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HALF DUPLEX MORSE CARRIER SYSTEM

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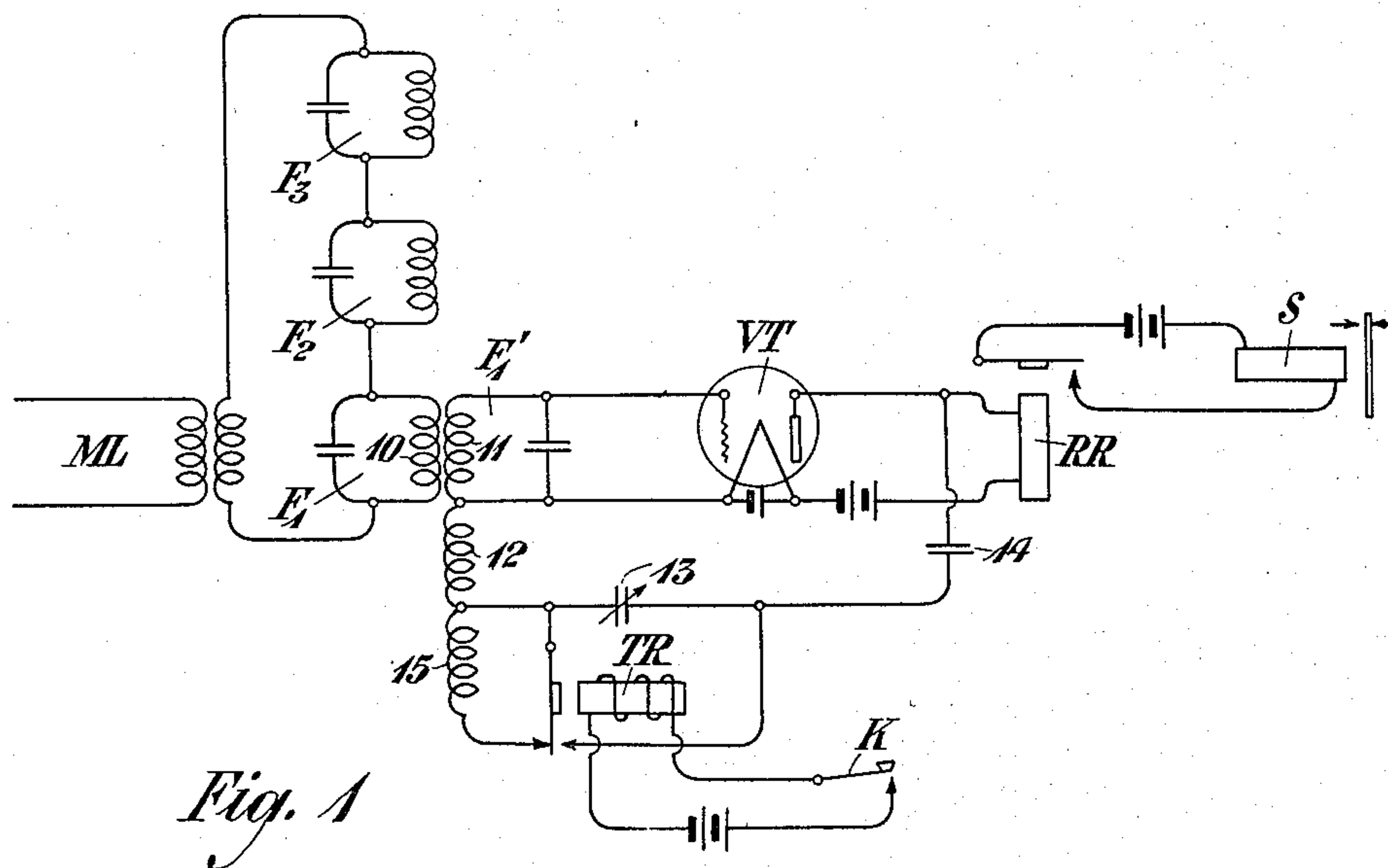


