

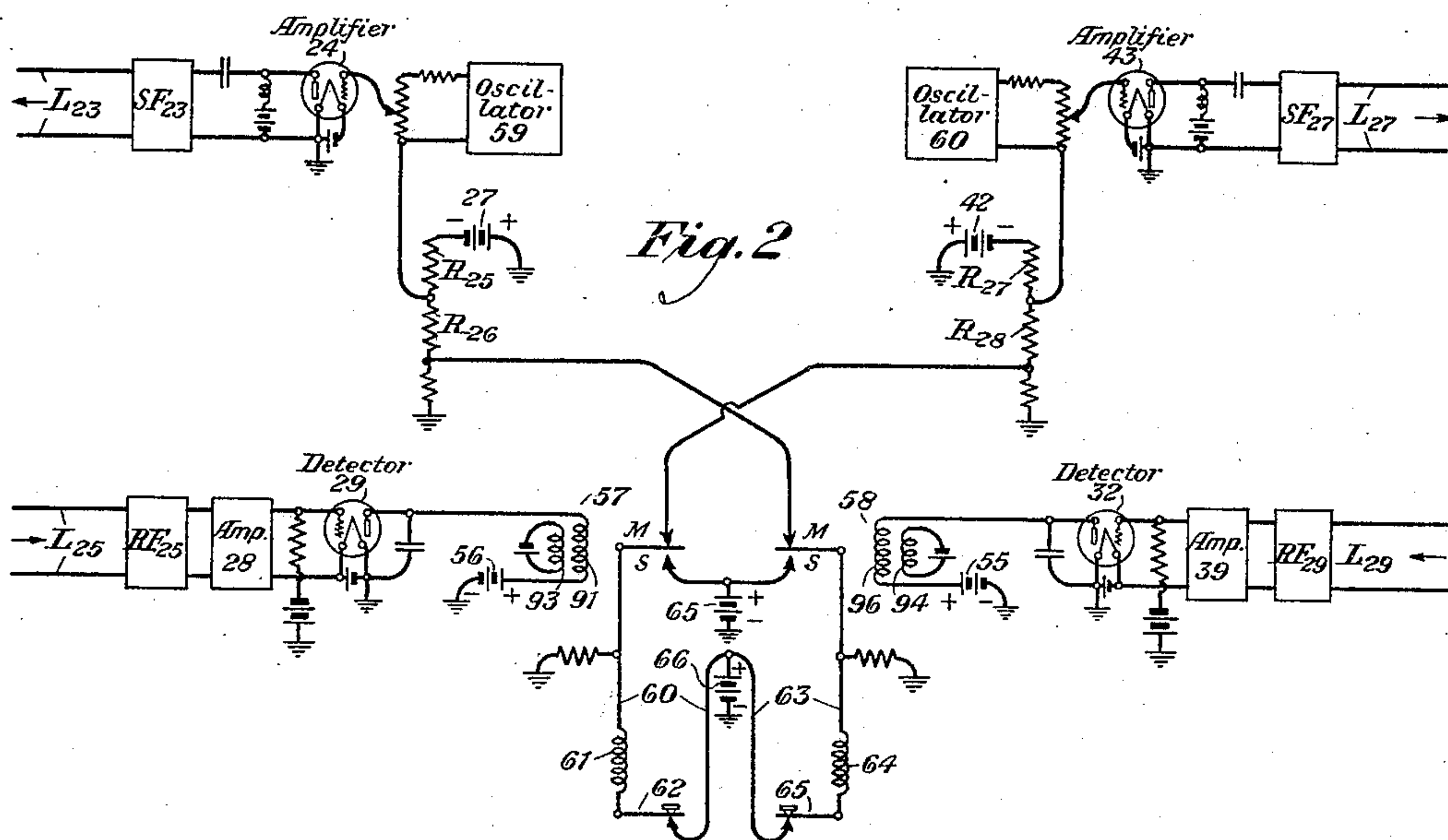
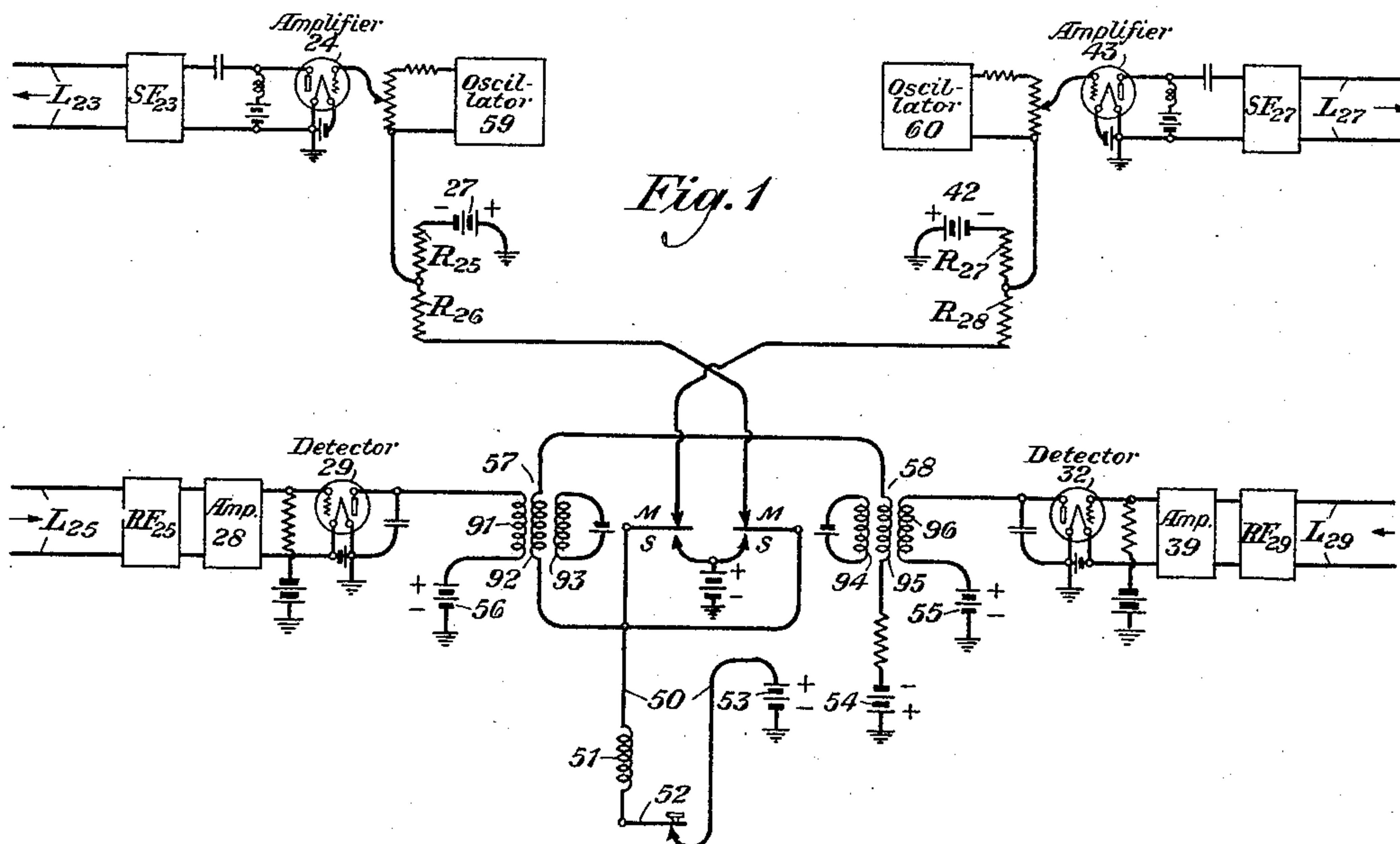
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TELEGRAPH REPEATER SYSTEM

