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INT CL[4] **H04Q**
On line database: WPI
updated as appropriate

FIG. 1

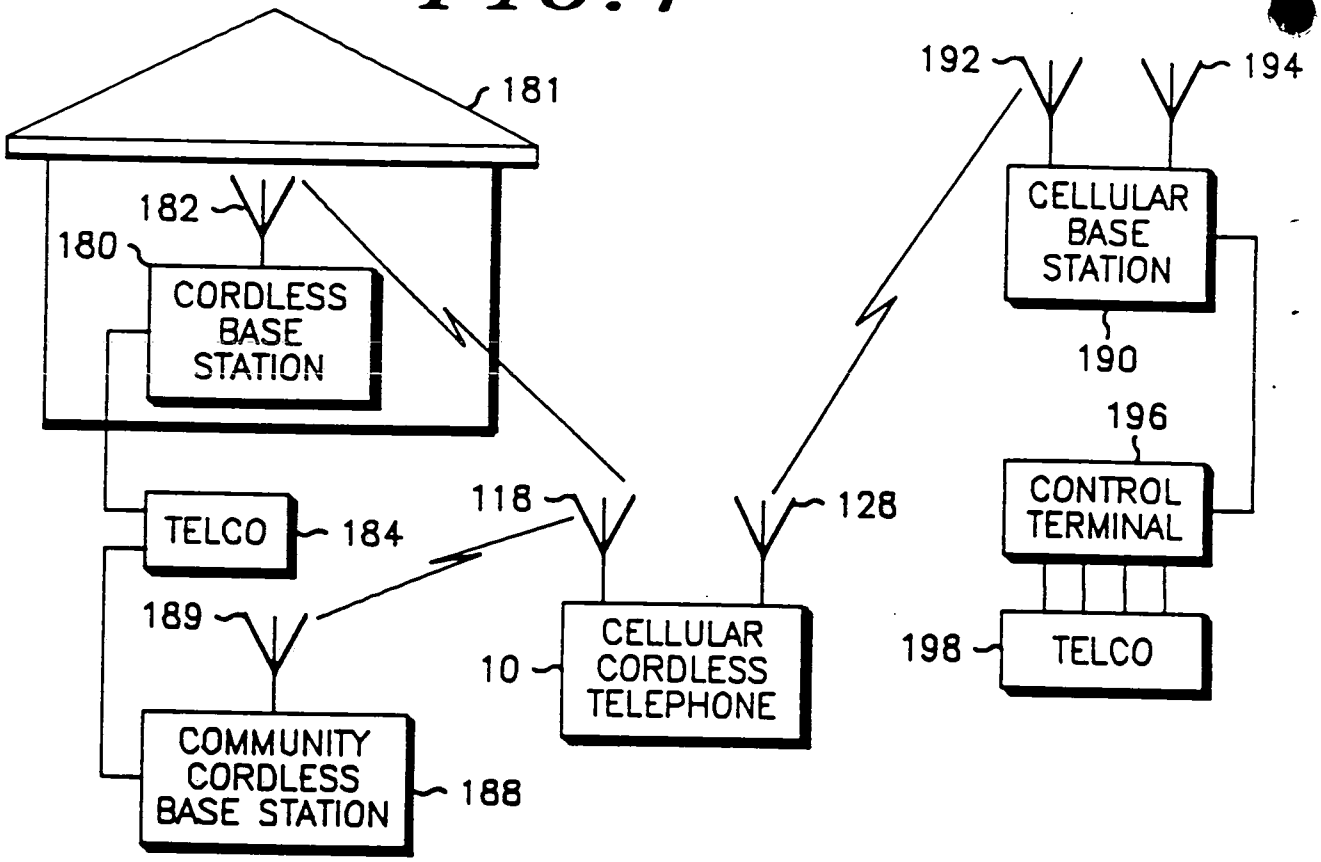
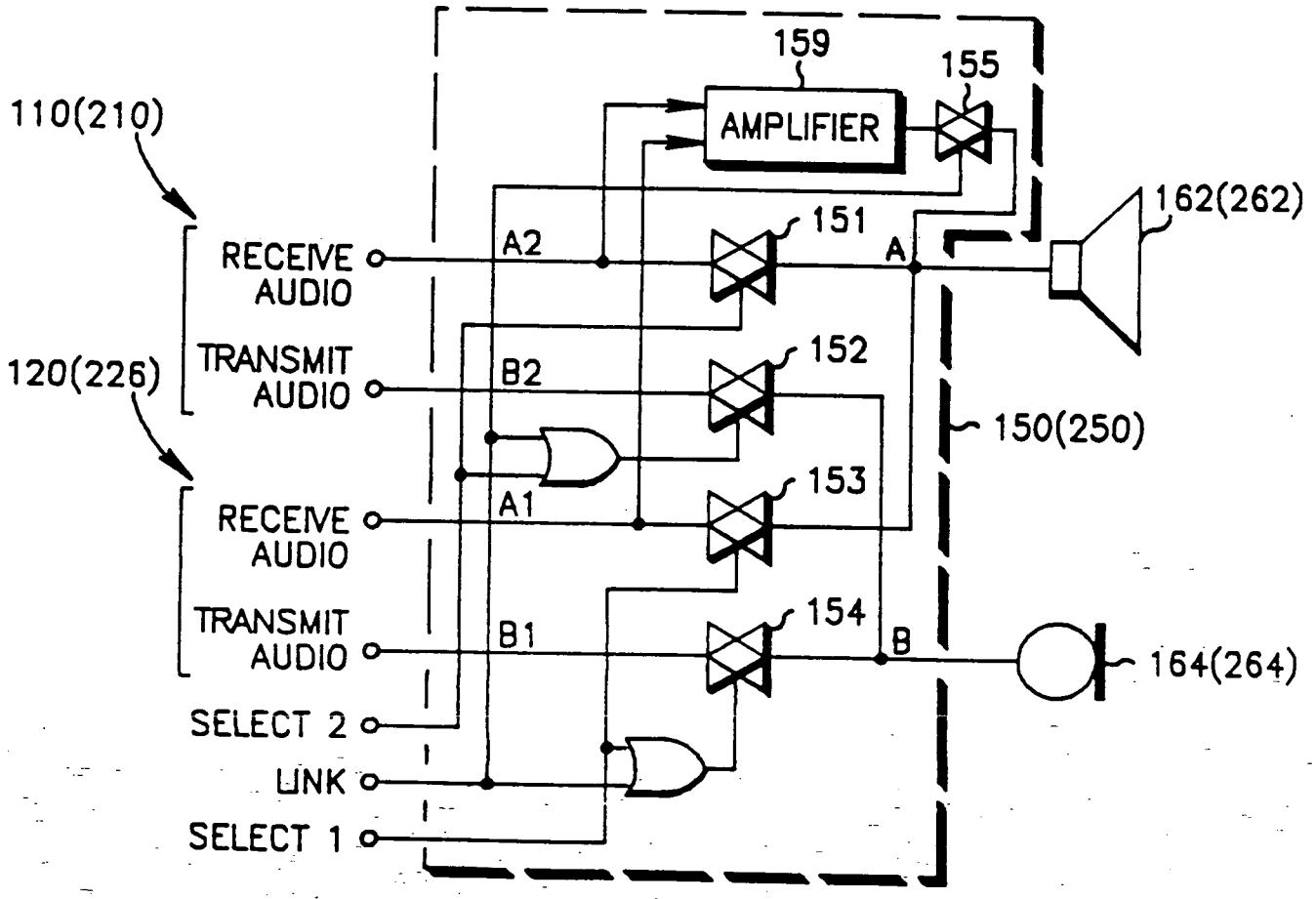

