

March 19, 1935.

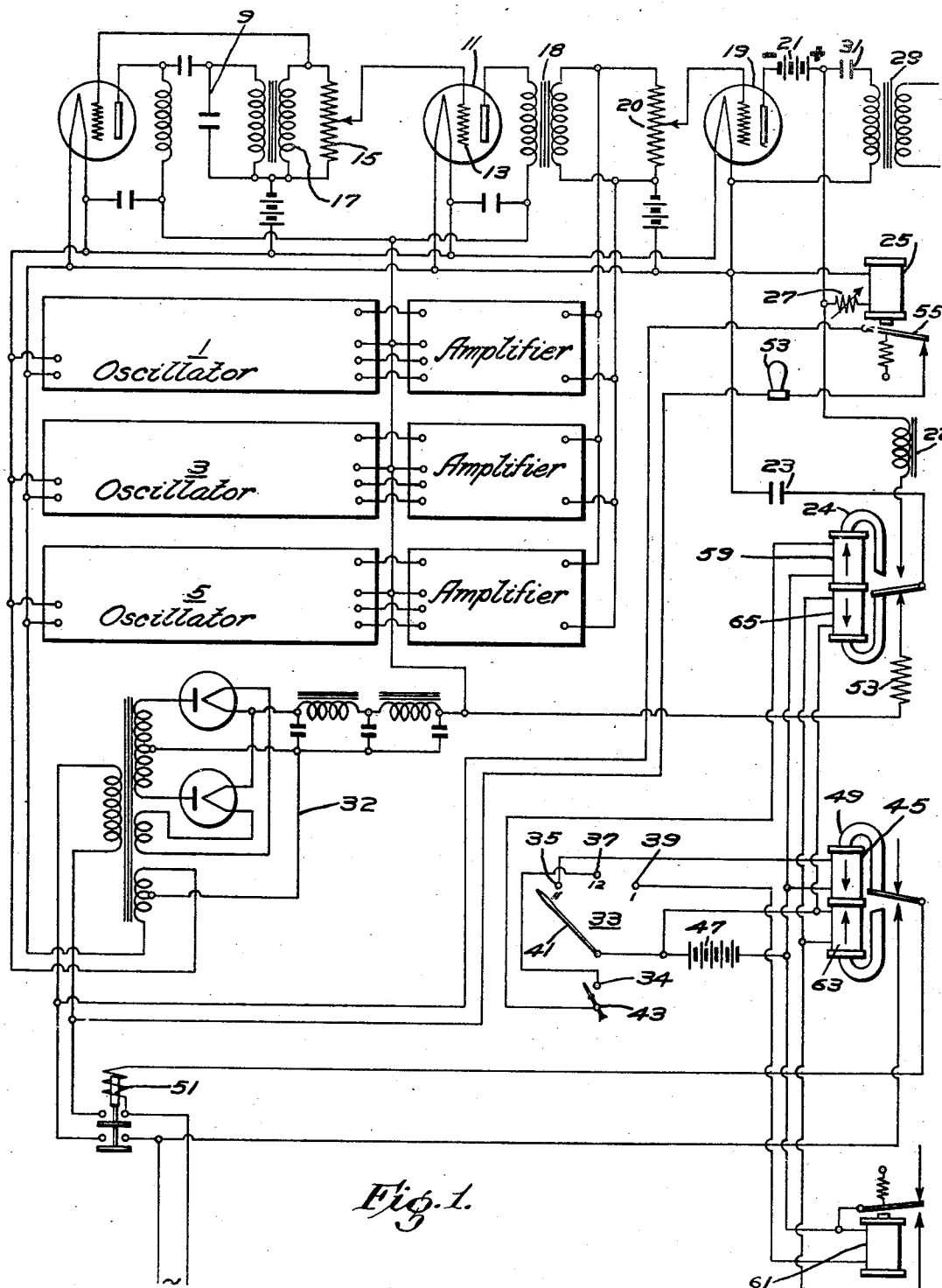
V. E. TROUANT

1,994,902

RADIO TRANSMITTING SYSTEM

Filed Oct. 6, 1930

2 Sheets-Sheet 1



INVENTOR

Virgil E. Trouvant.

BY
Charles E. Carr
ATTORNEY

March 19, 1935.