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TELEGRAPH REPEATER SYSTEM

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This invention relates to telegraph systems employing carrier channels for the transmission of a plurality of messages and more particularly to improvements in repeater arrangements for interconnecting the circuits of such systems.

In telegraph systems of the radio or wired carrier type it has been the practice to provide at the terminals of the lines and at intermediate repeater points, relays for sending signals, relays for receiving signals, and relays for transmitting break signals. It is one of the primary objects of the arrangements of the invention to provide repeater arrangements for a carrier telegraph system in which the number of relays for sending, receiving, or breaking may be greatly reduced. The elimination of a large number of relays from a telegraph system would result in the advantages of reduced expense and maintenance. A further advantage of the repeater arrangements of the invention is that full flexibility in patching together of different channels of different frequencies at the repeater is provided. Other objects and features of the invention will appear more fully from the detailed description thereof hereinafter given.

In the arrangements of the invention the output of a carrier telegraph detector at the repeater station is passed to the loop circuit there at and operates a sensitive relay at the subscriber's office. This eliminates the need for the receiving relay heretofore used at the channel terminal for repeating signals from the incoming channel to a loop circuit or to an outgoing channel. For sending purposes a resistance network is provided associated with the grid of the sending amplifier of an outgoing channel at the repeater, whereby a comparatively high negative potential is applied to the grid of the sending amplifier whenever the incoming signal from an associated channel is a spacing one or when the printer transmitter or subscriber's key in the repeater loop circuit is open. This would stop the flow of carrier from the sending amplifier to the line. When a marking signal is received over the incoming channel relay means in the loop circuit at the repeater will

be operated thereby and will apply positive battery from the loop over the relay contacts to the resistance network so as to bring the grid potential of the sending amplifier to the proper value so that it will operate as an amplifier and carrier current may be transmitted to the outgoing line. Special biasing circuits are provided by the arrangements of the invention for the relays at the repeater to insure the proper transmission of a break signal from the subscriber's loop circuit thereat.