Fig. 1

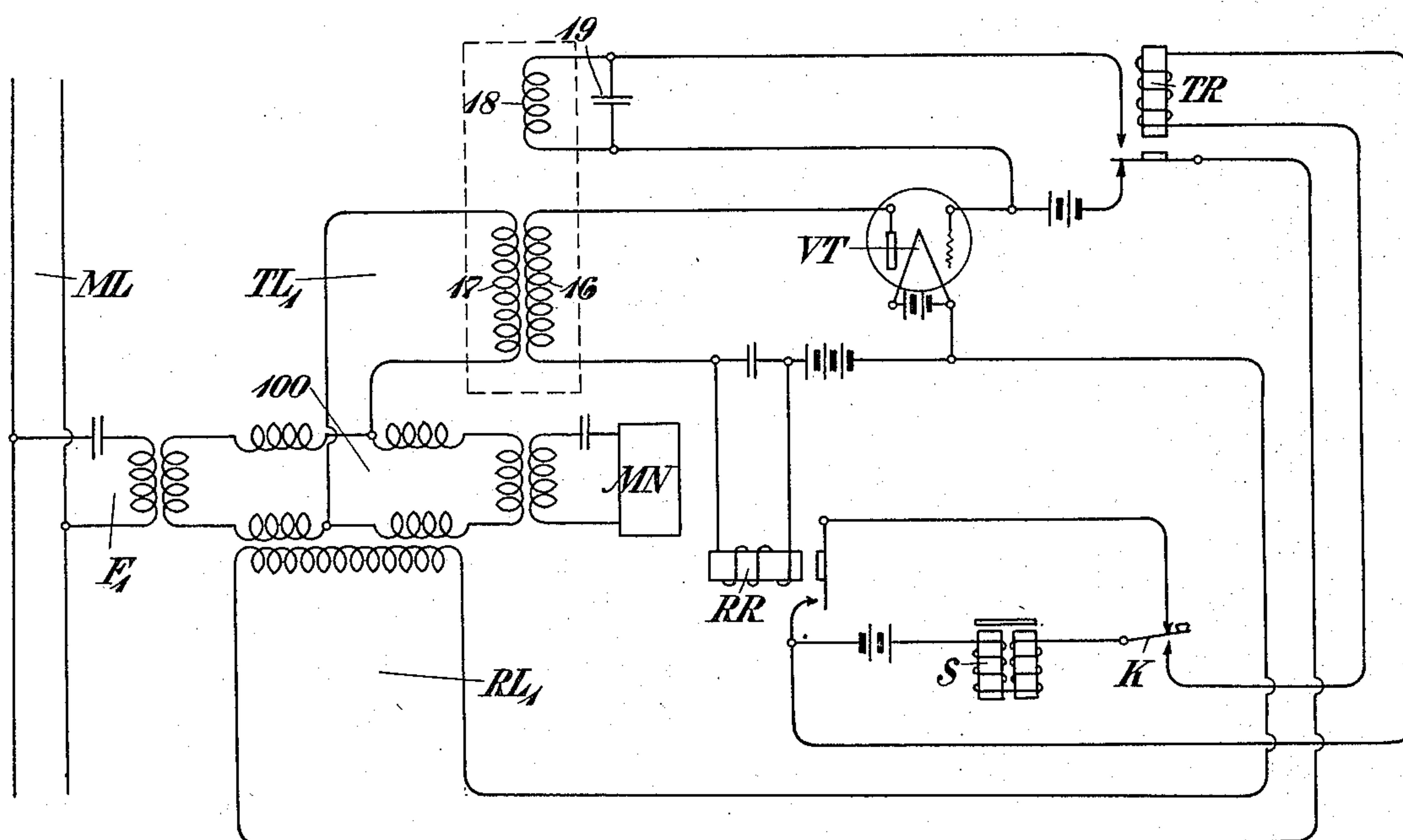


Fig. 2

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UNITED STATES PATENT OFFICE.

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HALF-DUPLEX MORSE CARRIER SYSTEM.

Application filed August 11, 1921. Serial No. 491,532.

To all whom it may concern:

Be it known that I, HERMAN A. AFFEL, residing at Brooklyn, in the county of Kings and State of New York, have invented certain Improvements in Half-Duplex Morse Carrier Systems, of which the following is a specification.

This invention relates to signaling systems, and more particularly to multiplex signaling systems employing carrier currents for transmission purposes.

One of the purposes of this invention is to produce a simple terminal apparatus for half-duplex Morse operation over carrier channels. A salient feature of the terminal arrangement is that the same vacuum tube is employed both as a receiving detector and as an oscillation tube for sending signals. More specifically considered, the tube is arranged to function during receiving both as an amplifier and a detector, the tube being provided with a feed-back circuit, the constants of which may be changed so that the tube will either reamplify the received signals or oscillate to generate the carrier frequency. This arrangement permits of switching the circuits of the tube from sending to receiving condition, and vice versa, in accordance with the signals transmitted. Another important feature of the invention is that it enables the tuned circuits for associating the carrier channel with the main line to be used both for sending and receiving, thereby reducing the number of tuned circuits to half the number ordinarily required.

