Oct. 28, 1924. 1,513,451

L. ESPENSCHIED

HALF DUPLEX MORSE CARRIER SYSTEM

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Fig. 1

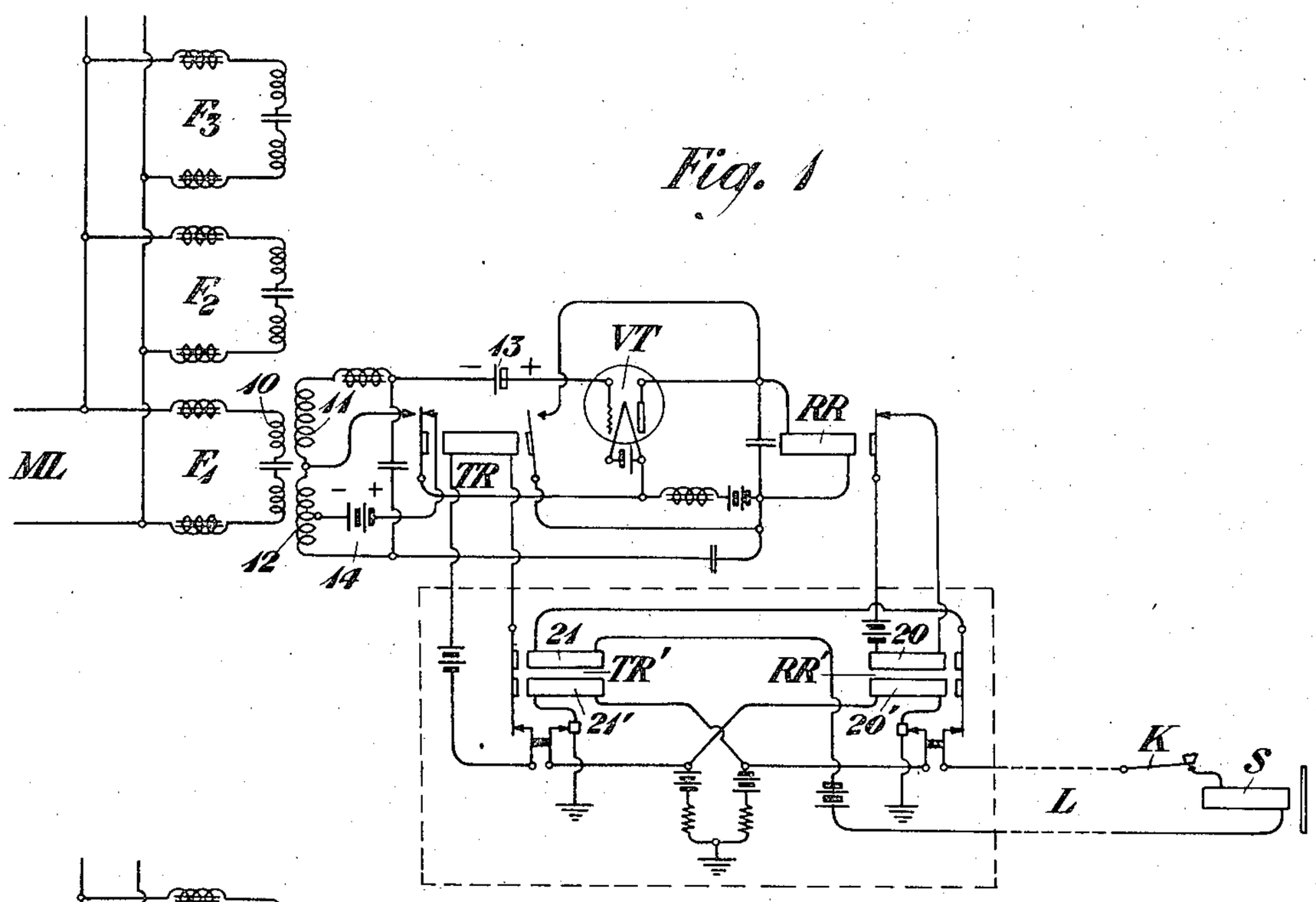
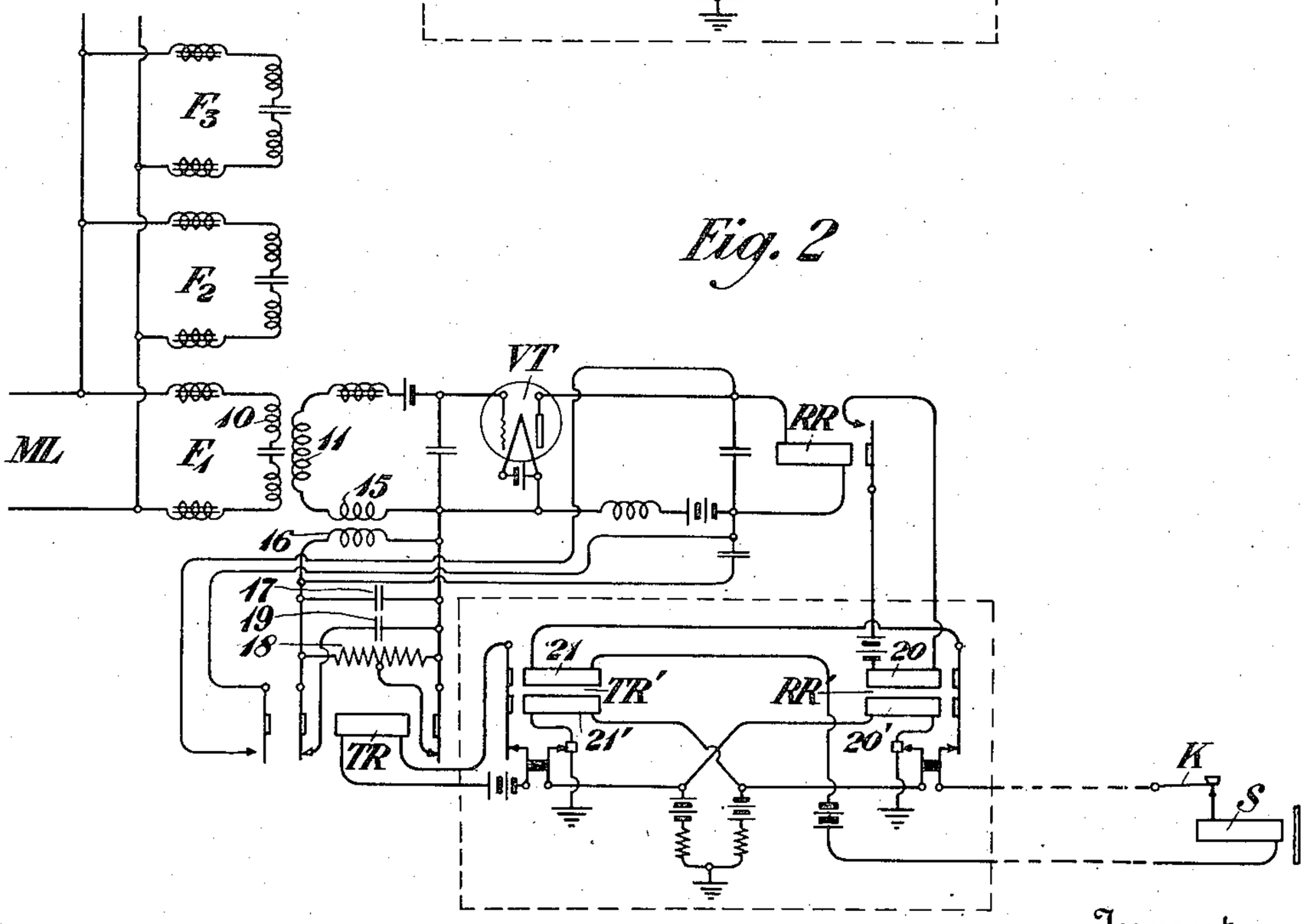


