth. Simultaneously with the closure of the contact *k′*, or before or after said closure, the contact k''' is opened by the energization of the magnet *r′* thereby opening the circuit of the oscillation detector Y, and finally, after the system has thus been put in condition for transmitting the armature K is attracted and the sonorous circuit is energized. In the receiving system, the inductance L and the condenser C′ may be employed for altering the natural period of the elevated receiving conductor system. M″ is a transformer, the primary I_1'' of which is included in the elevated receiving conductor system and the secondary I_2'' of which forms part of the resonant receiving circuit C″. The oscillation detector Y which may be of any suitable type and which herein is shown as an anode Z of small area and a cathode *z* of much larger area immersed in an electrolyte, may be associated in any suitable manner with the resonant receiving circuit. T is a telephone and R is a resistance which with the battery B′ constitutes a potentiometer.

Considerable difficulty has heretofore been experienced by wireless telegraph engineers in making the condensers of oscillating circuits stand up to the high potentials impressed upon them. Various types of high potential condensers have been devised, but on account of the ionization of the dielectric in the immediate vicinity of the edges of the condenser plates and the resulting brush discharges which there take place the life of such condensers is liable to be shortened. Assuming, by way of example that the spark gap S of the sonorous circuit is of such length that 75000 volts difference of potential will be developed between the armatures of the oscillating-circuit condenser, the ionization of the air immediately surrounding the points of greatest electrical density will cause a brush discharge which not only unnecessarily absorbs energy but which causes a more or less rapid deterioration of the condenser dielectric, and this is true even although the condenser be immersed in oil or other insulating fluid. If instead of using one condenser of say .015 microfarads capacity, we connect in series with the spark gap S and primary I_1 ten large condensers each of .15 microfarads capacity, it will be obvious that the resultant capacity of the oscillation circuit is the same as before and also that the difference of potential developed at the terminals of each condenser is only 1/10 of what it was before, or 7500 volts. If the condensers are each charged to a potential as low as 7500 volts, or even to a potential of greater value, no ionization of the air or other dielectric surrounding the condenser can take place and hence there will be no brush discharge with the resultant waste of energy and deterioration of the condenser dielectric above referred to. Accordingly as shown in Fig. 1 I substitute for the small condenser usually employed, the capacity of which is about .015 microfarads, a plurality of much larger condensers, for example ten condensers each having a capacity of about .15 microfarads. Each condenser consists of the conducting plates U and the dielectric W which may be of any suitable material, and which may be so thin on account of the relatively low potential developed between the plates that the desired capacity may be ob-

tained by constituting each condenser of two plates of conducting material pasted on the opposite sides of a single plate of insulating material such as a thin plate of glass or a sheet of paraffined paper.

I claim,

1. In a space telegraph system, a normally closed power circuit including the primary winding of a transformer, a sonorous circuit, a normally open intermediate circuit connecting said sonorous circuit to the secondary of said transformer and means operated by a sending key for controlling the current flow in said intermediate circuit.

2. In a space telegraph system, a normally closed power circuit including the primary winding of a transformer, a sonorous circuit, a normally open intermediate circuit connecting said sonorous circuit to the secondary of said transformer and a series contact switch operated by a sending key for controlling the current flow in said intermediate circuit.

3. In a space telegraph system, a normally closed power circuit including the primary winding of a transformer, a sonorous circuit, a normally open intermediate circuit connecting said sonorous circuit to the secondary of said transformer, means for controlling said intermediate circuit, a Morse key, and a magnet controlled thereby for operating said means.

4. In a space telegraph system, a sonorous circuit, a normally closed power circuit, a normally open intermediate circuit connecting said sonorous circuit with said power circuit, and means for controlling said normally open circuit, said means comprising a switch having a plurality of series-contacts.

5. In a space telegraph system, a normally closed power circuit including the primary winding of a transformer, a sonorous circuit, a normally open intermediate circuit connecting said sonorous circuit to the secondary of said transformer, and means for controlling said normally open circuit, said means comprising a switch having a plurality of series-contacts.

6. In a space telegraph system, a normally closed power circuit including the primary winding of a transformer, a sonorous circuit, a normally open intermediate circuit connecting said sonorous circuit to the secondary of said transformer, and a magnetically-operated series-contact switch for controlling said intermediate circuit.

7. In a space telegraph system, an elevated conductor, a receiving system connected therewith, an oscillation detector associated with said receiving system, a transmitting system associated with said elevated conductor, a sending key and electromagnets controlled by said key and so constructed and arranged that upon the depression of said key the receiving system will be short-circuited, the circuit of the oscillation detector opened and the transmitting system energized.

8. In a space telegraph system, an elevated conductor, a receiving system connected therewith, an oscillation detector associated with said receiving system, a transmitting system associated with said elevated conductor, a sending key and electromagnets controlled thereby, means operated by one of said electromagnets for short-circuiting said receiving system and means operated by another of said electromagnets for controlling said transmitting system.

9. In a space telegraph system, an elevated conductor, a receiving system associated therewith, an oscillation detector associated with said receiving system, a transmitting system associated with said elevated conductor, a sending key and three electromagnets controlled thereby, means operated by one of said electromagnets for short-circuiting said receiving system, means operated by another of said electromagnets for opening the circuit of said oscillation detector, and means operated by the third electromagnet for controlling said transmitting system.

10. In a space telegraph system, a normally closed power circuit including the primary winding of a transformer, a sonorous circuit, a normally open intermediate circuit connecting said sonorous circuit to the secondary winding of said transformer, and a series-contact switch for controlling said intermediate circuit.

In testimony whereof, I have hereunto subscribed my name this 12th day of Nov., 1906.

SEWALL CABOT.

Witnesses:
E. B. TOMLINSON,
GEO. K. WOODWORTH.