E. H. COLPITTS.

SIGNALING METHOD AND SYSTEM.

APPLICATION FILED FEB. 5, 1917.

1,375,675. Patented Apr. 26, 1921.

Fig. 1.

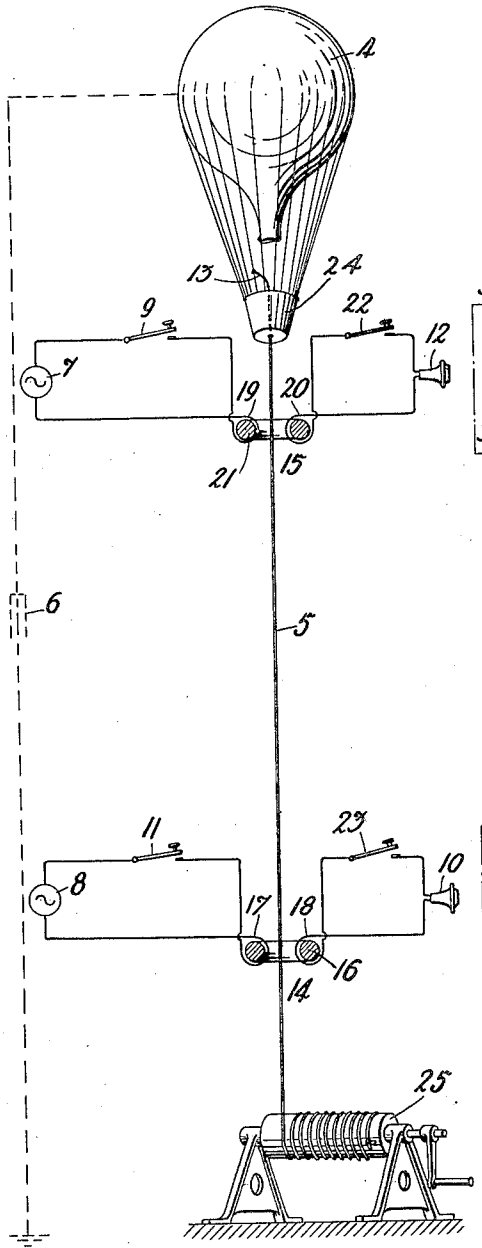
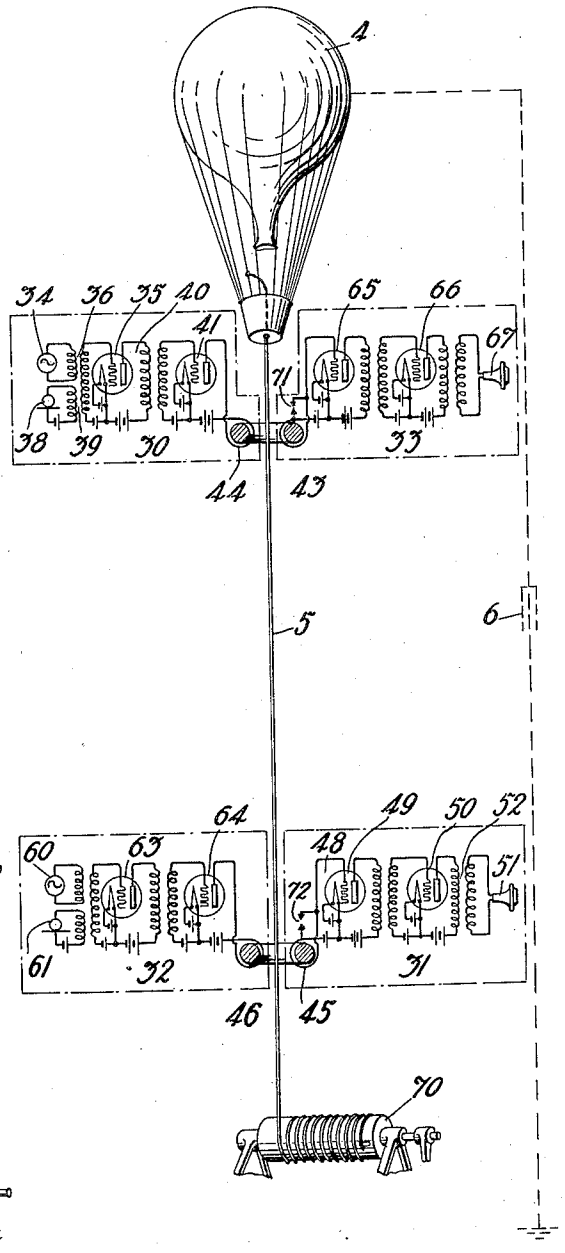


Fig. 2.



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UNITED STATES PATENT OFFICE.

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SIGNALING METHOD AND SYSTEM.

