Dec. 6, 1938. G. ROTHERT 2,139,135

TELEPHONE SYSTEM

Filed July 27, 1936 2 Sheets-Sheet 1

FIG. 1

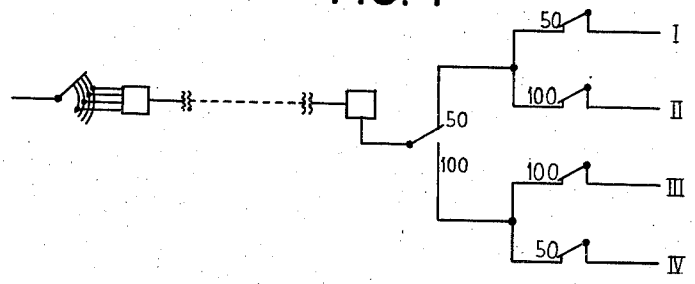


FIG. 2

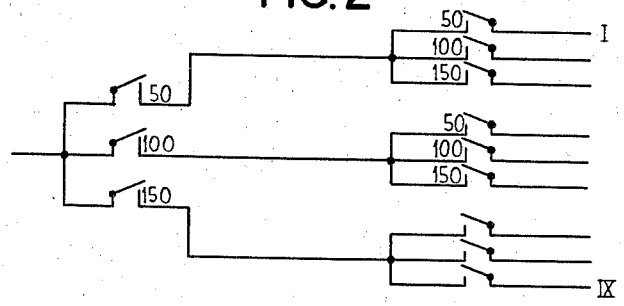
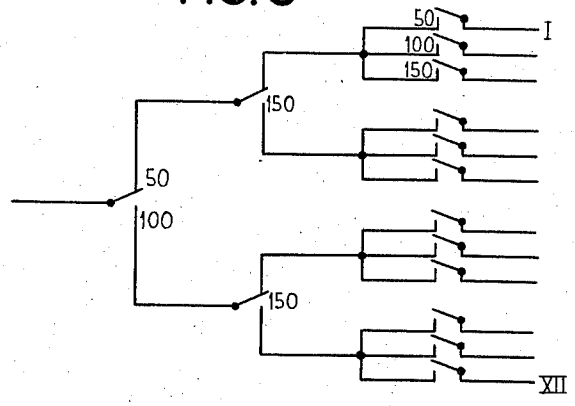


FIG. 3



INVENTOR.
GERHARD ROTHERT

BY Chas. Tu. Candy.

ATTORNEY.