Fig. 2



Inventor
L. Espenschied

By his Attorney

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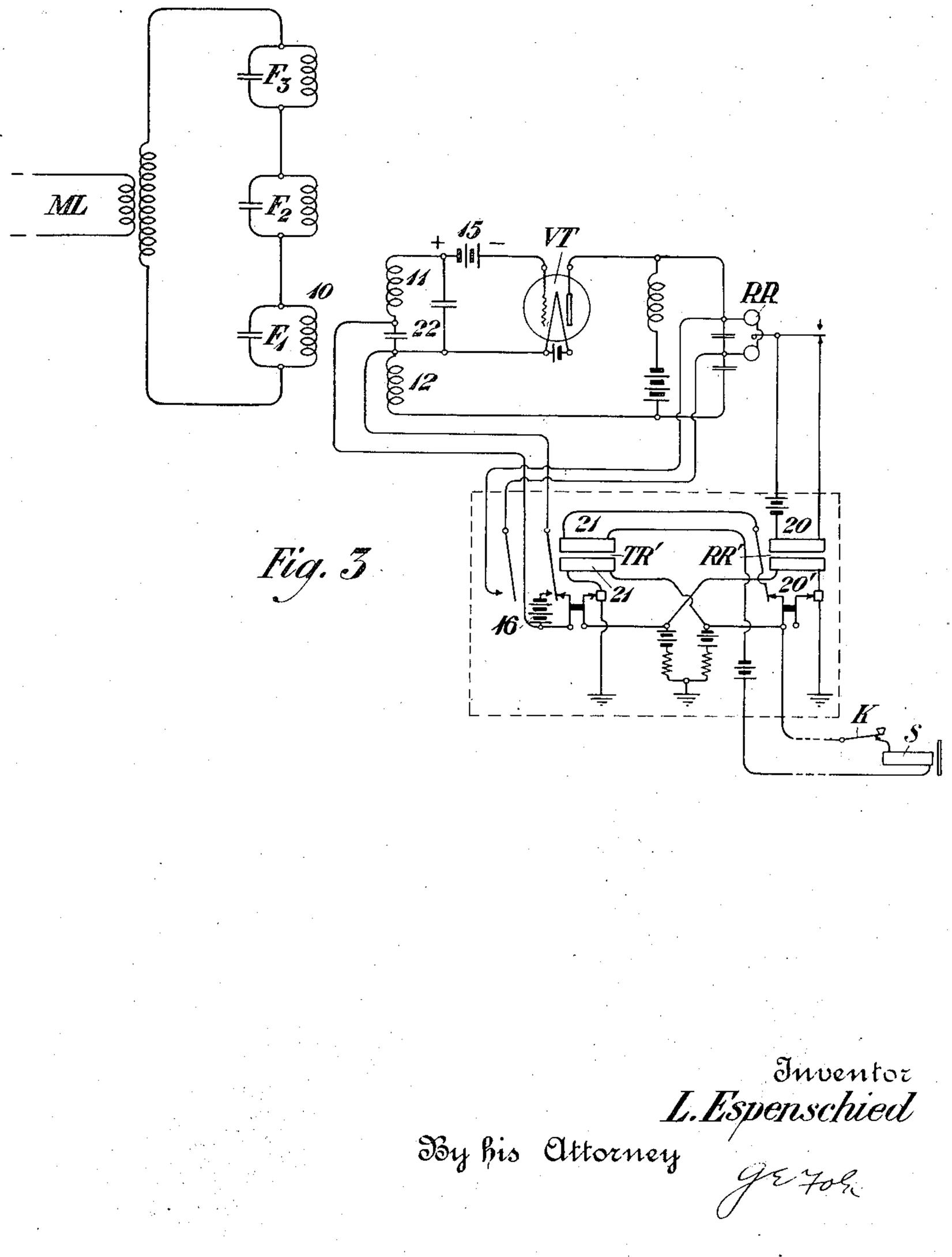

Fig. 3

Inventor
L. Espenschied

By his Attorney

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UNITED STATES PATENT OFFICE.