The invention may be more fully understood from the following description together with the accompanying drawings in the Figures 1 and 2 of which the invention is illustrated. Fig. 1 illustrates the repeater arrangements of the invention as applied to a half duplex telegraph system, while the repeater arrangements of Fig. 2 are shown as applied to a full duplex telegraph system. Similar reference characters have been utilized to denote like parts in both figures.

In Fig. 1 the repeater arrangements of the invention are shown as applied to a half duplex telegraph system. In incoming line L_{29} is shown including a selective circuit or filter such as RF_{29} and an amplifier 39. The output circuit of the amplifier would be connected to a detector 32. The output of the detector 32 may be transmitted to a loop circuit 50 and operate a sensitive relay 51 therein, thus eliminating the need for a receiving relay for repeating the signals from the line L_{29} to the loop circuit 50. An outgoing line L_{23} is shown to which it is desired to repeat the signals coming in over line L_{29} . The outgoing line L_{23} includes a selective circuit or filter SF_{23} and a sending amplifier 24 the input of which is connected to an oscillator 59. The grid of the sending amplifier 24 will be connected to a resistance network R_{25} R_{26} . Connected by the resistance network to the grid of sending amplifier 24 is a relatively high source of negative potential 27. This, under certain conditions, would block the amplifier 24 and stop the flow of carrier current from the oscillator 59 to the line L_{23} . However, when a marking signal is transmitted to the repeater over

the line L_{29} the relay 58 will be operated and hold its armature on its marking contact. Under these conditions a positive potential from the battery 53 will be transmitted over the loop circuit 50 and marking contact of relay 58 to the resistance network R_{25} R_{26} . This will reduce the negative potential applied from battery 27 to the grid of the sending amplifier and allow it to function as an amplifier and thus repeat the carrier signal on out over the line L_{23} . For repeating signals in the other direction the line L_{25} is shown including a selective circuit or filter RF_{25} and an amplifier 28 the output of which is connected to a detector 29. An outgoing circuit L_{27} is shown including a selective circuit or filter SF_{27} and a sending amplifier 43, the input of which is connected to an oscillator 60. Connected to the grid of sending amplifier 43 is a resistance network R_{27} R_{28} . A relatively high negative potential may be applied from the battery 42 to the grid of amplifier 43 and under certain conditions will block the amplifier and prevent carrier from being transmitted from the oscillator 60 to the line L_{27} . When a marking signal is transmitted over the line L_{25} the relay 57 will operate and hold its armature to its marking contact. Under these conditions a positive potential from the battery 53 would be applied over the loop circuit 50 and marking contact of relay 57 to the resistance network R_{27} R_{28} and will reduce or neutralize the negative potential applied to the amplifier 43. This will allow the amplifier 43 to function and will allow carrier to be transmitted from oscillator 60 to the line L_{27} , thus repeating the incoming signal. The incoming signals from either the line L_{29} or L_{25} will be transmitted over the loop circuit 50 and operate a sensitive relay 51 therein.

The relays 57 and 58 each have two biasing windings and one operating winding. For example, in relay 58 the operating winding is 96 and the biasing windings are 95 and 94. The biasing winding 95 obtains current from the loop circuit 50 and tends to hold its armature to spacing. The other biasing winding 94 tends to hold the armature to marking. The force exerted by winding 95 to move the armature to the spacing contact is greater than that exerted by winding 94 to move the armature to the marking contact by an amount one-half as great as the force exerted by winding 96 to move the armature to the marking contact. These arrangements are provided in order to obtain a clear-cut break signal from the subscriber's loop 50. For example, assume a current of 6 mils, received from the line L_{29} as a marking signal, to be flowing through winding 96. This might be neutralized by a current of 6 mils in biasing winding 95 which is obtained from the loop circuit.

The relay armature will be held to the marking contact however, by a current of 3 mils in the biasing winding 94. When a spacing signal is received from the line the relay armature operates to spacing due to the 6 mils spacing current in the biasing winding 95 overcoming the 3 mils marking current in the biasing winding 94. Relay 57 is similar in structure and operation to relay 58. When a spacing signal or break signal is received from loop 50 by reason of the opening of the key 52 the armatures of both relays 57 and 58 are held firmly to marking by the current flowing in windings 93 and 94, respectively, regardless of any incoming signals from either line L_{25} or line L_{29} , thus providing a good break signal. As has been heretofore pointed out, positive potential from battery 53 may be applied to or disconnected from the resistance networks R_{25} R_{26} and R_{27} R_{28} by means of the armatures and contacts of relays 57 and 58. The operativeness of amplifiers 24 and 43 may thus be controlled by the incoming signals.