V. E. TROUANT

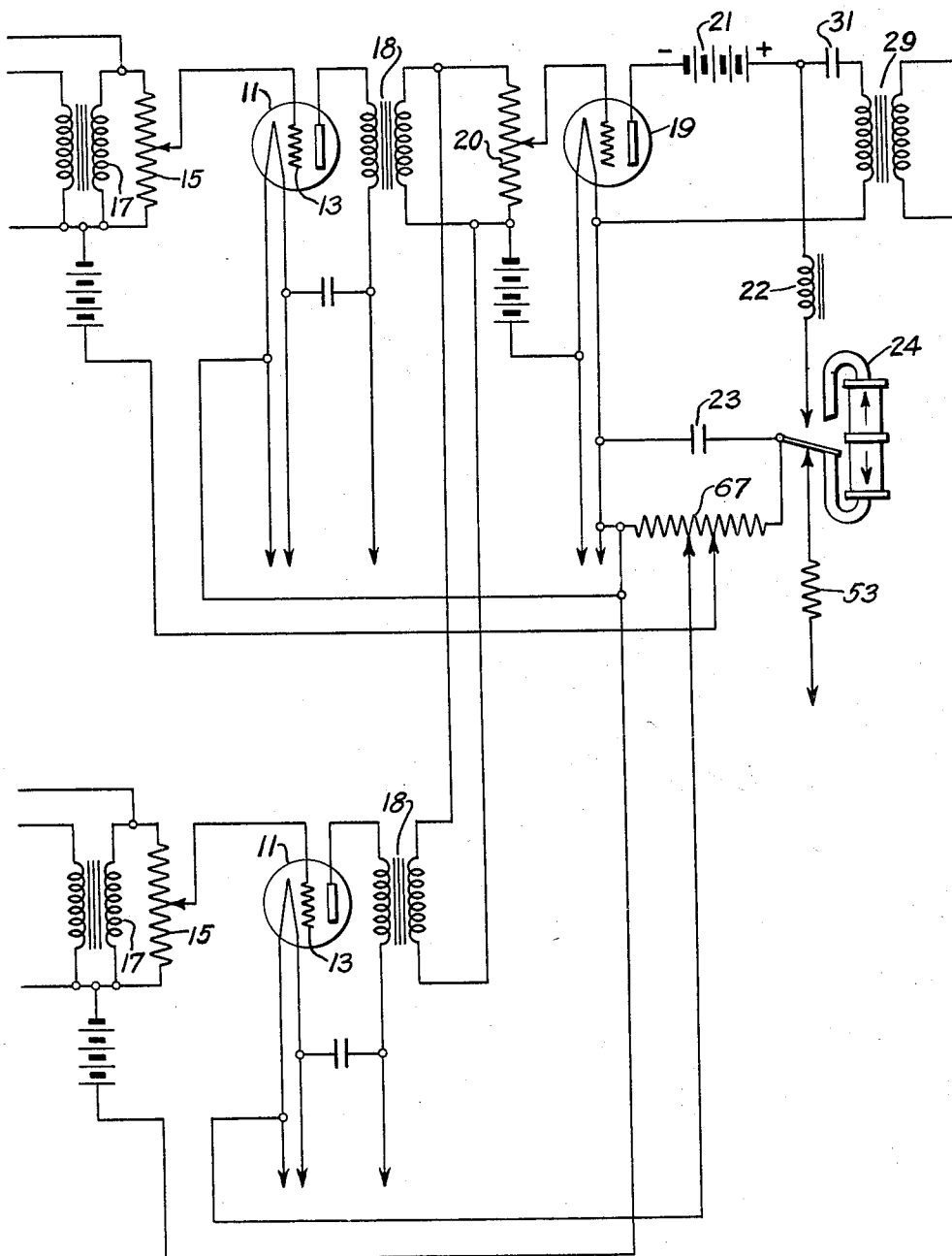
1,994,902

RADIO TRANSMITTING SYSTEM

Filed Oct. 6, 1930

2 Sheets-Sheet 2

Fig. 2.



WITNESSES:

Leon J. Taya
Broder

INVENTOR

Virgil E. Trouant

BY

F. W. Lyle
ATTORNEY

UNITED STATES PATENT OFFICE

1,994,902

RADIO TRANSMITTING SYSTEM

Virgil E. Trouant, Wilkinsburg, Pa., assignor to
Westinghouse Electric & Manufacturing Com-
pany, a corporation of Pennsylvania

Application October 6, 1930, Serial No. 486,616

4 Claims. (Cl. 177-7)

My invention relates to radio transmission systems and it has particular relation to systems for automatically broadcasting time-signals.

