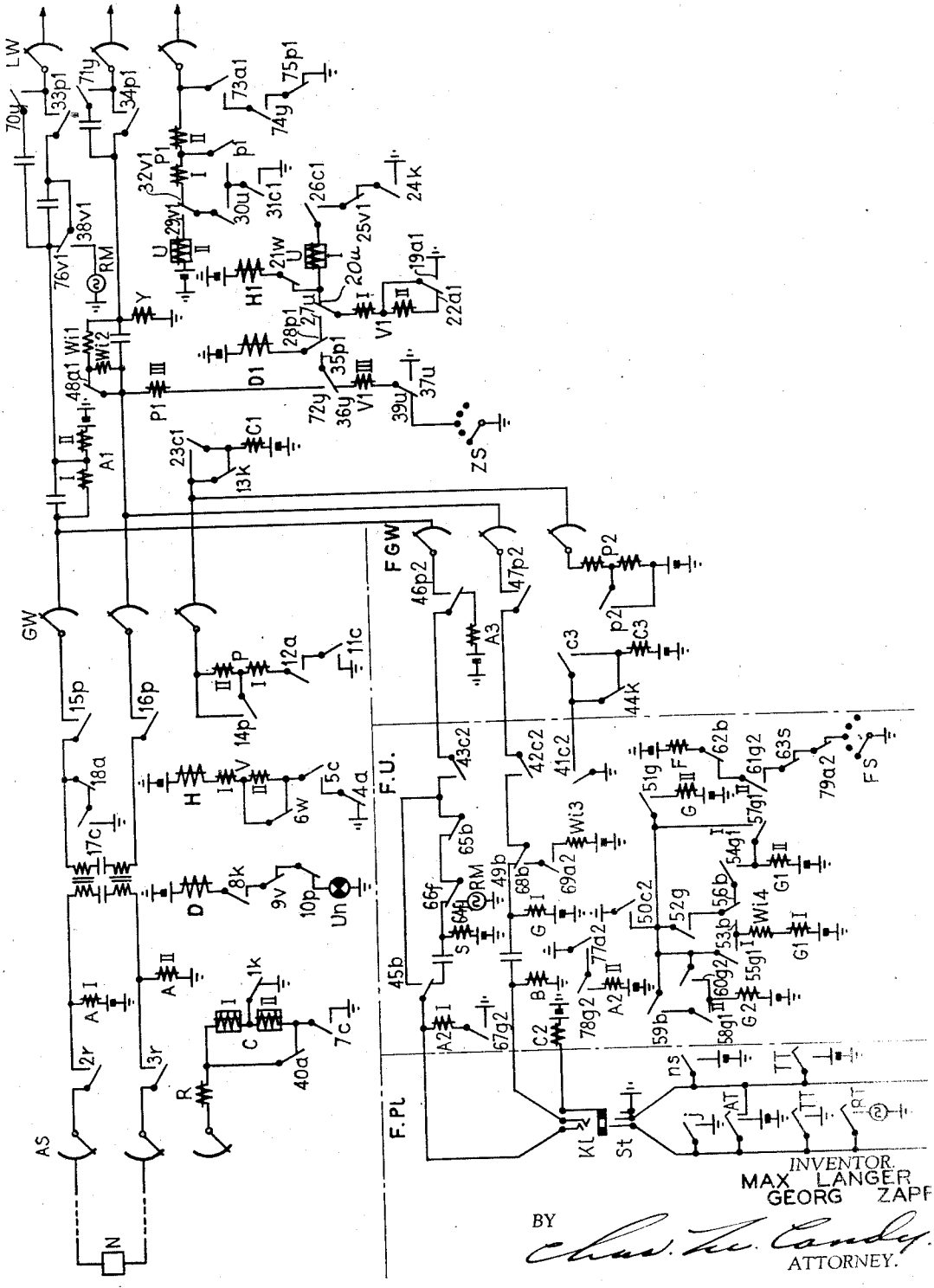
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AUTOMATIC TELEPHONE SYSTEM

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AUTOMATIC TELEPHONE SYSTEM

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The invention relates to automatic telephone systems in which the subscribers' stations can be called in different ways according to the type of connection set up so that they can tell from the way in which they are called what is the type of the connection in which they are being called.

In known arrangements calls of different kinds are completed over separate terminal connecting devices, for example, final selectors with which are associated differently arranged ringing devices.