The arrangements described provide great flexibility in patching between incoming and outgoing lines at the repeater due to the fact that separate oscillators are provided for each of the outgoing lines. Accordingly, the carrier frequency of the incoming lines may be different from the carrier frequency used on the outgoing lines.

In Fig. 2 a modification of the arrangements of the invention is shown as applied to an intermediate repeater for a full duplex system. The arrangements are substantially similar to those of Fig. 1 except that relays 57 and 58 have only one biasing winding. The biasing windings 93 and 94 in Fig. 2 would tend to hold the relay armatures on their spacing contacts. The current therein would be overcome by the marking current through windings 91 and 96 from the lines L_{25} and L_{29} . The loop battery 66 is made common to both loops 60 and 63, thus providing an arrangement for sending simultaneously to the east or west lines by connecting the telegraph keys in this common branch. In Fig. 2 similar reference characters have been used to denote like parts with respect to Fig. 1. As the operation of the arrangements of Fig. 2 is in other respects similar to that heretofore described with respect to Fig. 1, no further description thereof will be given.

It is pointed out that the arrangements of the invention are applicable to telegraph systems employing radio facilities or wired facilities or combinations of both such facilities.

While the arrangements of the invention have been disclosed as embodied in certain specific arrangements which are deemed desirable, it is understood that they are capable of embodiment in many and other widely

varied forms without departing from the spirit of the invention as defined by the appended claims.

What is claimed is:

1. In a telegraph system a repeater arrangement comprising incoming and outgoing transmission channels for transmission in one direction, incoming and outgoing transmission channels for transmission in the other direction, each of said incoming channels including receiving amplifiers and detectors, each of said outgoing channels including sending amplifiers and sources of signaling current connected to the input thereof, a subscriber's loop circuit connected to the output of said detectors, and relay means associated with the output of said detectors for controlling the application of a blocking potential to said sending amplifiers.
2. In a telegraph system a repeater arrangement comprising incoming and outgoing transmission channels for transmission in one direction, incoming and outgoing transmission channels for transmission in the other direction, each of said incoming channels including receiving amplifiers and detectors, each of said outgoing channels including sending amplifiers and sources of signaling current connected to the input thereof, means for applying a relatively high negative potential to the grids of said sending amplifiers to render them inoperative, a subscriber's loop circuit connected to the output of said detectors, relay means controlled by said loop circuit and the output of said detectors, and means controlled by said relays for reducing the negative potential applied to the grids of said sending amplifiers to render them operative.
3. In a telegraph system a repeater arrangement comprising incoming and outgoing transmission channels for transmission in one direction, incoming and outgoing channels for transmission in the other direction, each of said incoming channels including receiving amplifiers and detectors, each of said outgoing channels including sending amplifiers and sources of signaling current connected to the input thereof, resistance networks connected to the grids of said sending amplifiers, means for applying a relatively high negative potential to said resistance networks to render said sending amplifiers inoperative, a subscriber's loop circuit connected to the output of said detectors, means for applying to said loop circuit a positive potential sufficient when applied to said networks to reduce the negative potential applied to said sending amplifiers and thus render them operative, and relay means controlled by said loop circuit and the output of said detectors for connecting said loop circuit to said resistance networks.
4. In a telegraph system a repeater arrangement comprising incoming and outgoing

ing transmission channels for transmission in one direction, incoming and outgoing transmission channels for transmission in the other direction, each of said incoming channels including receiving amplifiers and detectors, each of said outgoing channels including sending amplifiers and sources of signaling current connected to the input thereof, resistance networks connected to the grids of said sending amplifiers, means for applying a relatively high negative potential to said resistance networks to render said sending amplifiers inoperative, a subscriber's loop circuit connected to the output of said detectors, means for applying to said loop circuit a positive potential sufficient when applied to said networks to reduce the negative potential applied to said sending amplifiers and thus render them operative, and relay means controlled by said loop circuit and the output of said detector for connecting said loop circuit to said resistance networks, each of said relays having an operating winding in the output of the detector, a biasing winding in the loop circuit designed to hold the relay armature to its spacing contact and a second biasing winding designed to hold the relay armature to its marking contact, the resultant of the forces exerted by said two biasing windings being opposite in direction to and approximately one half as great in magnitude as the force exerted by the operating winding.

In testimony whereof, we have signed our names to this specification this 10th day of June 1931.

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