

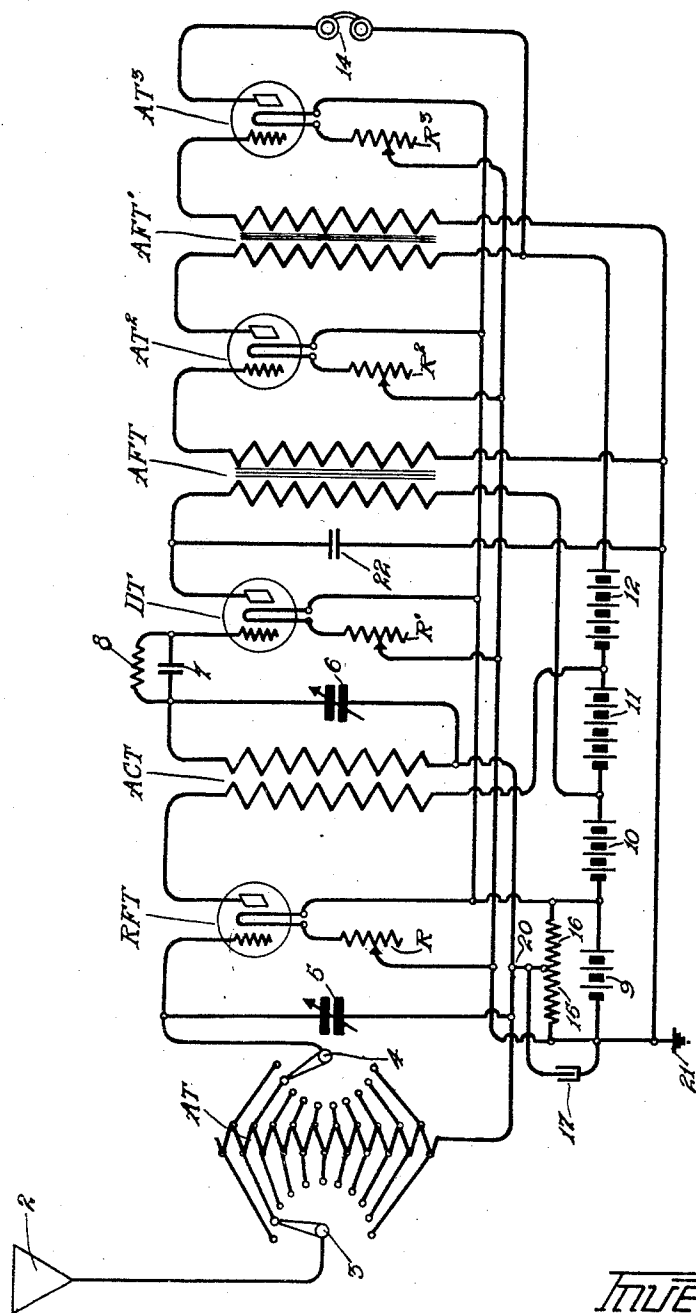
Jan. 31, 1928.

H. D. CURRIER

1,657,567

METHOD OF RECEIVING ELECTRICAL OSCILLATIONS

Filed Nov. 12, 1924



Inventor:
Hiram D. Currier.
By *Curtis* *Attorney.*

UNITED STATES PATENT OFFICE.

HIRAM D. CURRIER, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

METHOD OF RECEIVING ELECTRICAL OSCILLATIONS.

Application filed November 12, 1924. Serial No. 749,366.

My invention relates to wireless telegraphy and telephony and resides in certain novel circuit arrangements for such systems, and in the accompanying drawing my invention is shown as employed for the reception of signals. The invention however is not limited to receiving purposes and its objects are to provide a novel and improved organization of the elements comprising such a system and which provides an arrangement affording sharpness of tuning, power and clearness in respect of the signals received.

The accompanying drawing diagrammatically shows a preferred organization embodying the invention in which 2 illustrates the antenna connected to an auto-transformer AT. I provide a pair of switches 3 and 4 for the auto-transformer so that the number of turns both in the primary and secondary of the same may be varied to make the same operate efficiently over the wave band of oscillations to which the receiving circuit is adapted to respond. Across the auto-transformer, I provide a variable capacity 5 for turning the same. With my arrangement as shown, I provide a radio frequency audion tube RFT, a detector tube DT and two other audion tubes AT² and AT³ for so called audio frequency amplification. The radio frequency tube is connected to the detector tube through an air core transformer ACT which has a substantially one to one ratio between the primary and secondary thereof. I tune the secondary of the transformer ACT by means of a variable capacity 6, the detector tube DT being coupled to the tube AT² by means of an iron core transformer AFT and the tube AT³ is related to the tube AT² by means of an iron core transformer AFT'. I provide the usual grid condenser and grid leak 7 and 8 which are connected to the grid member of the detector tube DT.

I have shown a separate variable resistance for controlling the current flow of the filaments for each of the audion tubes, but it is understood that one rheostat may be used for two or more tubes. A low voltage

battery 9 is provided for furnishing current to heat the filaments of the audion tubes. I provide higher voltage batteries 10, 11 and 12 for furnishing current to the plates of the audion tubes. At 14, I provide an oscillation receiving device which is shown in the drawing as a pair of receivers but may be any other desired receiving device. I have found it desirable in my arrangement to provide substantially a zero potential upon the grids of the tubes RFT and DT. To accomplish this arrangement, I have provided a pair of coils 15 and 16 bridged across the battery 9, the central point of these coils being connected to the grid returns of the tubes RFT and DT. If found desirable, a variable device such as a potentiometer may be used in place of the arrangement which I have just described. To provide a path that the incoming oscillations will readily travel, I have provided a condenser 17 bridged from point 20 to ground at 21. This condenser is of a size to readily pass the high frequency incoming oscillations.