The problem of the present invention is to enable differential ringing in systems in which the different kinds of calls pass over the same final selector which is equipped with automatic ringing devices, and the problem is solved in that the ringing devices arranged in the final selector transmit ringing current periodically after the subscriber's line has tested free independently of the type of call and switching means are associated with the connecting paths for calls of different types which superimpose on the periodic ringing current of the final selector ringing current of different duration and/or with different intervals.

The arrangement according to the invention has the special advantage that no disconnecting devices are required for the automatic ringing in the final selector.

In the drawing an embodiment of the invention for telephone systems with local and long distance working is represented. All the switching devices and circuits which are not absolutely necessary for the understanding of the invention have been omitted for the sake of clarity. In the top left-hand corner of the drawing is represented a subscriber's station N for local calls which reach a final selector LW which is provided both for local and distant calls over a call finder AS and a group selector GW and over which the desired local call can be established. Distant calls can be established from the trunk position FPL in the left-hand bottom corner over a repeater FÜ and a group selector FGW to the same final selector LW and over this to the desired local subscriber.

The establishment of a local call will first be described briefly:

When the subscriber at station N takes up his receiver the call finder AS is started up in the known way and connects the calling subscriber's line to a free group selector GW. Relays R and C energize over the lower wiper of the call finder and over the off-normal contact 1*k* of the group selector. Relay R switches through the subscriber's line to the line relay A over contacts 2*r* and 3*r* and this relay also energizes. For the purpose of setting the group selector on a free final selector in the desired group the subscriber transmits an impulse train whereby relay A is deenergized impulsively. On each impulse the following circuit is set up for the vertical magnet of the group selector: earth, contacts 4*a* and 5*c*, rotary off-normal contact 6*w* of the group selector, winding I of relay V, winding of the vertical magnet H, battery and earth. As soon as the vertical magnet has taken the first vertical step contact 1*k* is opened. Relays R and C then hold up over contact 7*c* which has meanwhile closed. At the end of the impulse train transmitted by the subscriber relay V releases, so that the rotary magnet D is energized over the off-normal contact 8*k* also closed on the first vertical step of the vertical magnet and over contacts 9*v* and 10*p* and over the interrupter Un and moves the wipers of the group selector on one step. The circuit for the rotary magnet D is broken periodically by the interrupter Un until the test relay P is energized over the following circuit when the lower wiper of the group selector tests on a free final selector: earth, contacts 11*c* and 12*a*, windings I and II of relay P, lower wiper of GW, off-normal contact 13*k* of the final selector LW, the winding of relay C1, battery and earth. Relay P short-circuits its high resistance winding II at contact 14*p* and thus guards the seized final selector in the known way. The speaking leads of the group selector are switched through to the final selector at contacts 15*p* and 16*p*.

If now a further impulse train is transmitted from the calling station N for setting the final selector relay A falls back again on each impulse and completes a circuit for windings I and II of relay A1 in the final selector LW over contacts 17*c*, 18*a* and 15*p* and the upper wiper of the group selector GW. Each time this relay energizes it sets up a circuit for the vertical magnet H1 of the final selector by closing its contact 19*a*1, over winding I of relay V1, and contacts 20*u* and 21*w*. Relay V1 remains energized throughout the impulse train since on account of its winding II being short-circuited periodically at contact 22*a*1 it operates as a slow relay. On the first vertical step contact 13*k* in the test circuit is opened. The test relay P in the group selector and relay C1 in the final selector hold up over contact 23*c*1. When the first impulse train operating on the final selector LW has terminated relay V1 releases and closes the following circuit for relay U: off-normal contact 24*k*, contacts

25v1 and 26c1, winding I of relay U, contact 21w, the winding of the vertical magnet H1, battery and earth. In this circuit only relay U energizes while the vertical magnet H1 on account of the high resistance of this relay does not receive sufficient current to energize. Relay U closes its contact 27u and thus switches over the circuit controlled by contact 19a1 on to the rotary magnet of the final selector over contact 28p1. This magnet is energized by the next impulse train sent out by the subscriber N and sets the wipers of the final selector LW on the contacts of the wanted line. It should be mentioned that relay U remains energized over a second winding II over contacts 29v1, 30u and 31c1 during the influencng of the rotary magnet. When now relay V1 releases at the end of the impulse train contact 29v1 is opened and this promotes the release of relay U. During the release period of this relay, relay P1 can operate over contacts 31c1, 30u and 32v1 if the wanted line is free. It switches the speaking leads through at contacts 33p1 and 34p1 and by closing its contact 35p1 energizes winding III of relay V1 over contacts 36y and 37u so long as relay U has not released. Ringing current from the ringing machine RM is transmitted to the subscriber's line as the so-called first ringing pulse over contact 33p1 and the upper wiper of the first selector. When relay U releases, relay V1 energized temporarily over contact 39u and the 10-seconds switch ZS every 10 seconds and thus applies ringing current to the subscriber's line periodically over the above-mentioned path. When the called subscriber replies relay Y energizes and breaks the ringing circuit by opening contact 36y.