It has previously been proposed to re-broadcast in the United States, the hourly time signals received by radio from London, such signals to be derived, at the original transmitting station abroad, from the notes of "Big Ben", a famous bell hanging in the House of Parliament. By reason of the fact, however, that satisfactory radio reception of the notes of Big Ben cannot always be had, on account of static, fading and other disturbances, it becomes desirable to generate locally the tone of a bell of the type referred to whereby dependence upon the reception of signals from across the ocean will not be necessary.

It is, accordingly, one object of my invention to provide means for simulating the tone quality of a bell and transmitting the same at predetermined time intervals, as for example, a stroke each hour or at more frequent intervals, as desired.

Another object of my invention resides in a very efficient and economical system for accomplishing the desired results.

Additional objects of my invention will be disclosed in the following description taken in conjunction with the accompanying drawings wherein I have disclosed in Figure 1, a diagrammatic sketch of a system capable of functioning to produce the results desired.

Figure 1 of the accompanying drawings is a circuit diagram illustrating an embodiment of my invention.

Fig. 2 is a circuit diagram of a portion of the circuit of Fig. 1 to which has been added an improved feature.

In the system, as devised by me, I provide a plurality of oscillators, each tuned to a different audio frequency, the particular frequencies being such as would constitute the fundamentals of the basic notes of a bell. The quality of a bell tone which is determined by the overtones generated by it, will, in my synthetic bell system, be supplied by the harmonics appearing in the oscillatory circuits. The magnitude of these harmonics may be varied to obtain quality of reproduction by altering the anode potentials on an oscillator tube with respect to its heated cathode.

As examples of the fundamental frequencies generated in the oscillation generators, I have found that the following frequencies, 153, 184, 228 and 312 cycles, together with their harmonics give me a very good reproduction of the tone quality of a bell. Another combination of fundamental

frequencies which I have found very suitable for the purpose is 107—128—160—214. Tone quality of bells of different pitch may, of course, be simulated by merely changing the fundamental frequencies of the oscillation generators utilized in the system. To accurately reproduce the tone of a bell, all the fundamental frequencies should not bear the harmonic relationship to each other. I also consider it within the scope of my invention to combine a plurality of synthetic bell tones whereby the effect of chimes may be simulated.

Referring more particularly to the drawings, I have disclosed a plurality of oscillation generators 1, 3, 5, in block representation and one represented by numeral 7 showing the circuits embodied therein. This particular circuit arrangement of the oscillator is representative of the others, and for this reason, I have disclosed only one of them in detail. This oscillation generator comprises a standard oscillating circuit 9 which is coupled to an amplifying tube 11, the grid 13 of which is connected to a variable resistor 15 shunting the input coil 17 of the oscillator. This adjustable contact means provides a method of volume control, variations of the contact along the resistor 15 controlling the amplitude of the oscillatory current in the input circuit of the amplifying tube thereby changing the grid potential impressed on the grid of that tube.

All of the oscillation generators are connected in parallel arrangement to a common amplifying tube 19 through audio transformers 18, as specifically illustrated in the circuit arrangement of the detail diagram of the one oscillator. The coupling to the common amplifier 19 is similar to that of the coupling provided between the oscillator 7 and its individual amplifier 11, that is, the grid is connected to a variable resistor 20 shunted across the output or secondary of the audio transformer coupling 18, thereby providing additional volume control means for the system.

One of the chief difficulties encountered in the development of my system was to prevent some tone appearing in the output circuit of the common amplifier when there was no positive plate potential on the anode. Merely maintaining the anode free of a positive plate potential is not sufficient. I have solved the difficulty in the following manner:

In the output circuit of the common amplifier, I provide a battery 21 of sufficient potential and connected in such a manner as to place a negative potential on the plate of such value as to render the amplifier normally inoperative. This arrangement will absolutely prevent electrons

from being attracted to the anode, and consequently no tones can appear in the output circuit at any time unless a positive potential is impressed on the anode.