181
182
180
CORDLESS BASE STATION
192
194
CELLULAR BASE STATION
190
196
CONTROL TERMINAL
198
TELCO
TELCO
184
118
128
189
10
CELLULAR CORDLESS TELEPHONE
COMMUNITY CORDLESS BASE STATION
188

FIG. 9


159
155
AMPLIFIER
110(210)
RECEIVE AUDIO
A2
151
A
162(262)
120(226)
TRANSMIT AUDIO
B2
152
150(250)
153
RECEIVE AUDIO
A1
TRANSMIT AUDIO
B1
154
B
164(264)
SELECT 2
LINK
SELECT 1

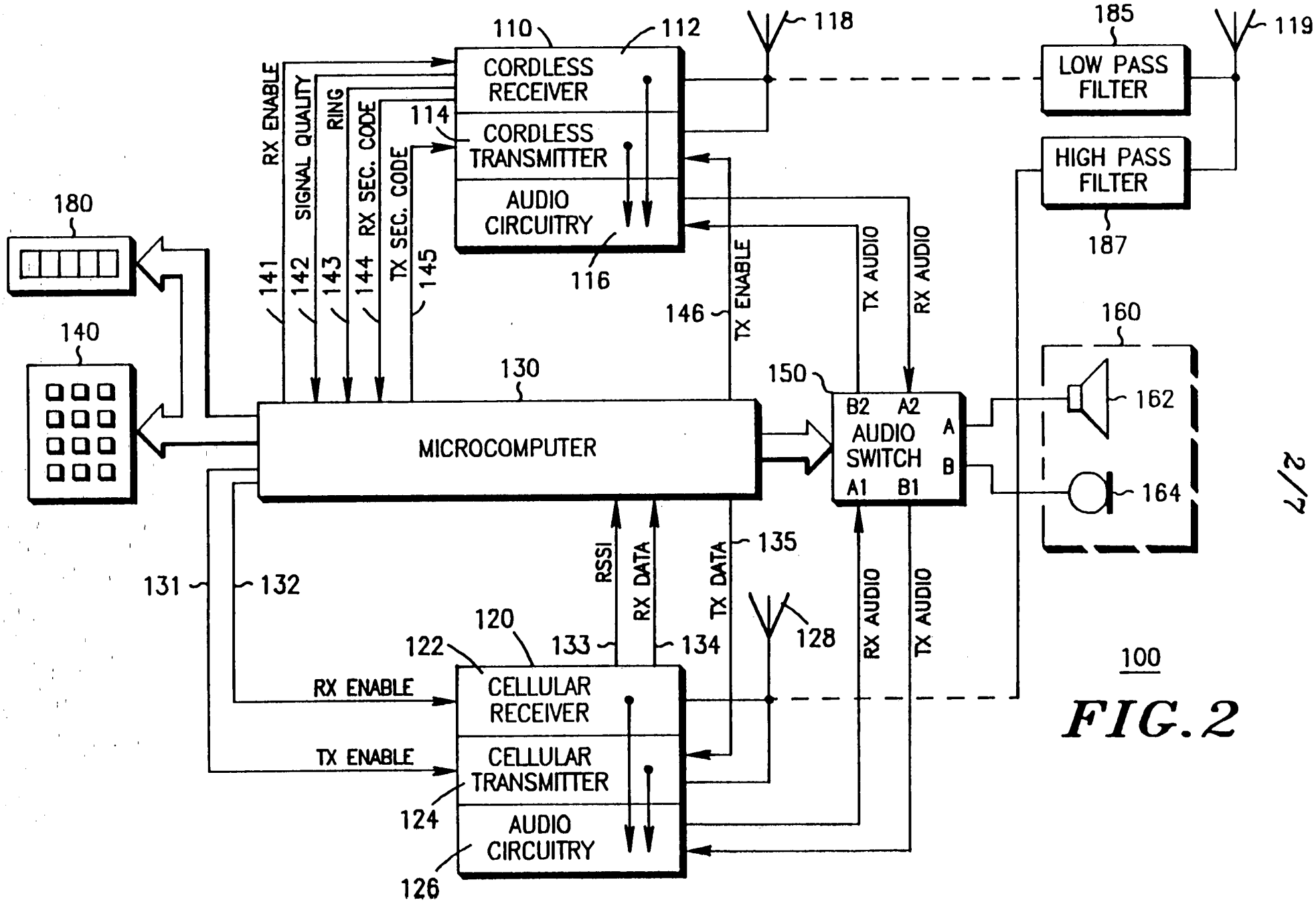

110
112
118
185
119
CORDLESS RECEIVER
CORDLESS TRANSMITTER
AUDIO CIRCUITRY
LOW PASS FILTER
HIGH PASS FILTER
187
114
116
180
140
141
142
143
144
145
146
RX ENABLE
SIGNAL QUALITY
RING
RX SEC. CODE
TX SEC. CODE
TX ENABLE
TX AUDIO
RX AUDIO
130
150
160
162
164
MICROCOMPUTER
B2 A2
AUDIO SWITCH
A
B
A1 B1
131
132
135
RSSI
RX DATA
TX DATA
120
122
133
134
128
RX ENABLE
TX ENABLE
CELLULAR RECEIVER
CELLULAR TRANSMITTER
AUDIO CIRCUITRY
124
126
100