Dec. 6, 1938. G. ROTHERT 2,139,135

TELEPHONE SYSTEM

Filed July 27, 1936 2 Sheets-Sheet 2

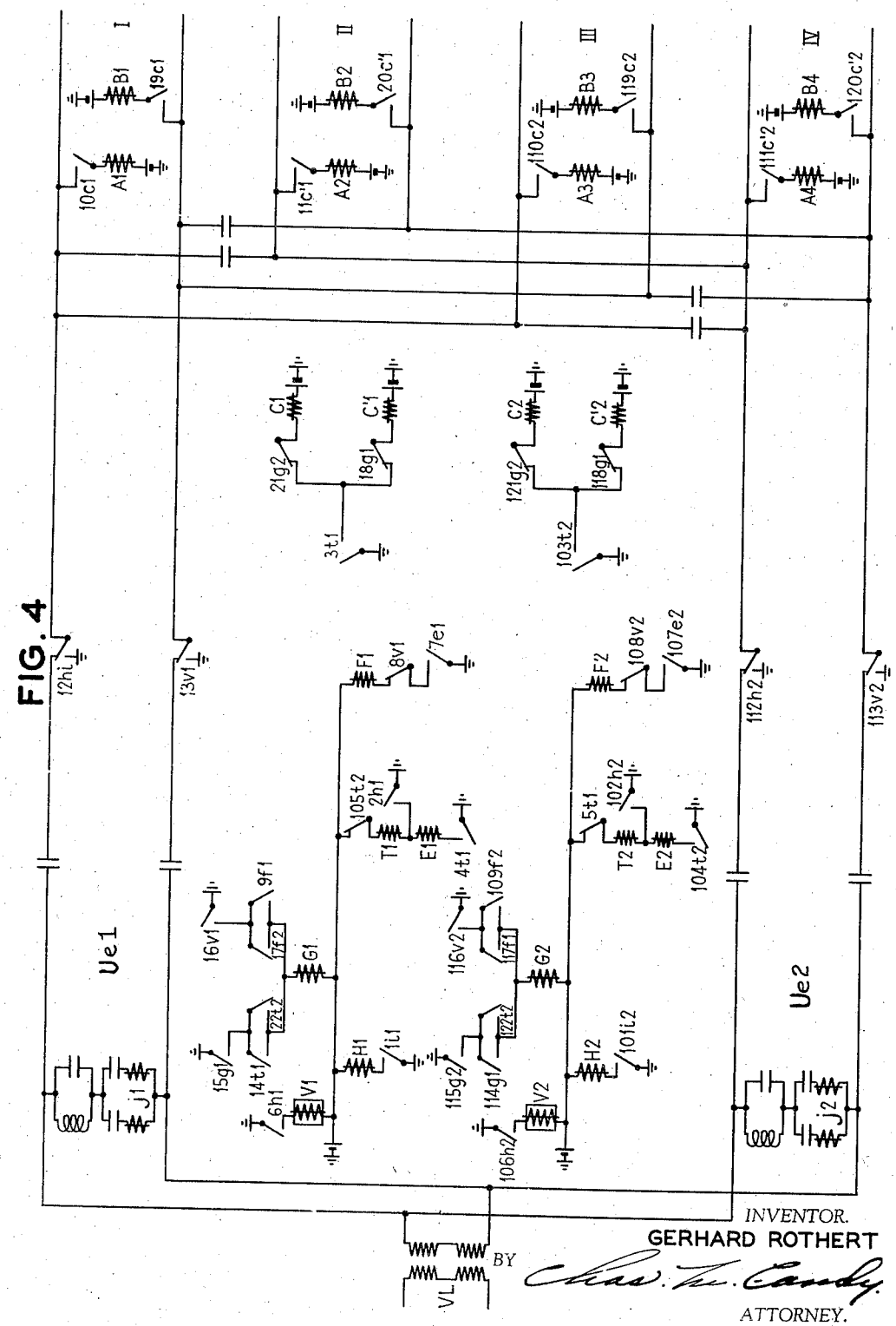


FIG. 4

INVENTOR.
GERHARD ROTHERT
BY Chas. Tu. Candy
ATTORNEY.

Patented Dec. 6, 1938 2,139,135

UNITED STATES PATENT OFFICE

2,139,135

TELEPHONE SYSTEM

Gerhard Rothert, Berlin-Siemensstadt, Germany, assignor to Siemens & Halske Aktiengesellschaft, Siemensstadt, near Berlin, Germany

Application July 27, 1936, Serial No. 92,773
In Germany August 20, 1935

11 Claims. (Cl. 179—16)

The invention concerns a circuit arrangement for telephone systems having a plurality of exchanges arranged in series and adapted for automatic operation.

In such systems the determination of the desired traffic direction, i. e., the selection of the exchange or a particular group of lines in the exchange over which the desired subscriber may be reached takes place in various ways, for example by setting the selectors on particular levels to which the connecting lines leading to the particular exchanges or groups of lines are connected, by compound selectors, by impulses of alternating current having a particular frequency or combination of frequencies, and in various other ways.

When characterizing the direction by alternating currents of different frequencies the characterizing impulses are produced by special impulses, namely so called preliminary impulses independent of the selecting impulses. These characterizing impulses which are transmitted before or between the selecting impulse trains of the individual stages of selection involve delay in the establishment of the call, and if several traffic directions are to be differentiated by utilizing several special alternating current sources, considerable expense is also involved.

The object and aim of the arrangement according to the invention is to avoid these difficulties and this is achieved in that the characterizing of a particular traffic direction is effected by impulses of which some (for example one) are preliminary impulses, for example, a seizing impulse having a particular frequency, while the others are constituted by the consequent numerical impulses serving to set the selectors which further impulses have the same or a different frequency.

The invention is described below with reference to the embodiments shown in the drawings. Figs. 1 to 3 represent diagrammatically three embodiments, namely Fig. 1 the selection of four different traffic directions by means of two frequencies, Fig. 2 the selection of nine different directions by means of three frequencies, and Fig. 3 the selection of twelve different directions by means of three frequencies, two preliminary impulses being used. Of course, further embodiments can be given. Fig. 4 shows the embodiment represented diagrammatically in Fig. 1 together with those details necessary for the understanding of the invention. In the embodiment according to Fig. 4 a talking connection is assumed to be set up which comes in over the connecting line VL and is extended in the four directions I to IV.

