No. 749,584.

PATENTED JAN. 12, 1904.

H. SHOEMAKER.

WIRELESS SIGNALING SYSTEM.

APPLICATION FILED OCT. 3, 1902.

NO MODEL.

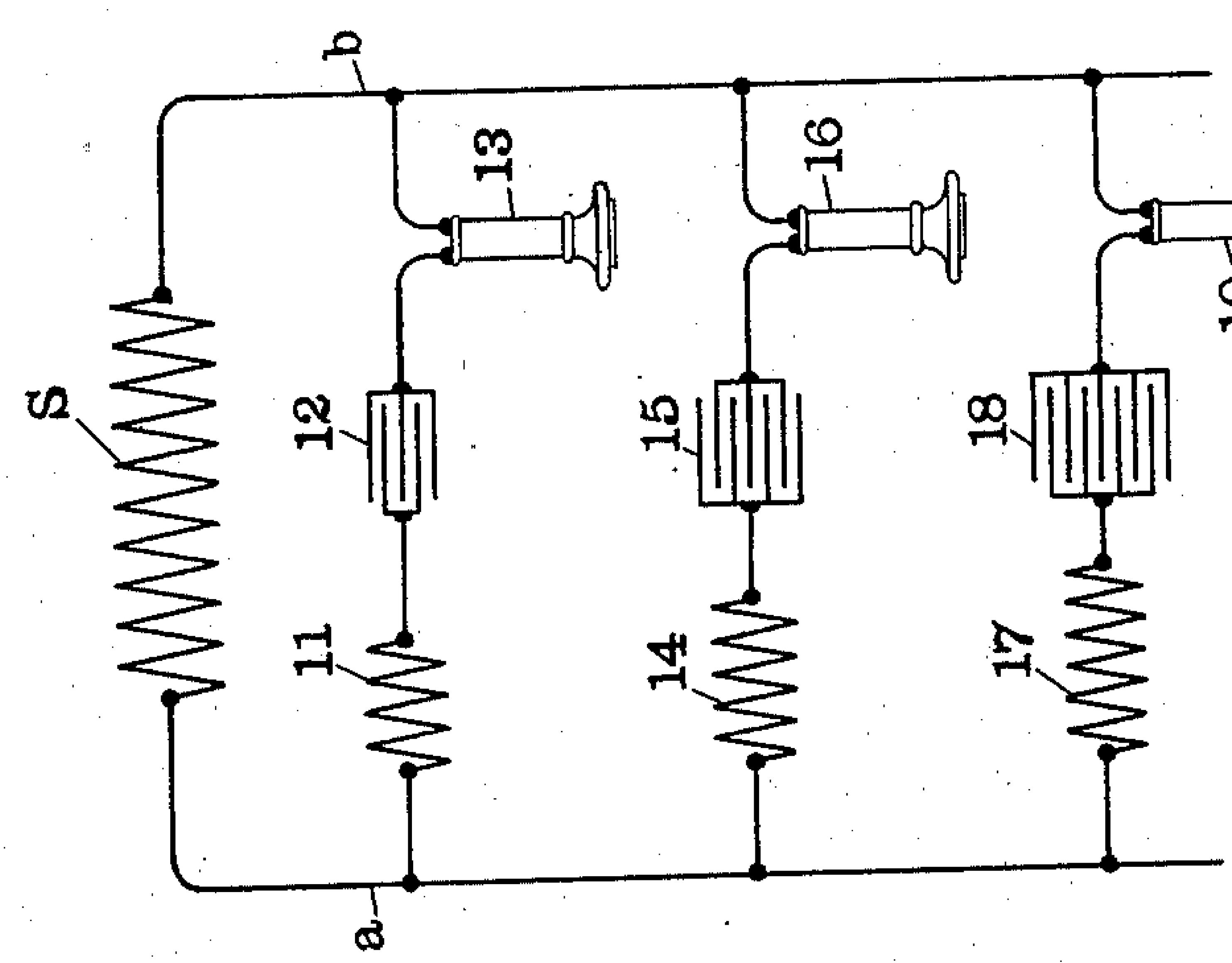

Fig 2.