1,375,675. Specification of Letters Patent. Patented Apr. 26, 1921.

Application filed February 5, 1917. Serial No. 146,703.

To all whom it may concern:

Be it known that I, EDWIN H. COLPITTS, a subject of the King of Great Britain, residing at East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Signaling Methods and Systems, of which the following is a full, clear, concise, and exact description.

This invention relates to means and apparatus for signaling; more particularly it relates to means for establishing communication between an anchored balloon and the ground.

Balloons, such as are used for observation purposes are generally anchored to earth by some suitable means, such as a single metallic cable, which controls the height of the balloon above ground. It is very often desirable to have some means for intercommunication with the ground without complicating the anchoring apparatus thereby. In order to provide for such a signaling means, it has been suggested that transformer windings be inserted in the cable at both the earth and the balloon, upon which windings voice currents or modulated high frequency currents may be impressed. But such a scheme is objectionable on account of the necessity for having at the balloon end of the cable an insulator in shunt with the transformer winding in order to support the tension of the cable; also the anchorage or windlass for the earth end of the cable must be insulated, which insulation is difficult to maintain except under ideal circumstances.

The object of this invention is to furnish a simple and effective method and means for carrying on such a communication without introducing any additional conductors between the balloon and the earth, and without modifying the cable or the anchorage apparatus in any way whatsoever.

For the accomplishment of this purpose, this invention employs the conducting qualities of the single cable connecting the balloon to earth as one side of a signaling circuit, and completes the circuit by means of the capacity between the balloon and the ground. At one end of said cable, a source of signal waves is provided which, after being impressed on the signaling circuit, actuates a suitable receiver at the other end. The signals are impressed on the signaling circuit by means of a transformer, the primary winding of which is connected to said source, and the secondary of which consists of the anchoring cable, which is magnetically coupled to said primary. At the receiving end, the transformer for impressing oscillations upon the receiving device has its primary winding consisting of the anchored cable, and its secondary connected to said receiving device.

For the better understanding of this invention, reference is made to the accompanying drawings, in which—

Figure 1 illustrates the preferred form of the invention; and

Fig. 2 represents a modification thereof.

Fig. 1 illustrates the invention as embodied in a telegraphic signaling system. The balloon 4 is shown anchored to earth by means of a single conducting cable 5. This cable is connected to the conductive network or surface of the balloon at the point 13. The capacity between the conductive surface of the balloon and the ground is represented by the condenser 6. The combination of this condenser and the grounded cable comprises the complete signaling circuit. 7 and 8 are sources of alternating current. Key 9 serves as a means for varying the current from source 7 in accordance with the signals to be sent from the balloon to the ground. At the ground, these signals are detected by means of a suitable receiver 10. When it is desired to signal from the earth to the balloon, key 11 serves as a means for varying the current from the source 8 in accordance with said signals, and, at the balloon, receiver 12 serves to detect them. 14 is a transformer at the ground, preferably having a closed magnetic circuit with a circular core 16 shown in cross-section. Around the core are wound the primary winding 17 coupled to the source 8, and secondary winding 18 coupled to the receiver 10. The cable 5 serves as the secondary for winding 17 and as the primary for winding 18. A similar transformer 15 is located at the balloon end of the cable. Primary winding 19 is con-

nected to the source 7 and secondary winding 20 is coupled with the receiver 12. The primary for the secondary winding 20 and the secondary for the primary winding 19 consists of the cable itself. The core 21 is shown in cross-section. Windings 17, 18, 19 and 20, although shown as consisting of only one turn each, may have any suitable number of turns.

25 is a windlass upon which the cable may be wound or unwound, thereby providing means for regulating the height of the balloon above ground. This windlass need not be insulated, but on the contrary, should be well grounded to afford a good conducting path from the earth to the balloon. It is preferable that the core 16 of the transformer 14 should not be clamped tightly around the cable, but the cord should have some external support so that the cable may pass through it freely without interfering with the position of the transformer.

The transformer 15 may be located in the basket 24 of the balloon or it may be clamped to the cable some distance below it, as shown in the drawing. In the latter case the lead wires from the two windings 19 and 20 should be of such a length that the transmitting and receiving apparatus are conveniently located for the operator in the basket.

In order to prevent the current from source 7 from actuating the receiver 12, which is associated with it at the same end of the cable, it may be desirable to insert in the receiving circuit some means, shown in Fig. 1 as a key 22, for breaking said circuit while current is being impressed upon the signaling circuit from said source. Similarly, it may be desirable to insert key 23 in the receiving circuit at the ground in order to prevent receiver 10 from being actuated by current from source 8.

It is evident that telephone transmitters may be substituted for the two keys 9 and 11, and direct current sources instead of the oscillation generators 7 and 8, so that voice currents may be used for intercommunication between the balloon and the ground.