When the call is terminated relay A releases in the group selector when the party at station N replaces his receiver and short-circuits the windings of relay C at contact 40a. The circuit for relay P in the group selector and for relay C1 in the final selector is broken at contact 11c. The said selectors are thus restored to normal.

The establishment of a trunk call by the operator at the trunk position FPL will now be described. For setting up such a call the operator inserts the plug St in the jack K1 of a free trunk repeater FÜ thereby energizing relay C2 of this repeater. It closes its contacts 41c2, 42c2 and 43c2, switches the speaking leads through to the trunk group selector FGW at the latter contacts and over the first contact and the off-normal contact 44k of the group selector FGW energizes the seizing relay C3. For setting the trunk group selector the operator now operates her dial switch of which the contacts *j* and *ns* are shown. Contact *ns* is operated when the dial is pulled off-normal and remains closed until the end of its run back. Relay B in the repeater FÜ is thereby energized and by closing its contact 45b switches the upper speaking lead coming from the trunk jack through to the impulse receiving relay A3 in the group selector FGW. At each impulse contact *j* of the dial switch is closed and energizes relay A3 which sets the group selector in the known way. When it tests on a free succeeding final selector, for example the selector LW shown in the drawing relay P2 energizes over the lower wiper of FGW and contact 13k and the winding of relay C1. The test relay P2 closes its contacts 46p2 and 47p2 whereby the speaking leads coming from the repeater FÜ are switched through to the seized final selector over the wipers of FGW. The setting of the final selector takes place in the same way as described above. When the selector LW is seized however the following circuit is set up for relay G in the repeater FÜ: earth, winding of relay Y in the final selector, resistance Wi1, contact 48a1, lower speaking lead of LW, middle wiper of FGW, contacts 47p2, 42c2 and 49b, winding I of relay G, battery and earth. Relay G energizes and locks up over its winding II over contacts 50c2 and 51g while relay Y in the final selector on account of the high resistance of relay G does not receive sufficient current to energize. On the first impulse train for setting the final selector relay B in the repeater FÜ energizes again and closes the following circuit: earth, contacts 50c2, 52g and 53b, resistance Wi4, winding I of relay G1, battery and earth. Relay G1 is a two-stage relay and only energizes partially over the resistance Wi4 whereupon its contacts 54g1I and 55g1I are closed. At the end of the impulse train relay B releases and completes a circuit for winding II of relay G1 over contacts 50c2, 52g, 56b and 54g1I. Over this winding relay G1 energizes completely and closes its contacts 57g1II and 58g1II. When the second impulse train for setting the final selector is transmitted relay B is energized in the repeater FÜ and completes the following circuit for relay G2: earth, contacts 50c2, 59b and 58g1II, the winding of relay G2, battery and earth. By closing its contact 60g2 relay G2 locks up and at contact 60g2 prepares the circuit for the "ring connecting" relay F. At the end of the said impulse train relay B releases so that the following circuit is closed periodically for relay F: battery, the winding of relay F, contacts 62b, 61g2, 63s, 79a2, the five seconds switch FS and earth. The switch FS closes the above circuit every five seconds so that the ringing machine RM is connected to the upper speaking lead over contact 64f periodically. In this way a five-seconds ringing is superimposed by the repeater FÜ on the ten seconds ringing being transmitted from the final selector when this tests free so that the called subscriber can determine from this particular kind of ringing that he is wanted for a trunk call. Naturally the ringing current superimposed on the automatic ringing from the final selector can be applied in different intervals or it may possess a different duration from the first mentioned ringing, for example it may be longer.

When the wanted party replies the following feeding circuit is established for him: earth, the winding of relay Y, contact 34p1, the middle-wiper of LW, the subscriber's loop, the upper wiper of LW, contacts 33p1, 76v1, winding II of relay A1, battery and earth. In parallel with winding II of relay A1 relay S is energized over the winding I of relay A1, the upper wiper of FGW and contacts 46p2, 43c2, 65b and 66f and this relay by opening its contact 63s breaks the circuit for the ring connecting relay F in the repeater FÜ and thus disconnects the periodic ringing. The disconnection of the ringing in the final selector takes place at contact 36y as indicated in the above description of a local call.