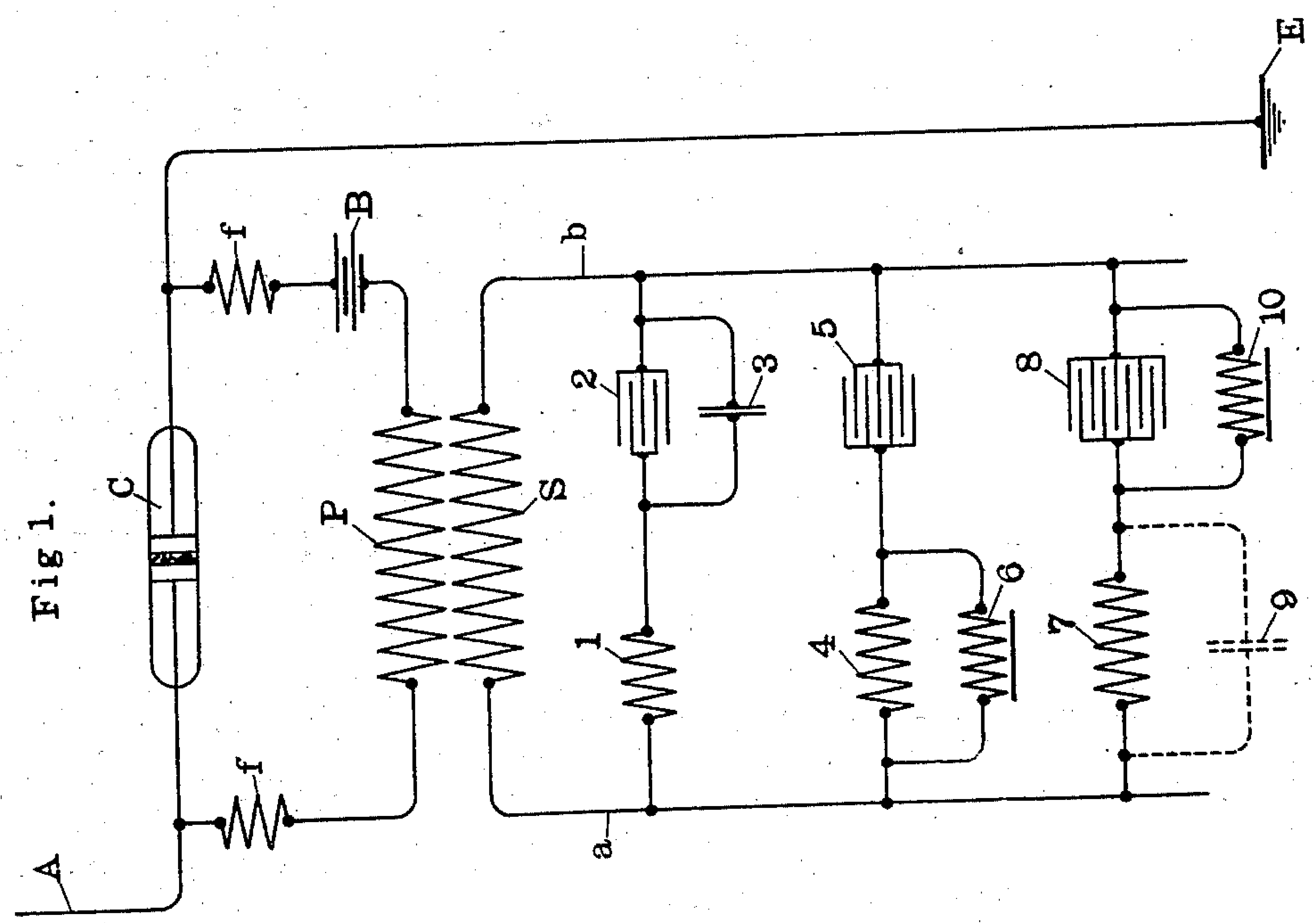

Fig 1.