FIG. 2

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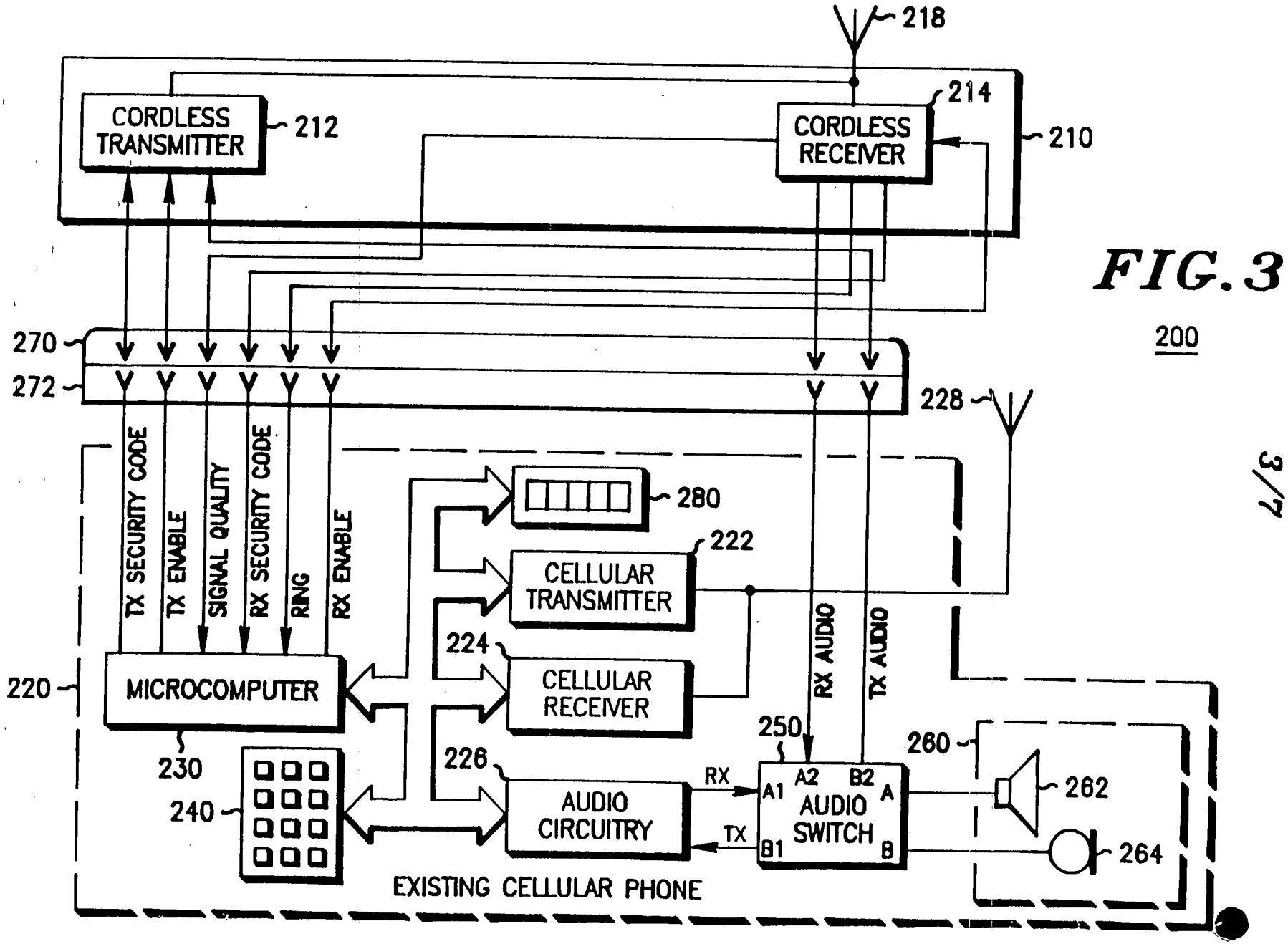