The selection of the desired direction I or II, etc., is effected by the preliminary impulse transmitted when initiating a call which in the embodiment forms the seizing impulse and by the first numerical impulse of the numerical impulse train transmitted subsequent to seizure. The direction I is determined by using an alternating current having a frequency of 50 cycles for the seizing impulse and for the numerical selection, in a corresponding manner the direction II is determined by frequencies of 50 cycles and 100 cycles, the direction III by 100 cycles for the seizing impulse and the numerical impulse and direction IV by a corresponding use of 100 cycles and 50 cycles. The relay J1 and the repeater Ue1 are tuned to receive and transmit impulses of 50 cycles while relay J2 and repeater Ue2 are tuned to respond to impulses of 100 cycles. The repeaters Ue1 and Ue2 have associated with them the devices necessary for executing the switching operations.

When on initiating a call the seizing impulse of 50 cycles is received over the connecting line VL the impulse relay J1 tuned to 50 cycles energizes transitorily, closes its contact 1i1 thereby energizing relay H1. The latter operates its contacts transitorily energizes relay V1 over contact 6h1 and by the closing of contact 2h1 relay T1 energizes in a circuit passing over the earth on contact 2h1, winding of relay T1 and contact 105t2 to battery. Relay T1 closes its contact 3t1 in the circuit of the seizing relays C1 and C'1, closes its contact 4t1 in the circuit of relay E1 and opens its contact 5t1 in the circuit of relay T2 in the repeater Ue2.

At contact 3t1 the selection of the traffic direction is prepared, at contact 4t1 the circuit for relay E1 is prepared, which relay on the opening of contact 2h1 on the release of relay H1 energizes and establishes the locking circuit for the two relays T1 and E1. At contact 5t1 (repeater Ue2) the circuit of relay T2 in the repeater Ue2 is opened by way of precaution. Relay E1 on energizing closes the circuit of relay F1 at its contact 7e1 and over contact 8v1 which was closed on the release of relay V1. This prepares the circuit of relay G1 at contact 9f1. At the same time on the closing of contact 3t1 the relays C1 and C'1 are energized and connect their contacts 10c1, 19c1, and 11c'1, 20c'1 to the leads of the line running in the directions I and II. Relays A1 and B1 do not then energize since their circuits are already broken at contacts

12*h*1 and 13*v*1 when relay T1 energizes. Thus the switching operations promoted by the short seizing impulse are at an end.

By means of the first numerical impulse in the first impulse train which now follows the direction discrimination prepared at contact 3*t*1 is completed. In the present case both the numerical impulses and also the seizing impulse were transmitted as already stated above at a frequency of 50 cycles. On the first impulse relay J1 energizes again and relay H1 energizes over the contact 11*i*1. The latter relay operates its contacts in the manner described above and by closing its contact 6*h*1 energizes relay V1 which operates as a slow-to-release relay and holds up throughout the impulse train. At its contact 16*v*1 it completes the circuit of relay G1 which passes from earth on contact 16*v*1, contact 9*f*1, winding of relay G1 to battery. Relay G1 locks up over its contact 15*g*1 and the contact 14*t*1 closed by the seizing operation and simultaneously at contact 18*g*1 breaks the circuit of relay C'1. In addition contact 13*v*1 is closed in the *b*-lead. The selection of the traffic division I is now completed by the opening of contact 18*g*1. The individual numerical impulses are transmitted over contact 12*h*1 to the numerical impulse receiving relay A1 in the known manner by the aid of relays J1 and H1, and relay A1 initiates the operations for setting the subsequently arranged selectors.

If direction II is to be selected alternating current having a frequency of 100 cycles is used for the numerical impulses whilst for the seizing impulse 50 cycles is used again. On the first numerical impulse relay J2 energizes in the repeater Ue2 which possesses the same devices as the repeater Ue1.

The operations occurring on seizure are the same as have been described above for selecting the direction I. In the repeater Ue1 the selection of the desired direction is prepared at contact 3*t*1. Relays T1, E1, and F1 energize and operate their contacts.