Witnesses

James M. Sawyer.

Alice T. Burrough.

Inventor

Harry Shoemaker

by Cornelius D. Ehret

his Attorney

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 749,584. Patented January 12, 1904.

UNITED STATES PATENT OFFICE.

HARRY SHOEMAKER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO INTERNATIONAL WIRELESS TELEGRAPH COMPANY, A CORPORATION OF NEW JERSEY, AND MARIE V. GEHRING, OF PHILADELPHIA, PENNSYLVANIA.

WIRELESS SIGNALING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 749,584, dated January 12, 1904.

Application filed October 3, 1902. Serial No. 125,743. (No model.)

To all whom it may concern:

Be it known that I, Harry Shoemaker, a citizen of the United States, residing at Philadelphia, in the city and county of Philadelphia and State of Pennsylvania, have invented a new and useful Wireless Signaling System, of which the following is a specification.

My invention relates to wireless signaling systems wherein the message or signal is represented by electroradiant energy transmitted through the natural media.

More particularly, my invention relates to the receiving-circuits of a wireless signaling system wherein several signals or messages may be simultaneously or independently received and recorded.

My invention comprises an arrangement of circuits at the receiving-station whereby several messages, each represented by a series of wave-trains succeeding each other at a predetermined rate, may be simultaneously or independently received or recorded.

My invention comprises means at a receiving-station whereby with a single wave-responsive device a plurality of fluctuating currents are produced, the frequency of each current being equal to the rate of succession of wave-trains representing a certain message or signal.

My invention comprises, further, a plurality of local circuits controlled by said wave-responsive device, each circuit containing means for selecting a certain message to the exclusion of other messages which may be simultaneously or independently received.

In my system there are a plurality of stations, each capable of emitting trains of waves of electroradiant energy, such trains succeeding each other at characteristic uniform rate, and each station is equipped with means for selecting the several messages or signals which may be transmitted to it simultaneously or independently to separate receivers or recorders.

It has been customary heretofore in wireless signaling systems for the purpose of securing selectivity, to attune a circuit or circuits at the receiving-station to the frequency of the electroradiant energy-waves. In my system, however, the selection or tuning has reference more particularly to the rate of succession of the wave-trains and not the periodicity of the waves themselves. At each spark at the spark-gap of the transmitter there is emitted from the radiating-circuit a train of waves of electroradiant energy, in some cases the number of waves per train reaching twenty, the frequency of said waves themselves being from in the neighborhood of one hundred thousand per second to several millions per second. The tuning or selecting has heretofore been accomplished by adjusting the constants of the receiving-circuit so that it should be selective of radiations of these enormously high frequencies. In the primary of the transmitting-transformers I employ alternating currents or reversed currents of definite and uniform rate, so that at the spark-terminals there are produced sparks at the same rate as the rate of the current in the primary of the transformers. At the receiving-station instead of adjusting the circuits to the frequency of the radiant energy itself there are produced in local circuits fluctuating currents of a periodicity or frequency equal to the rate of succession of the transmitted wave-trains, or, in other words, equal to the rate of succession of the sparks at the spark-gap of the transmitter and the current in the primary of the transmitting-transformer. It is to be understood, however, that though my selectivity is obtained by adjusting the constants of circuits with relation to the rate of succession of the wave-trains I may in addition attune the receiving circuit to be selective of waves of electroradiant energy of a certain frequency and thereby have double selectivity or selectivity of two kinds. In my system there may be a plurality of stations, each emitting its trains of waves at a characteristic and uniform rate, and each receiving-station of the system is supplied with as many selective circuits as there are remaining stations in the system, each circuit being adjusted as to its electrical constants to be selective of fluctuating currents of a frequency equal to the rate of succession of the trains of waves of a certain station. For example, station No. 1 may transmit trains of waves at the rate of two hundred per second, station No. 2 at the rate of three hundred per second, and station No. 3 at the rate of three hundred and seventy-five per second. Station No. 1 when operating as a receiver will have then two local circuits, one of which will select fluctuating currents of a frequency equal to three hundred per second, thereby selecting a message coming from station No. 2, and another circuit selective of fluctuating currents of a frequency equal to three hundred and seventy-five per second, which will select the message being transmitted from station No. 3. Similarly when station No. 2 is operating as a receiver it will then be supplied with two local circuits one of which is selective of fluctuating currents of a frequency equal to two hundred per second, and therefore selecting the message being transmitted from station No. 1, and another circuit adjusted to select fluctuating currents of a frequency of three hundred and seventy-five per second, and therefore selecting a message being transmitted from station No. 3. Likewise when station No. 3 is operating as a receiver it has two local circuits, one of which is selective of fluctuating currents of a frequency of two hundred per second, and therefore selective of the message being transmitted from station No. 1, and another circuit adjusted to select fluctuating currents of a frequency of three hundred per second, and therefore selective of the message transmitted from station No. 2.