218
CORDLESS TRANSMITTER
212
CORDLESS RECEIVER
214
210
270
272
228
TX SECURITY CODE
TX ENABLE
SIGNAL QUALITY
RX SECURITY CODE
RING
RX ENABLE
280
222
CELLULAR TRANSMITTER
224
CELLULAR RECEIVER
220
MICROCOMPUTER
230
240
226
AUDIO CIRCUITRY
RX AUDIO
TX AUDIO
250
RX
TX
A1
A2
B2
A
B1
B
AUDIO SWITCH
260
262
264
EXISTING CELLULAR PHONE

FIG. 3

200

3/7

FIG. 4

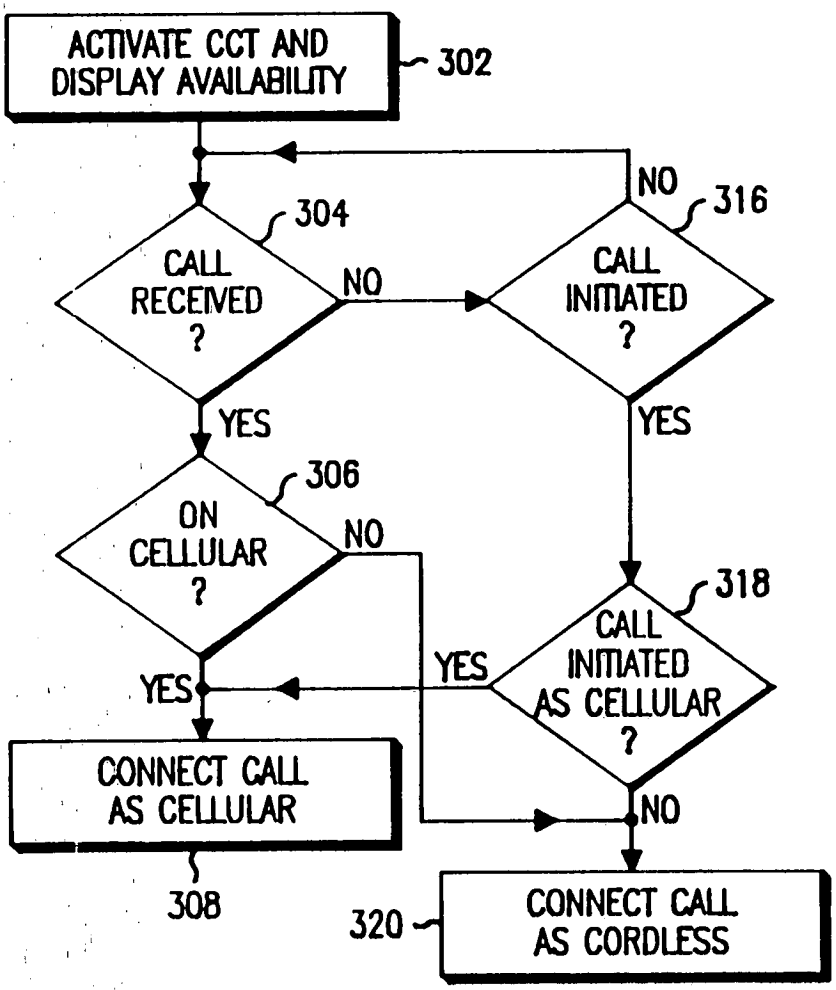

ACTIVATE CCT AND DISPLAY AVAILABILITY
302
CALL RECEIVED ?
304
NO
CALL INITIATED ?
316
NO
YES
YES
ON CELLULAR ?
306
NO
YES
CALL INITIATED AS CELLULAR ?
318
YES
NO
CONNECT CALL AS CELLULAR
308
CONNECT CALL AS CORDLESS
320