Other and further features of the invention will be clear from the following description, when read in connection with the accompanying drawing, Figure 1 of which illustrates a terminal circuit arrangement embodying the principles of the invention, and Fig. 2 of which illustrates a modified form of circuit illustrating certain of the principles of the invention.

Referring to Fig. 1 ML designates a main transmission line terminating in selective circuits F_1 , F_2 , F_3 , etc., the selective circuit arrangements being adapted to associate the main line with terminal carrier channels. The carrier apparatus associated with but one of the selective devices is illustrated, but it will be understood that similar apparatus will be provided for each channel. The apparatus associated with the selective device

F_1 includes a vacuum tube VT of the usual three-element type. A tuned circuit or other selective device F_1' is included in the grid circuit of the vacuum tube. This tuned circuit is coupled with the tuned circuit or selective device F_1 and renders the vacuum tube selective of the received carrier frequency when receiving and serves to determine the frequency of the vacuum tube when functioning as an oscillator, as will be described later. The output circuit of the vacuum tube VT includes a receiving relay RR for controlling the circuit of a sounder S in any well-known manner.

The tuned circuits F_1 and F_1' are coupled together through windings 10 and 11 of a transformer, and a third winding 12 arranged in inductive relation to the windings 10 and 11 is connected in the plate filament circuit. This circuit also includes capacities 13 and 14 which may be connected in series. A transmitting relay TR controlled by a transmitting key K is arranged to short-circuit either the capacity 13 or a winding 15 in inductive relation to the windings 10, 11 and 12.

Under normal conditions, when the key K is not operated to transmit signals, the tube circuits will be adjusted so that the tube functions as a reamplifying detector. Under these conditions, capacity 13 is effectively in series with the capacity 14 in the plate circuit, and the winding 15 is short-circuited to decrease the effective inductance of the winding 12 in the feed-back circuit so that the constants of the feed-back circuit are such that the tube will not oscillate but will reamplify the received signals. Therefore, each time a train of carrier oscillations is received over the main line ML, the vacuum tube VT functions to energize the receiving relay RR to actuate a sounder S. When it is desired to send signals, the key K will be actuated to energize the transmitting relay TR in accordance with the dots and dashes of a code. Each time the relay TR is energized, the winding 15 will be open-circuited, thereby increasing the effective inductance of the winding 12, and the capacity 13 will be short-circuited, thereby increasing the capacity of the feed-back circuit. This results in such an adjustment of the constants of the feed-back circuit that the tube VT functions as a generator of carrier oscillations and a group of oscilla-

tions will be transmitted through the tuned circuit F_1 to the main line ML so long as the key is closed. By actuating the key in accordance with a code, groups of oscillations generated by the tube VT may be transmitted to the main line ML.

In the arrangement illustrated in Fig. 1, the combined transmitting and receiving apparatus is associated with the main line ML through a common instrumentality. An arrangement is illustrated in Fig. 2, however, in which the receiving and sending currents are passed between the line and the vacuum tube elements over separate circuits. This separation is effected by means of a balancing circuit arrangement of well-known form. Here the main line ML is associated with the carrier apparatus through a tuned circuit F_1 as before, but the tuned circuit F_1 is associated with the vacuum tube VT through a transmitting channel TL_1 and a receiving channel RL_1 . The channels TL_1 and RL_1 are associated through the usual hybrid coil arrangement 100, and the main line ML is balanced by means of a network MN to render the channels conjugate with respect to each other.

In this form of the invention, the vacuum tube VT under normal conditions is arranged to function as a simple vacuum tube detector and is not arranged for reamplification. The output circuit of the tube is associated with the transmitting channel TL_1 through a transformer comprising windings 16 and 17. A winding 18 is inductively associated with these windings and is connected in the grid circuit to provide the necessary feed-back for producing oscillations when the tube is to function as a transmitter. The winding 18 has a capacity 19 associated therewith to determine the frequency of the oscillation generator. The feed-back connection is normally opened at the contact of the transmitting relay TR when the apparatus is used for receiving.

A receiving relay RR is included in the plate circuit of the tube for the purpose of responding to the received signals. This relay controls the circuit of a sounder S which is included in circuit with the normally closed contact of the key K. When the key K is actuated, the sounder S is connected in circuit with the transmitting relay TR. The grid circuit of the vacuum tube VT is, under normal conditions, connected to the receiving channel RL_1 over the normally closed contact of the transmitting relay TR.