LLOYD ESPENSCHIED, OF QUEENS, NEW YORK, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

HALF-DUPLEX MORSE CARRIER SYSTEM.

Application filed August 11, 1921. Serial No. 491,510.

To all whom it may concern:

Be it known that I, LLOYD ESPENSCHIED, residing at Queens, in the county of Queens 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 and, preferably, the tube, when functioning as a detector, is provided with a feed-back connection for reamplifying purposes. Another feature of the invention resides in the fact that the switching of the circuit of the vacuum tube from detecting to oscillating condition is under the control of a subscriber's loop, this control being effected through the agency of the ordinary interlocking repeating relay arrangement employed in connection with Morse circuits.

Other and further features of the invention will be clear from the following description, when read in connection with the accompanying drawing, Figures 1, 2 and 3 of which illustrate three different embodiments 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. This tube is arranged to operate under normal conditions as a reamplifying detector, and for this purpose, its circuit is provided with two windings 11 and 12, inductively associated with the winding 10 of the selective circuit F_1. A transmitting relay TR is provided for controlling the circuits of the vacuum tube VT, and when this relay is in its normally energized condition, its armature is arranged to connect the filament of the vacuum tube to an intermediate point of the winding 12, but when the relay is deenergized, the filament is connected to the junction point between the windings 11 and 12. As the winding 12 is connected to the plate and the winding 11 is connected to the grid, the coupling between the plate and grid is less when the transmitting relay TR is energized than when it is deenergized. Consequently, the vacuum tube functions merely to reamplify under the former condition and the coupling is sufficient to permit it to oscillate under the latter condition. A polarizing battery 13 is included in the grid circuit, and when this battery alone determines the potential upon the grid, the grid voltage will be such as to render the tube efficient as an oscillator. An auxiliary battery 14 is included in the connection from the contact of the transmitting relay TR to the intermediate point of the winding 12, however, and when the transmitting relay is energized, this battery is connected in series with the battery 13, thereby changing the potential of the grid to the value most desirable for detecting purposes.

A relay RR is included in the plate circuit of the vacuum tube and this relay responds to the signals detected by the vacuum tube VT to open the circuit of the operating magnet 20 of a loop controlling relay RR′, the loop controlling relay functioning to open and close the loop circuit to transmit the detected signals to the loop, thereby actuating the sounder S. The winding of relay RR may be short-circuited by transmitting relay TR as will be described later. The loop circuit also includes an operating magnet 21 of a loop transmitting relay TR′. The relay TR′ controls the circuit of the transmitting relay TR so that signals originating in the loop may be repeated by means of the relay TR′ to switch the circuit of the vacuum tube VT from its detecting to its transmitting or oscillation condition. The relays TR′ and RR′ of the mechanical repeating arrangement are provided with auxiliary holding magnets 21′ and 20′, respectively. These magnets are normally short-circuited, the magnet 21′ being short-circuited by the contact of relay RR′ and the magnet 20′ being short-circuited by the contact of the relay TR′. The function of

the holding magnets is to prevent false operation, as will be described later.

Under normal conditions, the loop circuit will be closed, so that the relay TR′ will be energized and the transmitting relay TR will be energized. Under these conditions, the filament of the vacuum tube VT is connected through the battery 14 to an intermediate point of the winding 12, and the circuit of the tube is in condition for detecting. High frequency oscillations incoming over the line ML, when applied to the grid of the vacuum tube, will, therefore, be detected, the feed-back connection permitting the reamplification of the detected signals and the receiving relay RR, the short-circuit about which is held open by relay TR, will be operated to open the circuit of the operating magnet 20 of the loop controlling relay RR′. As the holding magnet 20′ of said relay is short-circuited at this time over the contact of the loop transmitting relay TR′. the armature of the relay RR′ will be permitted to fall off, thereby opening the loop to actuate the sounder S. This results in the deenergization of the operating magnet 21 of the relay TR′, but since the short-circuit about the holding magnet 21′ is open when the armature of the relay RR is released, the holding magnet 21′ is energized to maintain the circuit of the transmitting relay TR closed, thereby preventing the received signals from being repeated back to the main line ML.