Though I have given but three stations in the example above it is apparent how the number of stations may be increased simply by using different rates of succession for the trains of waves at each station and adjusting local circuits at each receiver to be selective of fluctuating currents of like frequencies.

At my receiving-station I prefer to employ a single wave-responsive device, preferably of the self-restoring type, which is subjected to the trains of waves arriving from the stations which may be simultaneously transmitting. In local circuits shunted around such wave-responsive device are means for rendering such circuits selective of fluctuating currents corresponding with the different trains of waves received, and there is common to all the local circuits a source of energy giving rise to such fluctuating currents under the control of the single wave-responsive device. At the transmitting-station an alternating current or a commutated direct current is employed in the primary of the transmitting-transformer, thereby setting the rate of succession of the trains of waves emitted by such transmitter.

For a detailed description of my invention reference is to be had to the accompanying drawings, in which—

Figure 1 represents a diagrammatic view of the circuits at a receiving-station wherein is employed a transformer in whose secondary circuit are a plurality of means for selecting separate messages. Fig. 2 is a diagram of the secondary circuit of the system shown in Fig. 1 with a modified arrangement of the means for selecting predetermined messages.

In Fig. 1, A represents the usual aerial conductor of a wireless-signaling system between which and the earth-plate E is connected the wave-responsive device C, preferably of the self-restoring type now well known in the art. In shunt to the wave-responsive device C is the local circuit, including the choke-coils *f f*, the source of energy B, and the primary of a transformer P. The secondary of said transformer is shown at S, and from the terminals thereof extend the conductors *a b*. Connected in parallel between said conductors *a b* are several circuits, each including means for selecting a message to the exclusion of other messages which may be simultaneously or independently received in the aerial circuit and which have been transmitted through the natural media in the form of wave-trains of electroradiant energy. The wave-responsive device C is influenced by each series of wave-trains impinging upon the aerial conductor A, and if several series of wave-trains are simultaneously received the wave-responsive device C changes its resistance in response to each series of wave-trains and each wave-train of a series. There result from these changes of the wave-responsive device C several fluctuating currents in the circuit of the primary coil P. Each fluctuating current has a periodicity equal to the rate of succession of the wave-trains of a certain series and representing a certain message. In other words, in the circuit of the primary coil P there exists superposed fluctuating currents. These currents are then either stepped up or stepped down in their potential by means of such transformer, and in the secondary circuit *a b* there are then alternating currents of different frequencies and superposed. The circuit, including the inductance 1 and the condenser 2, bridges these conductors *a b*. The relative proportion of the inductance 1 and capacity 2 are such that said circuit is selective of an alternating current of a certain frequency, or, in other words, of an alternating current of a frequency dependent upon the rate of succession of wave-trains representing a certain message. 3 is an electrostatic telephone-receiver connected directly in shunt to the condenser 2. The capacity of the telephone-receiver 3 is, however, so proportioned as not to be a controlling element of the circuit 1 2. With the circuit 1 2 adjusted to resonance with a current of a certain frequency there exists across the terminals of the condenser 2 an excessive potential, as is well known, and to this potential is subjected the translating device 3. 4 is an inductance, and 5 a condenser, bridged across said conductors *a b* and forming a circuit resonant with an alternating current of a frequency different from that of the current with which the circuit 1 2 is resonant. In other words, the circuit 4 5 is selective of and resonant with an alternating current of a frequency dependent upon the rate of succession of the wave-trains representing a certain message, which message is separate and distinct from the one reproduced in the telephone-receiver 3. In shunt to the inductance 4 is the telephone-receiver 6 of the electromagnetic type and whose inductance is such as not to be a controlling element of the resonant circuit 4 5. The telephone-receiver 6 is subjected to the excessive potential existing at the terminals of inductance 4. 7 8 is a third circuit bridging the conductors *a b* and is resonant with a current of still different frequency from those selected by the two preceding circuits. In this instance there is bridged the electromagnetic telephone-receiver 10 across the terminals of the condenser 8, the telephone-receiver 10 being therefore subjected to an excessive potential difference, as in the previous cases. As a modification the electrostatic telephone-receiver 9 may be bridged across inductance-terminals 7.

