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C. S. DEMAREST

TELEGRAPH SYSTEM

Filed June 28, 1924

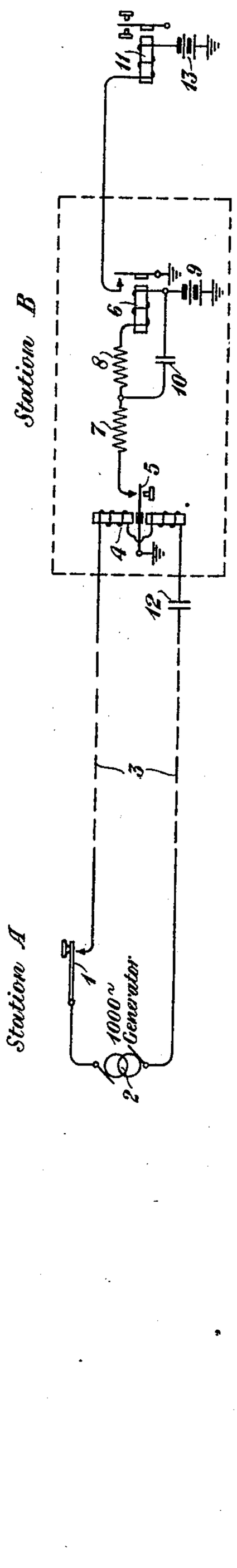

Fig. 1

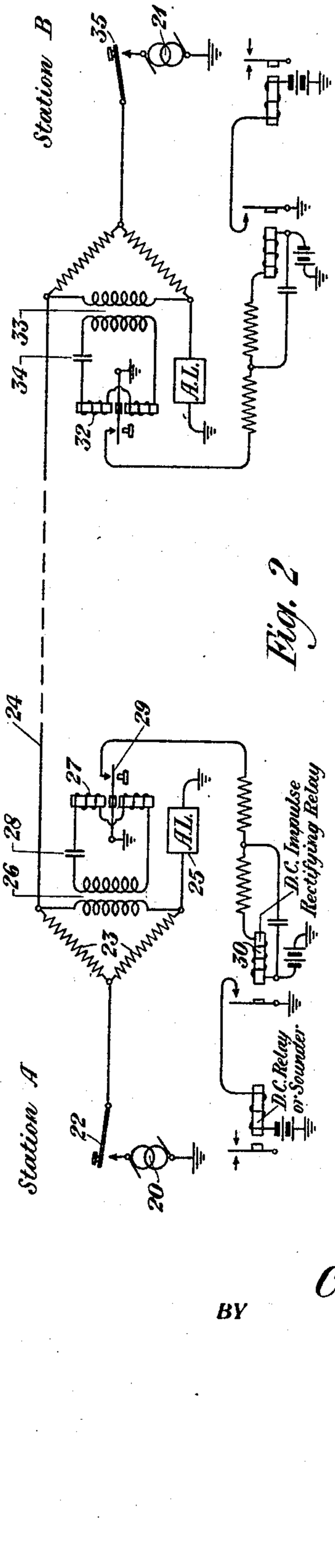

Fig. 2

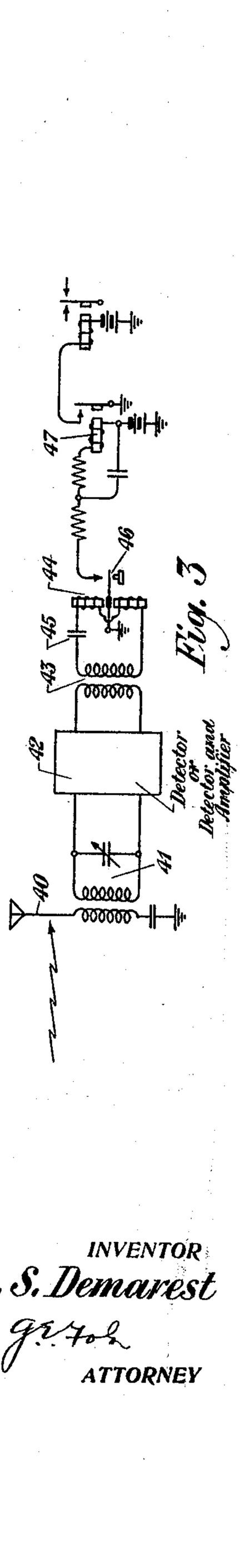

Fig. 3

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TELEGRAPH SYSTEM.