In the repeater Ue2 relay J2 energizes on the first numerical impulse and by closing its contact 10*i*2 energizes relay H2. This relay by closing its contacts 106*h*2 energizes relay V2. Relay V2 closes its contact 116*v*2 and thereby closes the circuit for relay G2 over the contact 117*f*1 which was closed on seizure. At its contact 21*g*2 relay G2 breaks the circuit for relay C1 and thereby determines direction II. Over contact 112*h*2 and contact 11*c*'1 closed during seizure the first numerical impulse is transmitted to relay A2 and over contact 113*v*2 and 20*c*'1 to relay B2. Relay H2 responds impulsively to the further numerical impulses received by relay J2 while relay V2 remains energized throughout the impulse train and retains its contact 113*v*2 closed during this time. Relay A2 energizes impulsively and effects the necessary operations for setting the subsequently arranged selectors in the known manner.

In a similar way to that already described for directions I and II the selection of directions III and IV is effected for which purpose the seizing impulses are transmitted at a frequency of 100 cycles and the subsequent numerical impulses at 50 cycles or 100 cycles. The circuits can easily be traced out with reference to the drawings and the preceding description for which purpose the references to relays and contacts in the repeaters Ue1 and Ue2 are the same but with different indices, for example, those in repeater Ue1 commence with 1 and in the repeater Ue2 with 101.

The circuits and switching operations would be similar if, as for example, in the embodiment according to Figs. II and III a larger number of directions were to be selected by using a third frequency and possibly also a second preliminary impulse.

What is claimed is:

1. In an automatic telephone system, a repeater, outgoing trunks accessible to said repeater, an incoming control trunk over which alternating current pulses of the same or different frequencies are transmitted to said repeater for selecting any one of said outgoing trunks, means in said repeater controlled by a preliminary pulse of alternating current of one frequency for selecting one pair of said outgoing trunks, means in said repeater controlled by a preliminary pulse of alternating current of another frequency for selecting another pair of said outgoing trunks, and means in said repeater controlled by the first pulse of a subsequent numerical series of impulses of alternating current of either of said frequencies for disconnecting a particular one of the outgoing trunks of the selected pair of trunks.

2. In a switching device, a first tuned circuit adapted to respond to a particular frequency of alternating current, a second tuned circuit adapted to respond to another particular frequency of alternating current, an incoming trunk over which alternating current is transmitted to said tuned circuits, two pairs of outgoing trunks accessible to said device, means controlled by each of said tuned circuits for selecting one pair of said outgoing trunks responsive to a preliminary pulse of alternating current, and additional means controlled by each of said tuned circuits for selecting one trunk of the selected pair responsive to a further pulse of alternating current, the pair of trunks selected responsive to said preliminary impulse and the one trunk of the selected pair of trunks selected responsive to said further pulse determined by the frequency of the alternating current received over said incoming trunk line.

3. In a telephone system, a repeater, a plurality of groups of outgoing trunks accessible to said repeater, an incoming trunk over which a preliminary impulse and a subsequent series of impulses of alternating current are transmitted to control said repeater, means in said repeater responsive to said preliminary impulse for selecting a particular group of said groups of outgoing trunks, said last means also responsive to said subsequent series of impulses, the first impulse of said series controlling said means to select a particular trunk in the selected group and the remaining impulses of said series controlling said means to repeat the impulses over the selected outgoing trunk.

4. A system as claimed in claim 3, in which the selection of the particular group of trunks and also the selection of the particular trunk in the group is controlled by the frequency of the alternating current.

5. In a switching system, a relay group, two groups of outgoing trunks accessible to said relay group, a first and second trunk in each of said two groups of trunks, a first and second frequency of alternating current, an incoming trunk connected to said relay group over which a preliminary impulse of alternating current of said first or second frequency is transmitted to

select one of said groups of outgoing trunks and over which a subsequent series of impulses of alternating current of said first or second frequency are transmitted to select one of the outgoing trunks in the selected group, means in said relay group responsive when the preliminary impulse and the subsequent series of impulses are of the first frequency of alternating current for selecting said first trunk in said first group, means in said relay group responsive when the preliminary impulse is of said first frequency and the subsequent series of impulses are of said second frequency of alternating current for selecting said second trunk in said first group, means in said relay group responsive when the preliminary impulse and the subsequent series of impulses are of said second frequency of alternating current for selecting said first trunk in said second group, and means in said relay group responsive when the preliminary impulse is of said second frequency and the subsequent series of impulses are of said first frequency of alternating current for selecting said second trunk in said second group.