When it is desired to transmit signals, the loop may be opened in accordance with dots and dashes by means of the key K. Each time the loop is opened, the magnet 21 of the loop transmitting relay TR′ is deenergized. As the holding magnet 21 is short-circuited over the contact of the relay RR, the armature of the relay TR′ is permitted to fall off, thereby opening the circuit of the transmitting relay TR. The armature of the relay TR shifts the connection of the filament, so that the connection now extends from the filament to the junction point between the windings 11 and 12, and the auxiliary battery 14 is no longer connected to the grid. The circuit of the tube is now in condition for the generation of oscillations, and groups of generated oscillations are transmitted to the main line ML for each dot and dash. When the armature of the relay TR′ falls off, it removes the short-circuit from about the holding magnet 20′ of the relay RR′, and thereby prevents the loop from being held open independently of the key K, should the receiving relay RR be energized by the transmitted signals. Said relay RR is short-circuited by relay TR, however, to prevent its operations.

A slightly modified arrangement of the vacuum tube circuit is illustrated in Fig. 2. In this case, the grid circuit of the vacuum tube is coupled to the selective circuit F_1 through windings 10 and 11. For the feed-back coupling, however, the grid circuit is provided with an auxiliary winding 15 which is inductively related to a winding 16 connected to the plate. The plate circuit includes a receiving relay RR, as in Fig. 1. A capacity 17 is normally connected in shunt with the winding 16 and a resistance 18 is also shunted across the terminals of said winding. An auxiliary capacity 19 is provided and the contacts of the transmitting relay TR are arranged so that when the transmitting relay is energized, as it is under normal conditions, the capacity 19 will also be connected in shunt with the feed-back winding 16. The contacts of the transmitting relay also, under these conditions, short-circuit a portion of the resistance 18. With the circuit thus adjusted, the energy transmitted from plate to grid through the feed-back connection will be sufficient to cause reamplification of detected signals, but will not be sufficient to cause the tube to oscillate. When signals are to be transmitted, however, the transmitting relay TR will be deenergized by the action of the key K in the manner described in connection with Fig. 1. This results in removing the short-circuit from about a portion of the resistance 18 and in disconnecting the capacity 19 from the feed-back connection. The adjustment of the feed-back connection will now be such that the vacuum tube functions as an oscillator to transmit groups of oscillations to the line ML for each dot and dash.

Fig. 3 illustrates a vacuum tube circuit arrangement which, like those of Figs. 1 and 2, is adapted to permit the vacuum tube to function as a reamplifying detector normally, but to generate oscillations when signals are to be transmitted to the line. In this case, the change from the reamplifying detector condition to the oscillation condition is controlled solely by the adjustment of the potential of the grid of the tube. The grid circuit of the tube includes a winding 11 and the plate circuit includes a winding 12 as before, both windings being coupled to the winding 10 of the selective circuit F_1. The filament of the tube VT is connected to the junction point between the windings 11 and 12. A blocking condenser 22 is included in the grid circuit, however, and under normal receiving conditions this condenser is short-circuited by the normally closed contact of the loop transmitting relay TR′. The potential of the grid of the tube is, under these conditions, determined solely by the battery 15, and this potential will be such that the tube operates as a reamplifying detector. When the loop transmitting relay TR′ is deenergized by opening the key K in the loop, however, the ar-

mature of the relay TR′ includes an auxiliary battery 16 in the shunt circuit to the condenser 22, thereby changing the potential of the grid of the tube VT so that the tube functions to generate oscillations which may be transmitted to the main line ML.

The relay RR in this instance may be a polar relay having a condenser in series with its winding to prevent direct space current from flowing therethrough. The polar relay will therefore respond only to the alternating current component of the detected signal and its armature will be unbiased so that it will rest on either contact when no signals are being received. To prevent response of the relay RR to oscillations generated when transmitting it will under these conditions be short-circuited by relay TR′.