Application filed June 28, 1924. Serial No. 723,009.

This invention relates to telegraph systems, and particularly to a system in which an impulse of alternating current is converted into an equivalent direct current impulse for actuating direct current apparatus at a repeater or a receiving station.

As is well known, it is desirable to employ alternating currents for the transmission of signals, but in order to receive such signals it is customary to convert the transmitted signals into equivalent direct current signals.

The object of this invention is to provide a simple and reliable mechanism for translating the impulses of alternating current into equivalent direct current impulses and causing the latter impulses to operate direct current telegraph apparatus.

This invention will be clearly understood from the following description when read in connection with the attached drawing of which Figure 1 shows schematically a simple form of embodiment of the invention; Fig. 2 shows the application of the invention for two-way signaling; and Fig. 3 shows an embodiment of the invention for receiving radio frequency signals.

In Fig. 1, station A is a transmitting station and station B a receiving station. For the sake of simplicity, transmitting apparatus at station A comprises a key 1 and a generator 2 capable of producing the alternating current by means of which the signals are transmitted over the line 3. Connected with the receiving end of this line is an alternating current relay 4 of a type shown in the copending applications of Thompson, Serial Nos. 525,727 and 525,728, filed December 29, 1921. This relay is highly sensitive and selective being tuned mechanically to resonate at the desired frequency, say, 1,000 cycles, and the circuit is also tuned for this frequency. The armature 5 of this relay is connected with the winding of relay 6, the connection including the resistances 7 and 8. The armature 5 is grounded, and the winding of relay 6 is connected with the battery 9. A condenser 10 is connected in parallel with the winding of relay 6 and the resistance 8. The contact of relay 6 is connected with the winding of a direct current telegraph relay or sounder 11. The manner in which this circuit operates is as follows:

Whenever the key 1 is closed a train of waves of the frequency of 1,000 cycles produced by the generator 2 will be impressed upon the line 3 and transmitted to the receiving station. This frequency lying within the voice range will be readily transmitted over the said line. The receiving circuit is tuned by the windings of relay 4 and by the condenser 12 so as to be resonant at this frequency. The armature 5 of this relay is also designed in the manner described in the said applications of Thompson to be mechanically resonant at this particular frequency. Consequently when this impulse of 1,000 cycles is impressed upon the windings of relay 4, the armature 5 will be set in vibration and will touch its contact at the rate of 1,000 times per second. Accordingly a circuit will be established from the battery 9 through the winding of relay 6 and resistances 8 and 7 and the contact of relay 5 to ground each and every time the armature of the relay touches its contact. Furthermore, the condenser 10 will be charged each time this circuit is closed. The armature of relay 6 will be attracted and will close its contact whenever the relay is energized, and by properly proportioning the constants of the condenser 10, the resistance 8 and the winding of relay 6, sufficient current will flow from the condenser through the winding to hold the armature of relay 6 attracted during the interval in which the armature 5 is away from its contact. Whenever the armature of relay 6 closes its contact, current will flow from the battery 13 through the winding of the telegraph relay or sounder 11 and will accordingly attract the armature thereof. This armature will remain attracted as long as the impulse of alternating current continues to flow through the windings of relay 4, viz, as long as the key 1 at station A remains closed. It will be seen, therefore, that by means of the arrangement shown schematically in this figure, it is practicable to convert the impulse consisting of a train of alternating current into an equivalent direct current impulse and to cause the latter impulse to operate a direct current relay or sounder or other direct current apparatus.

The arrangement shown in Fig. 2 is adapted for simultaneous two-way transmission. This is effected by transmitting at one frequency in one direction and at a different frequency in the opposite direction.