In Fig. 2, S, *a*, and *b* are the same as in Fig. 1. Bridged across the conductors *a b* are the three circuits 11 12 13, 14 15 16, and 17 18 19. Each of these circuits is selective of an alternating current of a frequency depending upon the frequency of succession of the wave-trains representing a distinct and separate message. 13, 16, and 19 are telephone-receivers of either the electromagnetic or electrostatic type connected directly in series with the selective circuits and of course in each instance operating as either a part of the inductance or the capacity of its circuit.

Though I have shown but one receiving-station with different modes of arrangement of circuits at such station, it is to be understood that there are in my system a plurality of stations each equipped with the devices herein shown and described. It is to be further understood that though I select principally by tuning the secondary circuits to a frequency depending upon the rate of succession of the wave-trains I may also attune the aerial receiving circuit or circuits, arranged in inductive or conductive relation therewith, to the rate of the waves themselves, thus securing, in effect, a double tuning. For example, at a certain station the rate of succession of the wave-trains may be three hundred per second, while the rate of the waves themselves may be five hundred thousand per second. At the receiving-station the circuit including or controlling the wave-responsive device will be attuned to a rate of five hundred thousand per second, while the secondary circuit controlled by said wave-responsive device for selecting a particular message would be selective of a current of relatively low rate—that is, depending upon the rate of succession of the wave-trains, which is three hundred per second.

It is to be understood that the arrangement of the wave-responsive device need not be confined to the series connection herein shown, but that it may be arranged in a circuit inductively connected with the aerial circuit, or it may be connected in shunt to the frequency-determining element of a resonant receiving-circuit. Furthermore, it is to be understood that instead of a single wave-responsive device, as herein shown, a plurality of wave-responsive devices may be used, either in series relation, parallel relation, or series parallel relation. It is to be further understood that in conjunction with a single aerial conductor may be employed several branch circuits, such circuits when taken in conjunction with the aerial conductor forming circuits selective of different frequencies of transmitted waves.

What I claim is—

1. In a wireless signaling system, a wave-responsive device, a local circuit controlled thereby and including a winding of a transformer, a plurality of circuits supplied by said transformer, and means in each circuit for reproducing a signal.

2. In a wireless signaling system, a wave-responsive device, a circuit controlled thereby and including a winding of a transformer, a secondary circuit, and means included in said secondary circuit for producing a predetermined signal to the exclusion of others.

3. In a wireless signaling system, a wave-responsive device, a circuit controlled thereby, a circuit in inductive relation with said circuit, and means in said last-mentioned circuit for producing a signal independently of signals received simultaneously therewith.