If the subscriber wanted for the trunk call should be busy a busy signal applied in the final selector LW in the known way is transmitted to the operator at the trunk position FPL over contact 66f in the repeater FÜ during the ringing pauses. In this case the ringing current applied at contact 64f cannot reach the subscriber's sta-

tion since the contacts 33*p*1 and 34*p*1 in the final selector are open. The operator thereupon operates her busy connecting key AT and thus connects battery to both speaking leads of the cord circuit. Consequently relay B in the repeater FÜ and relay A2 (winding I) are energized over the contact 67*g*2. By opening its contact 79*a*2, relay A2 breaks the circuit for the ring connecting relay F and locks up over its winding II over contacts 77*a*2; through the closing of contact 68*b* and 69*a*2, battery is applied to the lower speaking lead over the low resistance W*i*3 in the repeater FÜ and thus relay Y in the final selector is energized over contacts 42*c*2, 47*p*2 and 48*a*1 and the resistance W*i*1. Relay Y closes contact 70*y* and 71*y* at which the speaking leads are switched through to the seized subscriber's line over condensers. The operator can now inform the subscriber who is engaged in a local call of the presence of the trunk call and can cut off the trunk call by switching over cut-off key TT. By this means on the one hand relay B is operated again which released when the "busy" connecting key AT was released and on the other hand by applying earth to the left-hand lead of the cord circuit over the contacts 45*b*, 43*c*2 and 46*p*2 energizes relay A1 in the final selector LW. Relay Y holds up meanwhile in a longer circuit over contacts 35*p*1 and 72*y*, winding III of relay P1, resistance W*i*2 and W*i*1. Through the closing of contacts 73*a*1 and 74*y* the cut-off potential is applied to the lower wiper of the final selector over contact 75*p*1 of the testing relay which did not energize through the subscriber's line being busy. This causes relay P1 to be short-circuited in the final selector which holds the wanted subscriber's line busy in the known way. If meanwhile the wanted subscriber has replaced his receiver he can be rung again by the operator by the latter switching over her ringing key RT. The trunk call is released by the withdrawal of the plug *St* from the jack *Kl* at the trunk position on hearing the clearing signal.

What is claimed is:

1. In a telephone system, a substation, signal receiving means at the substation actuable when the substation is not engaged in a call, a plurality of signal transmitters, means for extending calls to said substation, means for rendering one of said transmitters effective alone in certain of said calls, and means for rendering more than one of said transmitters effective concurrently in others of said calls, thereby to actuate said first means differently in different calls.

2. In a telephone system, two sources of signalling current, a substation, means for extending a connection to said substation and for transmitting thereto signalling current from one source alone, or, alternatively, from both sources concurrently, and means at the substation actuated distinctively by said signalling current in dependence upon whether same is from one or both sources.

3. In a telephone system, means for generating codes differing in character, a substation, means for extending a connection to said substation and for transmitting over said connection one of said codes alone, or, alternatively, a plurality of said codes concurrently, and responding means at the substation actuated distinctively in dependence upon whether said one code or said plurality of codes are transmitted over the connection.

4. In a telephone system, a substation, signal receiving means at said substation actuable when the substation is not engaged in a call, means for extending calls of different values to said substation, a plurality of signal transmitters, means for rendering one of said transmitters effective alone if a call of one value is extended to said substation, and means for rendering more than one of said transmitters effective concurrently if a call of another value is extended to said substation, thereby to actuate said first means differently depending upon the value of the call extended to said substation.

5. In a telephone system, a plurality of signal transmitters, a substation, means for extending calls of different values to said substation, means operated when a call is extended to said substation to render one of said transmitters effective regardless of the value of said call, means operated only if the call is of a particular value to render another of said transmitters effective, and responding means at said substation controlled at times by said first transmitter alone and controlled concurrently by said two transmitters only if said call is of said particular value.

6. In a telephone system, subscriber lines, an operator's position, an automatic switch, means for extending a connection from a calling one of the lines or from said position to said automatic switch and for controlling said switch to extend said connection to any desired one of said lines, means in said switch for thereupon transmitting signalling current over said desired line, means associated with said position effective if said connection is extended therefrom to also transmit signalling current over same, and a signal terminating the desired line actuated by signalling current from both of said two last-named means if the connection is extended from said position, or actuated by signalling current from said means in the switch alone if the connection is extended from a calling one of said lines.

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