Thus, for example, the generator 20 at station A might produce a frequency of 1,000 cycles while the generator 21 at station B might produce a frequency of 1,100 cycles. The transmitting key 22 at station A is connected with the apex of the bridge arms 23, one of which is connected with the line 24 and the other with the artificial line 25. The receiving circuit at station A is represented as being connected across the arms 23 by means of the transformer 26, but it is to be understood that other well known means of connecting may be employed without varying the scope of the invention. The relay 27 is connected with the secondary winding of transformer 26, and the circuit of these windings is tuned by means of the condenser 28. This circuit, comprising the secondary of transformer 26, the windings of relay 27 and the condenser 28, is tuned for the reception of 1,100 cycles. The armature 29 of this relay is connected with the winding of relay 30 in the same manner in which the armature 5 of relay 4 was connected in Fig. 1, and since these details are similar they need not be further described. The receiving circuit at station B is similar to that at station A except that the circuit embracing the winding of relay 32, the secondary of transformer 33 and the condenser 34 is tuned to the frequency of 1,000 cycles.

When an impulse of 1,100 cycles is transmitted from station B by the closing of key 35, relay 27 at station A will be energized since the circuit of the windings of this relay is tuned to this frequency. The armature 29 of this relay will vibrate at the impressed frequency and will cause the operation of relay 30 which will remain energized so long as this impulse of alternating current continues to energize relay 27 and will transmit a direct current impulse to the direct current receiving apparatus, the length of which impulse is equal to the length of the alternating current impulse. By the operation of key 22 an impulse of alternating current of 1,000 cycles will be impressed upon the line 24 and will operate the alternating current relay 32 at station B which will effect the transmission of a direct current impulse in the same manner as described above. Since the frequencies of transmission are different, and since the transmitted frequencies are applied to the apex of the bridge arms, the receiving apparatus at stations A and B will not be affected by the signals transmitted from the same stations.

The arrangement shown in Fig. 3 illustrates the application of this invention to a radio system. If an impulse of radio frequency, modulated, for example, by an impulse of 1,000 cycles, is impressed upon the antenna 40, current will be set up in the tuned circuit 41 which will impress a corresponding potential upon the detector 42. The resultant detected signal of 1,000 cycles will be impressed by the transformer 43 upon the circuit of the relay 44, which is tuned by means of the condenser 45 for 1,000 cycles. The armature 46 of this relay will vibrate at this frequency and will effect the operation of relay 47 which in turn will transmit a direct current impulse the length of which will be proportional to the length of the alternating current impulse actuating the alternating current relay 44. This same circuit is applicable to the detection of carrier frequency signals with slight modifications. In such case the antenna 40 would be replaced by a transmission line over which the modulated carrier frequency current would be transmitted. This modulated signal would be detected in the same manner as described, and the resultant low frequency impulse would actuate the direct current apparatus.

While this invention has been described as embodied in a particular form and arrangement of parts, it is to be understood that it is capable of embodiment in other forms without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a telegraph system, the combination with a line of a source of alternating current, means for applying to the said line impulses of the said alternating current representing dots and dashes, and a receiving circuit having an alternating current relay mechanically and electrically tuned to the frequency of the said alternating current, and a direct current relay so controlled by the operation of the said alternating current relay that the armature of the direct current relay will be attracted during the time in which the armature of the alternating current relay vibrates.

2. In a telegraph system, the combination with an alternating current relay mechanically and electrically tuned to a definite frequency of a direct current relay controlled by the said alternating current relay and having means to transmit direct current impulses corresponding to the alternating current impulses actuating the said alternating current relay.

3. In a telegraph system, the combination with an alternating current relay of means to tune to a definite frequency the circuit containing the windings thereof, the armature of the said relay having a natural period of vibration equal to the resonant frequency of the circuit of the windings thereof, a direct current relay, the winding of which is connected with the armature of the alternating current relay and having a condenser connected in parallel with the said winding of such magnitude as to maintain the en-

ergization of the said relay during the time in which the armature of the alternating current relay is away from the contact connected with the winding of the said direct current relay so that the direct current relay remains energized substantially as long as the alternating current wave continued to operate the alternating current relay, and signal indicating means controlled by the said direct current relay.

4. In a telegraph system, the combination with a line over which signals, consisting of trains of unmodulated waves, are transmitted of a highly sensitive alternating current relay whose winding circuit is tuned to the frequency of the said waves and whose armature has the same natural period as the said waves, a direct current relay connected with the armature of the said alternating current relay and having a condenser in parallel with its windings, the capacity of which is such as to maintain the direct current relay energized during the interval in which the alternating current armature is away from the contact connected with the direct current relay.

In testimony whereof, I have signed my name to this specification this 27th day of June, 1924.

CHARLES S. DEMAREST.