The two sources of alternating current may well be oscillation generators of the audion type as described in the application of Hartley, Serial No. 31,476, filed June 1, 1915, as such a generator is of comparatively negligible weight, an important consideration in a signaling system for a balloon.

Fig. 2 illustrates the invention as adapted for signaling by means of high frequency oscillations modulated in accordance with speech currents. As in Fig. 1, the signaling circuit comprises the grounded cable 5, and the capacity of the balloon with respect to the ground represented by the condenser 6. 30 is a transmitting system by means of which high frequency oscillations, modulated in accordance with the audio-frequency oscillations to be transmitted, are impressed upon the signaling circuit. 31 is a receiving system at the ground end for rectifying and detecting the signals. A similar transmitting system 32, and a receiving system 33 are provided for communication from the earth to the balloon.

In the transmitting system 30, 34 is a source of high frequency oscillations that are impressed on the input circuit of the modulating device 35 by means of transformer 36. 38 is a source of low frequency signals, shown here as a microphone circuit, which is inductively related to the modulating device by means of transformer 39. The resultant high frequency oscillations, modulated in accordance with the low frequency signals in the output circuit 40 of the device, are impressed on an amplifier 41, preferably of the audion type. The resultant amplified oscillations are then impressed on the signaling circuit by means of a transformer 43, the primary of which consists of a coil 44, and the secondary of which consists of the anchoring cable itself. At the earth, the oscillations in the cable are impressed by means of the secondary coil 45 of transformer 46 upon the input circuit 48 of the detector 49. The detected oscillations, after amplification by the amplifier 50, are impressed upon the receiver 51 by the transformer 52.

Similar to system 30, the transmitting system 32 has a source of high frequency oscillations 60 and a telephone transmitter circuit 61 that impress their oscillations upon the modulating device 63. The modulated oscillations are then amplified by the amplifier 64, and are impressed upon the cable by means of transformer 46. Similar to system 31, the receiving system 33 has a detector 65 coupled to the cable. The detected oscillations are then impressed upon amplifying means 66. The amplified signals then actuate the receiver 67.

If it is desired to prevent oscillations from the transmitter system 30 from excessively actuating the receiver 67 of the receiving system 33, it may be found desirable to insert some power limiting device in said receiving circuit. This prevention can be accomplished, for example, by a spark gap 71, shunted across the input terminals of the tube 65 and so adjusted that sparking takes place only when the transmitting system 30 is being operated. A similar spark gap 72 across the input terminals of the tube 49 will prevent the strong oscillations from the transmitting system 32 from actuating the receiver 51 to an excessive degree.

As in Fig. 1, it is preferable to have the transformers of the closed magnetic type. The transformer 46 should preferably have some support other than the cable so as to provide for regulating the height of the

balloon by means of the windlass 70 without disturbing said transformer. As in Fig. 1, the windlass is grounded.

Any suitable means, as a wire network around the balloon, may be employed to increase its capacity with respect to the earth, and thereby increase the power of the signals.

It is evident that any suitable method other than the one illustrated may be used to produce modulated high frequency oscillations and to detect them. The modulating method shown is described in detail in the application of Van der Bijl, Serial No. 46,643, filed August 21, 1915.

Although this invention has been illustrated by means of modulated high frequency signaling systems, it is to be understood that its use is not so limited, but it may be applied to the transmission of voice currents alone or to any telegraphic system.

What is claimed is:

1. The combination of an aerial vessel, an anchoring strand connecting said vessel to the ground, an electric circuit comprising said strand and the capacity of said vessel to ground, means for signaling over said circuit comprising a source of signals at one end of said strand, means for impressing said signals upon said strand, a receiver near the other end of said strand, and a transformer, the primary winding of said transformer consisting of said strand and having its secondary connected to said receiver.

2. The combination of an aerial vessel, an anchoring strand connecting said vessel to the ground, an electric circuit comprising said strand and the capacity of said vessel to ground, means for signaling over said circuit comprising a source of signals at one end of said strand, a transformer having its primary connected to said source and having its secondary consisting of said strand, whereby the signals are impressed upon said strand, a receiver, and means for impressing the signals in said strand upon said receiver.

3. The combination of an aerial vessel, an anchoring strand connecting said vessel to the ground, an electric circuit comprising said strand and the capacity of said vessel to ground, means for signaling over said circuit comprising a source of electric signals near one end of said strand, a transformer having its primary winding connected to said source, its secondary winding consisting of said strand, a receiver near the other end of said strand, and a transformer, the primary winding of said transformer consisting of said strand and having a secondary connected to said receiver, thereby providing for intercommunication between said vessel and the earth.