4. In a wireless signaling system, a wave-responsive device, a circuit controlled thereby, a circuit in inductive relation with said circuit, and means in said last-mentioned circuit for producing a signal represented by wave trains succeeding each other at predetermined rate.

5. In a wireless signaling system, a wave-responsive device, a circuit controlled thereby, a circuit in inductive relation with said circuit, and means in said last-mentioned circuit for selecting a predetermined message.

6. In a wireless signaling system, a wave-responsive device, a circuit controlled thereby, a circuit in inductive relation with said circuit, and means for rendering said last-mentioned circuit selective of currents of predetermined frequency.

7. In a wireless signaling system, a wave-responsive device, a circuit controlled thereby, a plurality of circuits in inductive relation with said circuit, and means in each of said last-mentioned circuits for producing a separate and independent signal.

8. In a wireless signaling system, a wave-responsive device, a circuit controlled thereby, a plurality of circuits in inductive relation with said circuit, and means in each of said last-mentioned circuits for separating a signal from signals received simultaneously therewith.

9. In a wireless signaling system, a wave-responsive device, a circuit controlled thereby, a circuit in inductive relation with said circuit, and capacity and inductance in said last-mentioned circuit for rendering the same selective of a current representing a predetermined signal.

10. In a wireless signaling system, a wave-responsive device, a circuit controlled thereby, a plurality of circuits in inductive relation with said circuit, each of said last-mentioned circuits including frequency-determining elements for rendering it resonant with a current of a frequency dependent upon the rate of succession of wave-trains representing a predetermined signal.

11. In a wireless signaling system a wave-responsive device, a circuit controlled thereby, a circuit in inductive relation with said circuit, frequency-determining elements for rendering said last-mentioned circuit resonant with a current of a frequency dependent upon the frequency of succession of the wave-trains representing a predetermined signal.

12. In a wireless signaling system, a wave-responsive device, a circuit controlled thereby, means for rendering said circuit resonant with a current of predetermined frequency, and signal-producing means subjected to the potential difference existing at the terminals of the frequency-determining element of said circuit.

13. In a wireless signaling system, a wave-responsive device, a plurality of circuits controlled thereby, frequency-determining elements in each of said circuits rendering each circuit resonant with a current of different frequency, and a translating device subjected to the potential difference existing at the terminals of a frequency-determining element in each of said circuits.

14. In a signaling system, a wave-responsive device, a circuit controlled thereby, a circuit in inductive relation with said circuit, and means in said last-mentioned circuit for rendering the same selective of a current locally produced.

15. In a receiver of a wireless signaling system, a self-restoring wave-responsive device, a circuit controlled thereby and including a source of energy, a secondary circuit in inductive relation with said circuit and selective of a current fluctuating at a rate dependent upon the rate of succession of the transmitted wave-trains.

16. In a wireless signaling system, a receiving-conductor, a wave-responsive device influenced by a plurality of series of wave-trains, each series consisting of trains succeeding each other at characteristic rate, a circuit controlled by said wave-responsive device, a secondary circuit in inductive relation with said circuit, and a plurality of circuits coöperating with said secondary circuit, each of said circuits being selective of a message or signal represented by a series of wave-trains succeeding each other at characteristic rate.

17. In a wireless signaling system, a receiving-circuit attuned to the frequency of the transmitted energy-waves, a wave-responsive device influenced by energy received in said circuit, a local circuit controlled by said wave-responsive device, and a circuit in inductive relation with said local circuit and selective of a message represented by wave-trains succeeding each other at predetermined rate.

18. In a wireless signaling system, a receiving-circuit attuned to the frequency of the transmitted energy-waves, a wave-responsive device influenced by energy received in said circuit, a local circuit controlled by said wave-responsive device, and a plurality of circuits in inductive relation with said local circuit, each selective of a message represented by wave-trains succeeding each other at predetermined rate.