When signals are being received, the carrier oscillations incoming over the line ML will be transmitted through the hybrid coil to the receiving channel RL_1 and impressed on the grid circuit of the vacuum tube VT over the back contact of the sending relay TR. The receiving relay RR responds to

each train of oscillations to close a circuit over its front contact through the sounder S, and over the normally closed contact of key K, so that the sounder responds to the received signals. When it is desired to transmit signals, the key K will be actuated to close a circuit through the sounder S and over the lower contact of the key K, and through the winding of the transmitting relay TR to battery. The sounder S and the transmitting relay TR are actuated together, the latter shifting the connection of the grid circuit so that it includes the feed-back connection 18—19. The tube VT now oscillates at the sending carrier frequency so that the train of carrier oscillations will be transmitted through the transformer 16—17 so long as the transmitting relay TR is actuated, and these oscillations will be transmitted through the transmitting channel TL_1 to the main line ML.

It will be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated, without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. In a signaling system, a transmission circuit and carrier apparatus associated therewith, said carrier apparatus including a translating device, a signal transmitter and a signal receiver, circuits for said translating device and said signal receiver whereby said device will detect received carrier currents to operate said signal receiver, and means automatically controlled by said signal transmitter for changing the constants of said circuits so that the translating device will generate oscillations to be transmitted to said transmission circuit.

2. In a signaling system, a transmission circuit and carrier apparatus associated therewith, said carrier apparatus including a vacuum tube, a signal transmitter and a signal receiver, circuits for said vacuum tube and signal receiver whereby said vacuum tube will function to detect received oscillations to operate said signal receiver, and means automatically controlled by said signal transmitter for adjusting the constants of said circuits so that said vacuum tube functions as a generator of oscillations to be transmitted to said transmission circuit.

3. In a signaling system, a transmission circuit and carrier apparatus associated therewith, said carrier apparatus comprising a vacuum tube, a receiving relay and a transmitting relay, a circuit for said vacuum tube whereby said tube functions to detect signals from received carrier currents to operate said receiving relay, a feed-back connection for said tube, and means whereby said feed-back connection may be auto-

atically controlled by said transmitting relay to cause said tube to generate oscillations for transmission to said transmission circuit.

5 4. In a signaling system, a transmission circuit and carrier apparatus associated therewith, said carrier apparatus including a vacuum tube, a receiving relay and a transmitting relay, circuits for said vacuum
10 tube and receiving relay including a feed-back connection, and means controlled by said transmitting relay for changing the constants of said feed-back connection so that under normal conditions said vacuum tube
15 will function to detect and reamplify received signals, thereby operating said receiving relay, and whereby under signaling conditions said vacuum tube will function to generate oscillations for transmission over
20 said transmission circuit.

5 5. In a signaling system, a transmission circuit, a plurality of sets of terminal apparatus, each set including transmitting and receiving instrumentalities and circuits
25 therefor, selective circuits independent of the circuits of said transmitting and receiving instrumentalities for associating each set individually with said transmission circuit, and the transmitting and receiving instrumentalities of each set being so arranged
30 that signals will be transmitted from the set to the transmission circuit and from the transmission circuit to the set through the same selecting circuit.

35 6. In a signaling system, a transmission circuit, a plurality of sets of carrier terminal

apparatus associated therewith, each set including transmitting and receiving instrumentalities and circuits therefor, tuned
40 circuits independent of the circuits of said transmitting and receiving instrumentalities for individually associating said sets with said transmission circuit, and means whereby signals may be transmitted from the
45 transmitting instrumentality of the set to the transmission circuit, and from the transmission circuit to the receiving instrumentality of the set through the same tuned circuit.

7. In a signaling system, a transmission
50 circuit, a plurality of sets of carrier terminal apparatus associated therewith, each set including a vacuum tube, circuits for said tube whereby under certain circumstances it may function to detect signals and
55 under other circumstances it may function to generate oscillations for transmission to said transmission circuit, and selective circuits for individually associating each set
60 with said transmission circuit, each selective means including a tuned circuit constituting part of the vacuum tube circuit and a second tuned circuit independent of the tube
65 circuits, said first mentioned tuned circuit functioning to determine the frequency impressed upon the tube when receiving and to determine the frequency generated by the tube when transmitting.

In testimony whereof, I have signed my name to this specification this 10th day of
70 August, 1921.

HERMAN A. AFFEL.