6. In an automatic telephone system, a repeater, four outgoing trunks accessible to said repeater, an incoming control trunk over which preliminary pulses of alternating current of predetermined different frequencies are transmitted to said repeater, a first means in said repeater controlled by a preliminary pulse of alternating current of one frequency for selecting two of said outgoing trunks, and a second means in said repeater controlled by a preliminary pulse of alternating current of another frequency for selecting the remaining two of said outgoing trunks.

7. In a trunk selecting and impulse repeating system, a relay group, an incoming trunk line over which alternating current pulses of low and high frequencies are transmitted to said relay groups, a plurality of outgoing trunk lines, low frequency responding means in said relay group operated responsive to a preliminary pulse of low frequency alternating current for selecting certain of said outgoing trunks, high frequency responding means in said relay group operated responsive to a preliminary pulse of high frequency alternating current for selecting the remainder of said outgoing trunks, and means in said relay group controlled by said low frequency responding means responsive to a subsequent series of pulses of low frequency alternating current for connecting only one of the selected outgoing trunks to said incoming trunk and for repeating said series of pulses over the said connected trunk line, the particular trunk connected by said last mentioned means determined by the frequency of said preliminary pulse.

8. In a trunk selecting system, a relay group, an incoming trunk line terminating in said relay groups, a first and a second control means in said relay group parallelly connected to said incoming trunk line, each of said control means operated by different frequencies of alternating current received over said incoming trunk line, a plurality of outgoing trunk lines, relays controlled responsive to the operation of said first means by a preliminary pulse of one frequency for connecting all of said outgoing trunks to said incoming trunk, and additional relays controlled responsive to the operation of said second means by a subsequent pulse of another frequency for disconnecting all but one of said outgoing trunks.

9. In a switching system, a relay group, an incoming trunk line over which a preliminary impulse of alternating current and a subsequent series of impulses of alternating current are transmitted to said relay group, a plurality of outgoing trunks, a direct current impulse responding relay for each of said outgoing trunks, low frequency and high frequency responding relays in said relay group, means controlled by said low frequency responding relay for selecting a predetermined number of said plurality of outgoing trunks when the preliminary impulse transmitted over said incoming trunk line is of a low frequency, means controlled by said high frequency responding relay for selecting a different predetermined number of said plurality of trunks when a preliminary impulse of high frequency is transmitted over said incoming trunk, trunk connecting means in said relay group effective only after a preliminary impulse has been received for connecting only one of the particular selected plurality of outgoing trunks to said incoming trunks and excluding all others, the particular trunk connecting means operated responsive to the control of one of said frequency responding relays under control of said subsequent series of impulses, and means for simultaneously repeating direct current impulses corresponding in number to the impulses of said series to control the direct current impulse responding relay of the particular outgoing trunk that has been connected to said incoming trunk.

10. In a telephone system, an incoming trunk line, two branch lines connected to said incoming trunk line, two outgoing trunk lines connected to one of said branch lines, and two outgoing trunk lines connected to the other of said branch lines, a low frequency responding relay connected to one of said branch lines and a high frequency responding relay connected to the other of said branch lines, said relays operated responsive to transmission of alternating current of proper frequency over said incoming line, means controlled by the operation of said low frequency responding relay for connecting the two outgoing trunk lines associated with said first branch line to said incoming line, means responsive to the subsequent operation of said low frequency responding relay or said high frequency responding relay for disconnecting one or the other of said outgoing trunk lines from said incoming trunk line, and means controlled by the frequency responding relay that determines the particular outgoing trunk that is to remain connected to the incoming trunk line for repeating direct current impulses over the said connected outgoing trunk line to control the operation of automatic switches in a distant exchange.

11. In a telephone system, a repeater, an incoming trunk line terminating in said repeater, alternating current impulses of different frequencies transmitted over said trunk line for controlling the operation of said repeater, two outgoing trunk groups, each of said groups comprising a plurality of trunks, means in said repeater operated responsive to a first transmission of alternating current for connecting one of said outgoing trunk groups to said incoming truk line, and means in said repeater operated responsive to a second transmission of alternating current for disconnecting all but one trunk of the connected outgoing trunk group from said incoming trunk, the particular outgoing trunk connected to said incoming trunk determined by the frequency of the alternating current transmitted.

GERHARD ROTHERT.