I have determined that in an arrangement which is adapted to receive oscillations that vary a great deal in their frequency, that is, to receive oscillations of different wave lengths, that it is necessary to have the number of turns of the primary and secondary of the air core auto transformer AT variable to receive the maximum and most efficient operation of the same. Likewise, I find that where it is desired to receive incoming oscillations that do not vary a great deal from interfering oscillations that I can very nicely receive the desired oscillations without interference from interfering oscillations by regulating the number of turns of the auto-transformer in the primary and secondary of the same.

I further provide a condenser 22 connected from one terminal of the audio frequency transformer AFT to the grounded terminal of the battery 9 for the usual and well known purpose. I find that by having an efficient coupling between the antenna and the grid of the radio frequency tube

RFT in the nature of the auto transformer AT, that the rheostat plays an important part in bringing in the signal with maximum sharpness and volume.

5 When an incoming oscillation is to be received the switches 3 and 4 of the auto transformer are so set as to receive the best coupling effect between the primary and secondary thereof that the radio frequency
10 tube will readily handle. The condensers 5 and 6 are then operated to tune the coils to the wave length or to the cycle of the incoming oscillations. The rheostat controlling the heating current of the filament of the
15 radio frequency tube RFT may then be operated to change the current flow through the filament of said tube until the signal is received in the desired manner. The two condensers 5 and 6 and the rheostat R form
20 the main tuning units of the arrangement, the switches 3 and 4 being set according to the wave lengths of the oscillations that it is desired to receive.

The incoming oscillations are effective on
25 the audion tube RFT in the usual manner by way of the grid element, so that the potential changes operate the grid element through the medium of the auto transformer AT. The selected oscillations are then supplied to
30 the primary of the air core transformer ACT by the plate of the radio frequency tube. The secondary of the transformer ACT being tuned permits the selected repeated oscillations to act upon the grid of the detector
35 tube DT, which in return repeats the impulses through the primary of the audio transformer AFT and from the secondary of the audio frequency transformer AFT through the tubes AT² and AT³ by way of
40 the audio frequency transformer AFT', to the receiving device 14. By having the primary of the air core transformer ACT of substantially the same number of turns as the secondary thereof, and by having an efficient
45 coupling between the aerial and the radio frequency tube RFT, the grid of the detector tube is supplied with strong potential changes, and by using a zero potential upon the grids of the first two tubes I provide a
50 system which is extremely efficient and produces remarkable results. The transformers AT and ACT are preferably of the type disclosed in my co-pending application, S. N. 744,465, filed the 18th day of October, 1924.

55 On account of the very high frequency of the oscillatory currents involved in systems of this character and their tenuity together with the sensitively balanced effects that exist when such systems are operated, it is, as is well known, quite difficult to ascertain the precise actions and re-actions involved as applications of tests sometimes render ineffective the very matters that it is sought to consider.

60 The preceding description and explanation

will enable anyone skilled in the art to practice the invention and the analysis given is believed to indicate the principal effects involved in the results obtained.

Having described my invention what I claim as new and desire to secure by Letters Patent is:

1. A receiving circuit including a transformer having a continuous winding, one end of the same being permanently connected
75 thru a fixed condenser to earth, an oscillation receiving device, means for variably associating said oscillation receiving device with turns of said transformer, an audion tube having a control element and an anode,
80 means for variably associating said control element with other turns of said transformer, said two means functioning to provide a variable turn ratio between the input circuit including said oscillation receiving device
85 and the output circuit including said turns of said transformer, a variable condenser permanently connected to said grid control element and said fixed condenser across the turns in the input and output circuits of said
90 transformer but adapted to be variably associated with the winding of said transformer depending upon the association of said control element with said transformer, a second transformer having a primary connected to
95 the anode of said audion tube, a secondary winding for said second transformer, a variable condenser connected across said secondary winding for resonating the same to the desired frequency, and a second audion tube
100 connected to said secondary winding for receiving oscillations from said secondary winding and adapted to detect and relay the same to a reproducer.

2. A receiving circuit including a transformer having a continuous winding, a fixed
105 condenser and a potentiometer permanently connected to one end of the winding of said transformer, an oscillation receiving device, means for variably connecting said oscillation receiving device with turns nearest the
110 end of said transformer connected to said condenser and potentiometer, a relay amplifier having a control element and a plate, means for variably associating said control element with other turns of said transformer
115 away from the end thereof connected to said potentiometer and condenser, said two means being controlled to provide variable turn ratios between the input circuit including
120 said oscillation receiving device and the output circuit including turns of said transformer, a variable condenser permanently connected to said control element and said fixed condenser and potentiometer across the
125 effective turns of the transformer but adapted to be variably associated with the winding of said transformer depending upon the connection of said control element with said transformer, a second transformer having a
130

pair of windings, the primary winding of said transformer being connected to the anode of said relay amplifier, a variable condenser connected across the secondary winding of said transformer for resonating the same, an audion tube having its control element connected to the secondary winding of said second transformer and adapted for detecting oscillations received by said oscillation receiving device. 10

Signed by me at Chicago, county of Cook and State of Illinois, this 10th day of November, 1924.

HIRAM D. CURRIER.