Mar. 6, 1923. 1,447,793

M. LATOUR

RADIO RECEIVING SYSTEM

Filed Aug. 19, 1921 2 sheets-sheet 1

Fig. 1

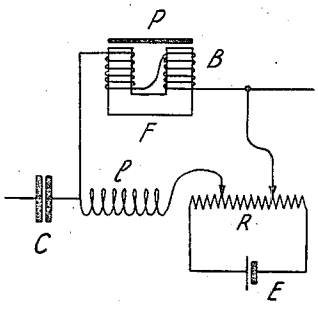


Fig. 2

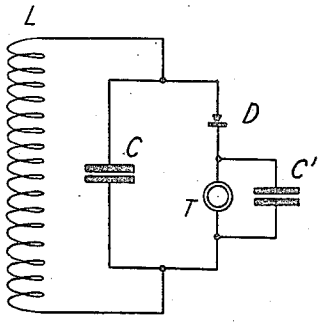


Fig. 3

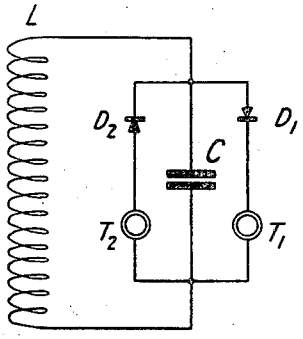
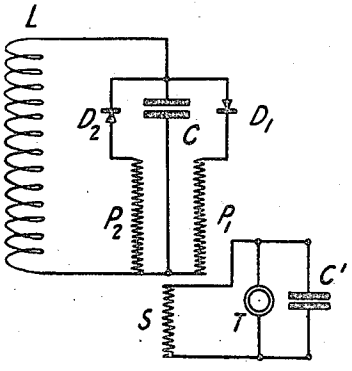


Fig. 4



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Fig. 5

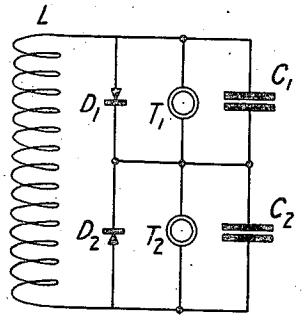


Fig. 6

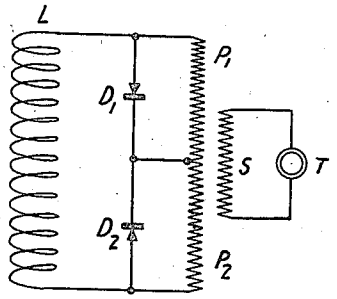
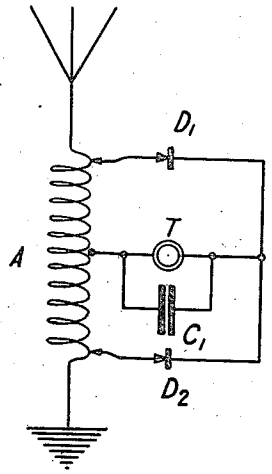


Fig. 7



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UNITED STATES PATENT OFFICE.

MARIUS LATOUR, OF PARIS, FRANCE.

RADIO RECEIVING SYSTEM.

Application filed August 19, 1921. Serial No. 493,660.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, MARIUS LATOUR, a citizen of France, and resident of Paris, France, have invented certain new and useful Improvements in Radio Receiving Systems (for which I have filed application in France, Feb. 11, 1915, patented June 15, 1920), of which the following is a specification, accompanied by drawings.

The present invention relates to improvements in circuit arrangements of radiotelegraphic receiving stations for the purpose of increasing the sensitiveness of the receiving and making possible the application of the principle of heterodyne action in the reception of Hertzian waves.

As well known, in the case of crystal detectors, the rectified portion of the current is proportional to the square of the alternating potential v acting on the circuit comprising the detector. On the other hand, if a potential V of a slightly different period is introduced into the receiving circuit, it is found that the sensitiveness of the receiving increased with the potential V up to a certain limit.

It has been found advisable to increase V until the law of the square no longer holds good and up to a point beginning at which the rectified portion of the current is simply proportional to the potential applied to the detector. The increasing of V above this value will be useless.

The only difficulty that will be encountered in increasing V will be the presence of a permanent rectified current in the telephone. This permanent current will cause the permanent attraction of the diaphragm that may cause a lowering of the sensitiveness of the telephone. As a result of this, beginning with a certain value for V, the increase in sensitiveness corresponding to the increase of V will be concealed.

This disadvantage may be remedied in the following simple manner:

A simple expedient is to use telephones provided with magnets of lower magnetization. The permanent rectified current would only add its effect to the magnetism of the magnet to supplement its insufficiency and produce the necessary permanent induction under the diaphragm. It is also conceivable that we may operate without a permanent magnet and use only the rectified current for producing the necessary permanent induction.

In the drawings, Fig. 1 shows the general arrangement of the telephone to be used, Fig. 2 shows a circuit for receiving with a crystal detector, Figs. 3, 4, 5 and 6 show arrangements with two detectors, and Fig. 7 shows a circuit arrangement in which a mercury rectifier is used.

The general arrangement of the telephone to be used is shown in Fig. 1 in which P represents the vibrating diaphragm, F the magnetic core and B the coil of the telephone.

The telephone is energized by means of a current of the proper continuous potential and direction passing through the telephone coil B. This continuous potential is obtained in the usual manner at the terminals of a potentiometer R supplied with current from a battery E. The self induction coil l is inserted for the purpose of preventing the passage of the telephonic current through this branch. The direct current source may produce a current of the same direction as the rectified current, or even current of the opposite direction.

The direct current source may or may not be connected with the detector depending whether or not the latter is protected by a capacity C in series.