19. At the receiver of a wireless signaling system, means for producing electric currents fluctuating at a rate equal to the rate of succession of the wave-trains representing a message, means for transforming said currents, and a circuit traversed by the transformed currents and selective of said currents.

20. In the receiver of a wireless signaling system, means for producing a plurality of fluctuating currents, each current fluctuating at a rate equal to the rate of succession of the wave-trains representing a separate message, means for transforming said currents and impressing them upon a plurality of circuits, and means for rendering each circuit selective of a current of definite frequency and representing a separate message.

21. In a wireless signaling system, a receiving-circuit, means controlled thereby for producing a plurality of currents fluctuating at rates characteristic of independent messages, means for transforming said currents and impressing them upon a plurality of circuits, and means for rendering each of said circuits resonant with a current of a frequency characteristic of a separate and independent message.

22. In a wireless signaling system, a receiving-circuit, means controlled thereby for producing a plurality of fluctuating currents, each current fluctuating at a rate equal to the

rate of succession of the wave-trains representing a separate and independent message, means for impressing the energy of said currents upon a plurality of secondary circuits, each of said secondary circuits including frequency-determining elements rendering it resonant with a current representing a separate and distinct message, and a translating device subjected to the potential difference at the terminals of a frequency-determining element in each secondary circuit.

23. In a wireless signaling system, a wave-responsive device, a circuit controlled thereby, a circuit in inductive relation with said circuit, and an inductance and capacity in said last-mentioned circuit for rendering it selective of a current fluctuating at predetermined rate.

24. In a wireless signaling system, a wave-responsive device, a circuit controlled thereby, a circuit in inductive relation with said circuit, and an inductance and capacity in series in said last-mentioned circuit for rendering it selective of a current fluctuating at a predetermined rate.

25. In a wireless signaling system, means for subjecting a wave-responsive device to electroradiant energy of predetermined frequency, a circuit controlled by said wave-responsive device, a circuit in inductive relation with said circuit, and means in said last-mentioned circuit for selecting a predetermined message.

26. In a wireless signaling system, a wave-responsive device, means for subjecting said wave-responsive device to electroradiant energy of predetermined frequency, a circuit controlled by said wave-responsive device, a circuit in inductive relation with said circuit, and means for rendering said last-mentioned circuit selective of currents of predetermined frequency.

27. In a wireless signaling system, a wave-responsive device, means for subjecting said wave-responsive device to the effects of electroradiant energy of predetermined frequency, a circuit controlled by said wave-responsive device, a circuit in inductive relation with said circuit, and means for rendering said last-mentioned circuit selective of currents having a frequency dependent upon the rate of succession of the transmitted wave-trains.

28. In a wireless signaling system, a receiving-circuit adjusted as to its electrical constants as to be selective of electroradiant energy of predetermined frequency, a wave-responsive device associated with said receiving-circuit, a circuit controlled by said wave-responsive device, a circuit in inductive relation with said circuit, and means in said last-mentioned circuit for selecting a predetermined message.

29. In a wireless signaling system, means for securing double selectivity comprising a receiving-circuit adjusted as to its electrical constants as to be selective of electroradiant energy of predetermined frequency, a wave-responsive device associated with said receiving-circuit, a circuit controlled by said wave-responsive device, a circuit in inductive relation with said circuit, and means for rendering said last-mentioned circuit selective of currents having a frequency dependent upon the rate of succession of the transmitted wave-trains.

30. In a wireless signaling system, a receiving-circuit selective of the effects of electroradiant energy of definite frequency, a wave-responsive device associated with said receiving-circuit, a circuit controlled by said wave-responsive device, a circuit in inductive relation with said circuit and means for rendering said last-mentioned circuit selective of currents having a frequency dependent upon the rate of succession of the transmitted wave-trains, whereby a message or signal represented by electroradiant energy of predetermined frequency transmitted in wave-trains succeeding each other at predetermined rate is selected to the exclusion of others.

HARRY SHOEMAKER.

Witnesses:

JOHN CONNELL,
ALICE T. BURROUGH.