4. In a signaling system, an aerial vessel, a cable connecting said vessel to the earth, an electric circuit comprising said cable and the capacity of said vessel to ground, means for signaling over said circuit comprising a source of signal waves at one end of said cable, a transformer for impressing said signals upon said cable, the secondary of said transformer consisting of said cable, a receiver near the other end of said cable, and a second transformer for impressing said signals upon said receiver, the primary of said second transformer consisting of said cable, said cable being capable of being moved independently of the remainder of said transformer while remaining operatively related thereto.

5. In a signaling system, a transformer having a primary and a secondary conductor, a closed magnetic structure for said transformer, one of said conductors having a straight portion projecting through said magnetic structure and capable of being moved independently thereof, while operatively electrically related thereto.

6. In a signaling system, a transformer having a primary and a secondary conductor, a closed magnetic structure for said transformer, one of said conductors comprising a cable of variable length projecting through said magnetic structure and capable of being moved independently thereof while operatively electrically related thereto, and a signaling instrument associated with one of said conductors.

7. A signaling system comprising a plurality of transformers, each of said transformers having a primary and a secondary conductor, a closed magnetic structure for each of said transformers, one of the conductors of each of said transformers comprising a straight portion of a line wire in said signaling system, said portion projecting through each of said magnetic structures and capable of being moved independently thereof while in operative relation thereto, and translating devices associated with said conductors.

8. In a signaling system, an electrical conductor, an aerial vessel connected to ground by said conductor, a plurality of closed magnetic structures around said conductor, one of said structures being movable independently of said conductor while in operative relation thereto, a plurality of transformers each comprising one of said structures, and a winding on each of said structures whereby current variations may be transmitted from one to another of said windings.

9. In a signaling system, a transformer having a primary and a secondary conductor, a closed magnetic structure for said transformer, one of said conductors comprising a cable of variable length projecting through said magnetic structure and capable of being moved independently there-

of while in operative relation thereto, means near one end of said cable for varying its effective length, said transformer being located between said varying means and the other end of said cable.

10. In a signaling system, means having appreciable capacity to ground, an electric conductor connecting said capacity means to ground, means at the ground for varying the effective length of said conductor, means at said capacity means for impressing signaling currents upon said conductor, and means near the other end of said conductor for detecting said signals, said detecting means being electrically associated with said conductor at a point between said capacity means and said varying means.

11. In a signaling system, an aerial vessel, a cable for anchoring said vessel to earth, an electric circuit including said cable and the capacity of said vessel to ground, means at the ground for varying the effective length of said cable, means in said vessel for impressing signaling currents upon said circuit, and means near the ground end of said cable for detecting said signals, said last named means being electrically associated with said cable at a point between said vessel and said varying means.

12. In a signaling system, an aerial vessel, a cable for anchoring said vessel to earth, an electric circuit including said cable and the capacity of said vessel to ground, means at the ground for varying the effective length of said cable, means in said vessel for impressing signaling currents upon said circuit, and means near the ground end of said cable for detecting said signals, said last named means being electrically associated with said cable at a point between said vessel and said varying means, each of said signaling and detecting means including a transformer having a primary and a secondary conductor, a closed magnetic structure for each of said transformers, one of the conductors of each of said transformers comprising a portion of said cable which projects through each of said magnetic structures and which is capable of being moved independently thereof.

13. The method of varying the length of the electrical conductor connecting a sending and a receiving station to vary the distance therebetween while maintaining them in electrical communication which comprises inductively connecting said stations and varying the distance between said stations by moving the primary conductor of said inductive connection relative to the secondary conductor thereof.

14. The method of varying the length of the electrical conductor connecting a sending and a receiving station to vary the distance therebetween while maintaining them in electrical communication which comprises inductively connecting said stations and varying the distance between said stations by moving the primary conductor of said inductive connection relative to the secondary conductor thereof, one of the conductors of said inductive connection comprising said conductor of variable length.

15. In a signaling system, a transformer having a primary and a secondary conductor, one of said conductors being a straight conductor associated with the other of said conductors and capable of being moved independently thereof while operatively electrically related thereto.

16. In a signaling system, a transformer having a primary and a secondary conductor, one of said conductors being a straight conductor capable of being moved independently of the other of said conductors while remaining in operative relation thereto, a body supportingly connected to said straight conductor, a sending device associated with one of said conductors, and a receiving device associated with the other of said conductors, one of said devices being located on said body.

17. In a signaling system, a cable of variable length, a plurality of transformers each having a primary and a secondary conductor, the primary conductor of one of said transformers comprising a straight portion of said cable, the secondary of another of said transformers comprising a straight portion of said cable, a body supportingly connected to said cable, a receiving device associated with the secondary conductor of said first-mentioned transformer, and a sending device associated with the primary of said second mentioned transformer, one of said devices being located on said body.

In witness whereof I hereunto subscribe my name this 2nd day of February, A. D. 1917.

EDWIN H. COLPITTS.