If there is no objection against new losses, a simple transformer may be used.

In this manner, the passage of the permanent rectified current through the telephone circuit will be prevented and the ordinary telephone action will be preserved.

As above stated, beginning with a certain value of V, it is impossible to increase the sensitiveness of the heterodyne. A method will be explained which makes possible a further increase of this sensitiveness after the increase of V becomes inefficacious.

The circuit shown in Fig. 2 is used for receiving with crystal detectors and contains one embodiment of the invention. L represents the secondary inductance of the receiving circuit. The detector D in series with the telephone T is connected in parallel with the condenser C. An additional condenser C′ is connected in parallel with the telephone T. No matter what may be said of the operation of a crystal detector, apparently it rectifies part of the alternating

current by which it is traversed. Whether this is caused by the effective rectification of the alternating current or the appearance of a continuous E. M. F. of thermo-electric origin, is without consequence on the phenomenon in the shunt D—T. Under all circumstances the conclusions would be the same.

The crystal detector acts actually only as an imperfect rectifier, but we may nevertheless consider it as a perfect rectifier for a certain portion of the alternating current, the only portion that affects the receiving. The non-rectified portion corresponds to an alternating current which passes without useful effect at least through the general inductance and the capacity of the receiving circuit.

Limiting ourselves to the rectified portion of the current, it should be remembered that only one-half a wave of the alternating current is utilized in the telephone circuit, the other half being suppressed. Notwithstanding this, one might conclude from the reasoning that is to follow that, the quantity of the rectified electricity may be deducted from two successive half waves.

Referring to Fig. 2, as long as the direction of the current in the general circuit is such that it may pass through the detector D, it will pass through L, D and T, and the condenser C will receive only a weak charge. When the direction of the current is reversed, the condenser will on the contrary receive a strong charge, and it might happen that the quantity of the electricity thus stored be added by the discharge of the condenser through DT to the electricity effectively rectified during the following half period.

Nevertheless, in such reasoning it must not be overlooked that the two waves of the oscillating current cannot be equally absorbed, and that a current having symmetrical waves is out of the question in the receiving circuit. As a matter of fact, the condenser C can under no circumstances take other than alternating current transporting equal quantities of electricity of both directions and that the circuit DT absorbs only direct current.

The sum of these two currents will therefore never be an alternating current that transports equal quantities of electricity of both directions and there can be no question of a useful sine wave current in the receiving circuit and of supplying energy for each half wave. However, a perfectly symmetrical arrangement may be realized by using two detectors. This is shown in the following figures.

Fig. 3 shows an arrangement in which two detectors D_1 and D_2 are connected in the opposite direction with respect to the main circuit comprising inductance L and capacity C. T_1 and T_2 are two telephone receivers. A single receiver may be used, but it must be provided either with two distinct windings or use must be made of a transformer having two primary windings P_1 and P_2 simultaneously acting on a single secondary winding S, as shown in Fig. 4.

The arrangement with two detectors shown in Figs. 3 and 4 may have the form of Figs. 5 and 6. In Fig. 5 detectors D_1 and D_2 connected in opposite directions, are respectively in parallel with T_1, C'_1 and T_2, C'_2. In Fig. 6 a transformer is provided with two primary windings P_1, P_2 and a secondary S and the other reference characters designate the same elements as in Figs. 3 and 4.

The circuit arrangement shown in Fig. 7 also may be used. In this arrangement a mercury rectifier is used, the self induction of the antenna being employed as an auto transformer.

If the circuit arrangements of Figs. 3, 4, 5, 6 and 7 are combined with the use of the heterodyne, consisting in the introduction of an E. M. F. V and an auxiliary E. M. F. V in the main circuit and if a sufficiently large auxiliary E. M. F. V is used so that the rectified portion of the current be in proportion with the potential applied to the two detectors, twice as sensitive a receiving circuit may be obtained as in case the usual quantities are used.

Having described my invention, what I claim is:

1. In a radio signaling system, the combination with a detector and a telephone of a heterodyne receiver connected thereto having the auxiliary E. M. F. of the heterodyne adjusted to a high value whereby a permanent rectified current component results in the telephone, means for magnetizing the magnet of said telephone and means for varying said magnetization, said means being adjusted to a point such that the resultant magnetization due to said rectified current and said magnetizing means maintains the sensitiveness of the telephone.

2. In a radio signaling system, the combination of a heterodyne receiver, a pair of rectifiers adapted to rectify currents from opposite directions, a coil associated with each detector and indicating means associated with said coils.

3. In a radio signaling system, the combination of a heterodyne receiver, a pair of rectifiers adapted to rectify currents from opposite directions, a coil associated with each detector, indicating means associated with said coils and a condenser in parallel thereto.

4. In a radio signaling system, the combination of a heterodyne receiver, a pair of oppositely connected rectifiers connected to said receiver and a telephone connected to each detector and to the receiver.

5. In a radio signaling system, the combination of a heterodyne receiver, a pair of oppositely connected rectifiers connected to said receiver and a telephone connected to each detector and to the receiver, and a capacity in said receiver connected in parallel to a detector and telephone.

6. In a radio signaling system, the combination of a heterodyne receiver, a pair of rectifiers connected thereto and in parallel to each other adapted to rectify currents from opposite directions, a coil connected to each detector and a telephone circuit coupled to each of said coils.

7. In a radio signaling system, the combination of a heterodyne receiver, a pair of rectifiers connected thereto and in series with each other with the opposite poles connected together, a coil connected in parallel with each rectifier and indicating means associated with each of said coils.

8. In a radio signaling system, the combination of a heterodyne receiver, a coil associated with said receiver, a telephone connected to an intermediate point of said coil in parallel with a pair of rectifiers connected to opposite sides of said coil.

MARIUS LATOUR.