5 In the same circuit, I also provide an audio frequency choke 22 in serial connection with a condenser 23 through the armature of a polarized relay 24. In parallel arrangement to said choke and condenser, I provide a single pole relay 25 in series with a variable resistor 27. The output energy of the amplifier is transmitted to a broadcasting means (not shown), through a transformer 29 and a direct current blocking condenser 31, in series with the primary of the transformer 29.

10 Energy for the system is derived from a socket power unit 32, commonly referred to as an S. P. U. circuit, which is supplied from an alternating current supply, preferably, an ordinary 110 volt lighting circuit. Under normal conditions, the alternating current supply is maintained in disassociated relationship to the S. P. U. circuit, as it is desired, in a system of the type comprising my invention, that the energy be connected to the system only at those predetermined intervals when utilized.

20 Since it is one object of my invention to broadcast a signal once every hour it will, therefore, be necessary to connect the source of energy only once per hour. To accomplish this result, I provide what might be termed a secondary clock element 33 having three contacts or terminals 35, 37, 39 on its face at such points as correspond to the 11, 12 and 1 o'clock indications and one contact representing the sixty second indication on the face of a standard timepiece. A minute hand 41 and a second hand 43 are also provided, the minute hand making one complete revolution per hour, whereas the second hand is designed to traverse one revolution per minute.

40 Assume, for purposes of further explanation, that the minute hand is approaching the hour when it will be desired to broadcast a signal. After the hand approaches and makes contact with the first terminal 35 which represents a time of five minutes to the hour, a circuit will be completed through one of the coils 45 of a polarized relay 49, the source of energy to which is supplied from a battery 47. The energization of the coil 45 will cause the armature of the relay 49 to shift thereby closing a circuit through a circuit-closing device 51, the function of which is to connect the alternating current source of energy to the S. P. U. circuit. During the five minute interval elapsing while the minute hand traverses the distance between the first contact 35 and that at terminal 37, energy will be supplied to the filaments, and the anodes of the respective tube circuits except that of the output tube 19, thereby permitting ample time for these circuits to become stabilized. Also, during this period, energy from the plate supply source will be impressed through the resistor 53 and the armature of the polarized relay 24 across the condenser 23 in the plate circuit of the common amplifier 19, thereby charging the condenser to substantially the voltage of the supply source.

70 In order to indicate the completion of the operation of the circuit closing device 51 and its associated circuits, I provide a signal lamp 53 connected across the alternating current supply source on the circuit side of the closing device, the circuit through the lamp comprising the armature 55 of the single pole relay 25, which arma-

ture is normally maintained in closed position by a spring element.

When the hand 41 reaches the second terminal 37 and makes contact therewith, the circuit through that contact will not be completed until the second hand swings around and makes contact or closes the circuit at the contact 34. This arrangement insures the operation of the signal on the second. Connections of these hands on their respective contacts will put the battery 47 across one of the coils 59 of a polarized relay 24 to break the circuit to the charged condenser 23 and connect said condenser in the plate circuit of the common amplifier tube 19. The condenser being of a much higher potential than that of the battery 21 in that circuit, will be caused to discharge in a direction whereby a positive potential will be impressed on the plate of that tube, thereby temporarily rendering said tube operative.

20 The amplifying tube remains in this operative condition only during the discharge period of the condenser, during which time the various frequency currents generated by the oscillators, together with their harmonics, will find an outlet through the transformer coupling 29 to the transmitting apparatus. The sudden discharge of the condenser will so modulate the tone frequency currents as to produce what might be termed, for want of a more appropriate expression, the "bong" of a bell. As the condenser discharge tapers off to its minimum value, the positive potential on the plate will gradually grow smaller with the result that the magnitude of the output energy will gradually fade, thereby producing the fading effect, so characteristic of bell tones.

The variable resistor 27 is made adjustable whereby the rate of fading or the duration of the fading effect may be controlled.

40 At the moment of the condenser discharge, sufficient current passes through the relay 25 to attract the armature 55, thereby opening the circuit to the indicating lamp 53. Since this circuit is broken momentarily only when the signal is broadcast, it serves as an indication of the operation of the circuit.