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 which under certain conditions functions as a reamplifying detector and under other conditions functions as a generator of oscillations, a subscriber's loop circuit, and means associated with said subscriber's loop circuit whereby signals detected by said translating device may be repeated to the loop, and whereby said translating device may be switched from its detecting to its oscillating condition, thereby transmitting oscillations to said transmission circuit.

2. In a signaling system, a transmission circuit and carrier apparatus associated therewith, said carrier apparatus including a vacuum tube which under certain conditions functions as a reamplifying detector and under other conditions functions as a generator of oscillations, a subscriber's loop circuit and means associated with said subscriber's loop circuit whereby signals detected by said vacuum tube may be repeated to the loop, and whereby in response to signals originating in the loop, the circuit of said vacuum tube may be switched from its detecting condition to its oscillating condition, thereby generating oscillations for transmission to said transmission circuit.

3. In a signaling system, a transmission circuit and carrier apparatus associated therewith, said carrier apparatus including a translating device which under certain conditions functions as a reamplifying detector and under other conditions functions as a generator of oscillations, a loop circuit and mechanical repeating apparatus associated with said loop circuit, said repeating apparatus comprising a repeating relay responsive to detected signals for repeating the detected signals to the loop, said repeating apparatus also comprising a repeating relay responsive to signals originating in the loop for switching the circuit of said translating device from its detecting to its oscillating condition, whereby oscillations will be transmitted to said transmission circuit.

4. In a signaling system, a transmission circuit and carrier apparatus associated therewith, said carrier apparatus including a vacuum tube which under certain conditions functions as a reamplifying detector and under other conditions functions as a generator of oscillations, a loop circuit and mechanical repeating apparatus associated with said loop circuit, said repeating apparatus comprising a repeating relay responsive to detected signals for repeating the detected signals to the loop, said repeating apparatus also comprising a repeating relay responsive to signals originating in the loop for switching the circuit of said vacuum tube from its detecting to its oscillating condition, whereby oscillations will be transmitted to said transmission circuit.

5. In a signaling system, a transmission circuit and carrier apparatus associated therewith, said carrier apparatus including a translating device which under certain conditions functions as a reamplifying detector and under other conditions functions as a generator of oscillations, a loop circuit and mechanical repeating apparatus associated with said loop circuit, said repeating apparatus comprising a repeating relay responsive to detected signals for repeating the detected signals to the loop, said repeating apparatus also comprising a repeating relay responsive to signals originating in the loop for switching the circuit of said translating device from its detecting to its oscillating condition, whereby oscillations will be transmitted to said transmission circuit, and means associated with said repeating apparatus for preventing said first mentioned relay from responding to signals transmitted from the loop and for preventing signals transmitted to the loop from operating said second relay.

6. In a signaling system, a transmission circuit and carrier apparatus associated therewith, said carrier apparatus including a vacuum tube which under certain conditions functions as a reamplifying detector and under other conditions functions as a generator of oscillations, a loop circuit and mechanical repeating apparatus associated with said loop circuit, said repeating apparatus comprising a repeating relay responsive to detected signals for repeating the detected signals to the loop, said repeating apparatus also comprising a repeating relay responsive to signals originat

ing in the loop for switching the circuit of said vacuum tube from its detecting to its oscillating condition, whereby oscillations will be transmitted to said transmission circuit, and means associated with said repeating apparatus for preventing said first mentioned relay from responding to signals transmitted from the loop and for preventing signals transmitted to the loop from operating said second relay.

7. In a signaling system, a transmission circuit and carrier apparatus associated therewith, said carrier apparatus including a vacuum tube having its grid and plate circuits coupled together to feed-back energy, a receiving relay associated with said plate circuit, a transmitting relay, and circuits controlled by said transmitting relay so that under certain conditions a potential will be applied to the grid of the tube such that it will function as a reamplifying detector and under other conditions the potential will be so changed that the tube functions to generate oscillations, said change in potential controlled by said transmitting relay being unaccompanied by any change in the constants of said feed-back connection.

In testimony whereof, I have signed my name to this specification this 9th day of August, 1921.

LLOYD ESPENSCHIED.