After the circuit to the coil 59 of the relay 24 is broken, which occurs when the second hand 43 leaves its contact 34, a desire for another signal does not exist until the lapse of another hour. Consequently, it becomes desirable from an economic viewpoint to remove the source of energy from the system and return the circuits and relays to their initial state. This is accomplished after a five minute interval when the hand 41 closes a circuit through the third contact 39, at which time the battery 47 is put across the relay 61, the operation of which serves to close a circuit through the coil 63 of the relay 49 thereby breaking the circuit to the closing device 51, causing said device to fall out and disconnect the alternating current supply from the system. At the same time, the armature associated with the relay 24 is pulled back because of the energization of the coil 65 of said relay, thus placing the condenser back in the charging circuit where it will be in position for another charging operation at the moment the alternating current supply is again placed in connection with the system.

75 The use of polarized relays in the system is highly desirable. One difficulty encountered in systems wherein circuits are controlled by clock arrangements is to obtain reliable contacts on

the clock. It is apparent that undue pressure cannot be brought to bear between the clock hand and its associated contacts to obtain and maintain good contact, as this would interfere to slow up the action of the timing mechanism, and where accuracy is needed, this effect would not be desirable.

One of the characteristics of a polarized relay is that it is stable in any operating position without external influences being required to hold it in that position, and an external force is necessary to cause it to shift its operating position.

Therefore, referring back to the drawing, when the hand 41 touches the contact 35, the relay 49 will operate to swing the armature as described above. This relay will maintain this operating position regardless of whatever chattering may occur at the contact 35. It will also maintain this position until the minute hand makes contact at the third terminal 39, at which time the relay 49 will be caused to assume a new operating position. Therefore, any variations occurring in the electrical contacting means of the clock arrangement will not affect the operation of the system.

It will be apparent to those skilled in the art that various changes may be made which will lie within the scope of my invention. In place of the battery 21 in the plate circuit of the common amplifier, I might, for example, bias the grid of the tube 19 at, or just beyond the cutoff point, during which state the amplifier will be inoperative, and I might utilize a condenser or other means for impressing a positive bias or positive potential on said grid at the moment when it is desired that a signal be given. Other equivalent changes will suggest themselves to one skilled in the art. I might, as an example, suggest the use of photo-cell circuits or other light sensitive devices instead of contact means on the clock face as another change existing within the contemplation of my invention. In lieu of the clock arrangement for timing the operation of the system, I contemplate, also, the use of a film for operating the system at predetermined intervals, or I might record the bell tones on the film and broadcast them directly from the film at regular time intervals.

An additional change which I might suggest as being within the scope of my invention, comprises means whereby certain secondary reactions in bell tones may be reproduced to add to the perfection and accuracy of the tones developed in my system.

In the analysis of bell tones, it is usually found

that certain of the harmonics increase in volume during such intervals as the fundamental decreases. To simulate this characteristic, I might shunt the condenser 23 in the discharge circuit with a resistor 67 and incorporate portions of this resistor in the input circuit of the amplifier tubes 11 to provide additional grid bias for said tubes. Connections may be made as illustrated in Fig. 2 in such manner as to cause the grid bias on certain of the tubes 11 to increase and on others of the tubes 11 to decrease during discharge of the condenser 23. Consequently, when the condenser 23 discharges, the output of some of the amplifiers will have a tendency to increase in volume while others decrease to produce the effect referred to above.

Therefore, while I have disclosed my invention in great detail, I do not desire to be limited to such details, except, insofar as is necessitated by the prior art and the spirit of the appended 20 claims.

I claim as my invention:

1. Synthetic electrical tone producing apparatus comprising means for generating current at tone frequencies, means providing an outlet for said tone frequency current and means connected in said outlet for said tone frequency for causing said current of tone frequency to fade at a predetermined rate.

2. Synthetic tone producing apparatus comprising means for generating current at a plurality of frequencies, means automatically providing an outlet for said frequency current at predetermined intervals of time, and means for causing said frequency current to fade at a predetermined rate when such outlet is provided.

3. Synthetic tone producing apparatus comprising means for generating current at a plurality of frequencies, means providing an outlet for said current, means for causing said current to fade, and means for controlling the rate of fading.

4. Synthetic electrical tone producing apparatus comprising a plurality of oscillation generators adjustable to different tone frequency currents, an amplifier, means for connecting said oscillation generators to said amplifier, means for causing said amplifier to become operative, means for causing said tone frequency currents to fade during said operative periods, and means also during said operative periods, for causing certain of said tone frequency currents to increase in amplitude relative to others of said currents.

VIRGIL E. TROUANT. 55