FIG. 5

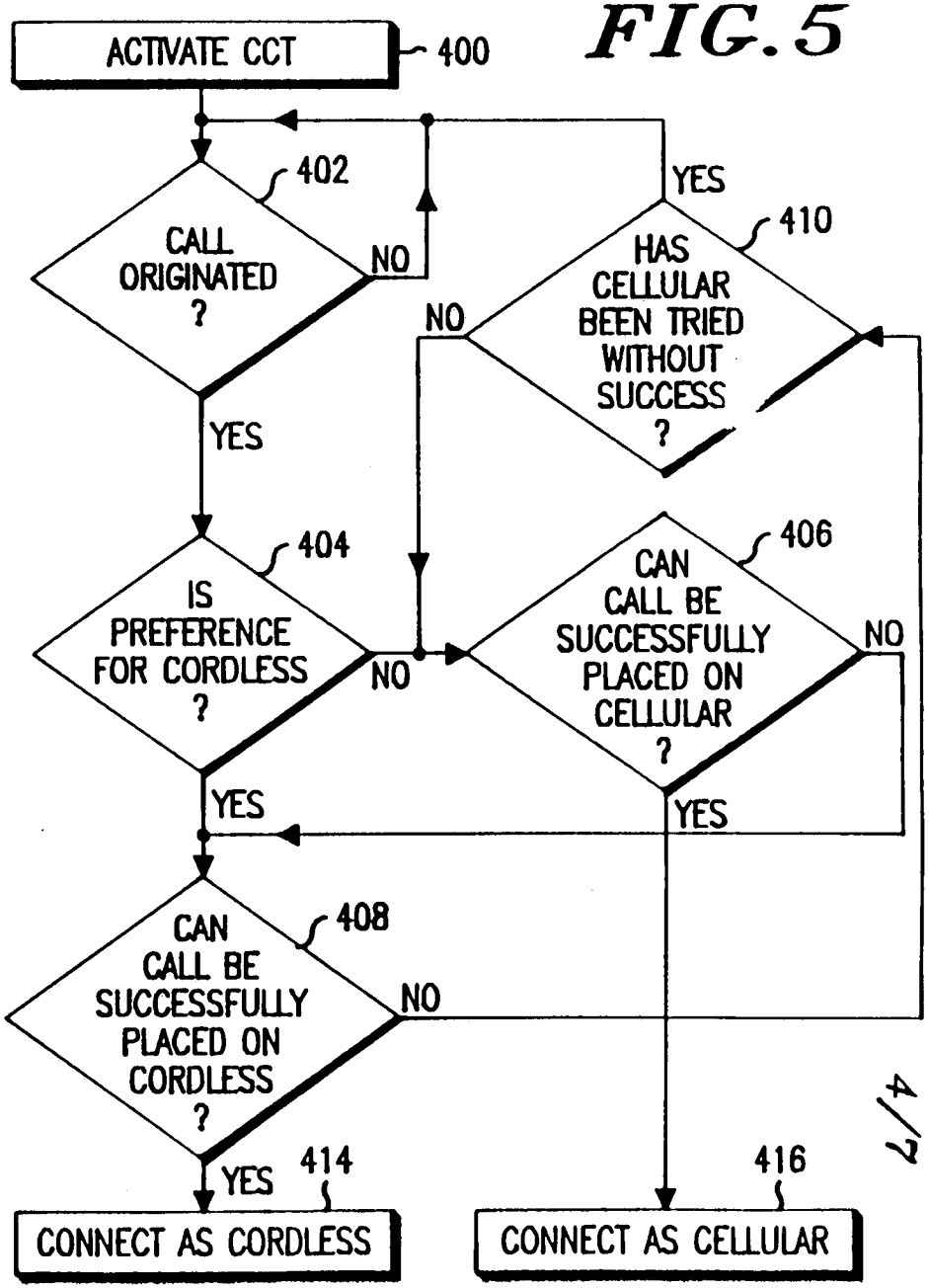

ACTIVATE CCT
400
CALL ORIGINATED ?
402
NO
YES
HAS CELLULAR BEEN TRIED WITHOUT SUCCESS ?
410
NO
YES
IS PREFERENCE FOR CORDLESS ?
404
NO
CAN CALL BE SUCCESSFULLY PLACED ON CELLULAR ?
406
NO
YES
YES
CAN CALL BE SUCCESSFULLY PLACED ON CORDLESS ?
408
NO
YES
414
CONNECT AS CORDLESS
416
CONNECT AS CELLULAR

FIG. 6

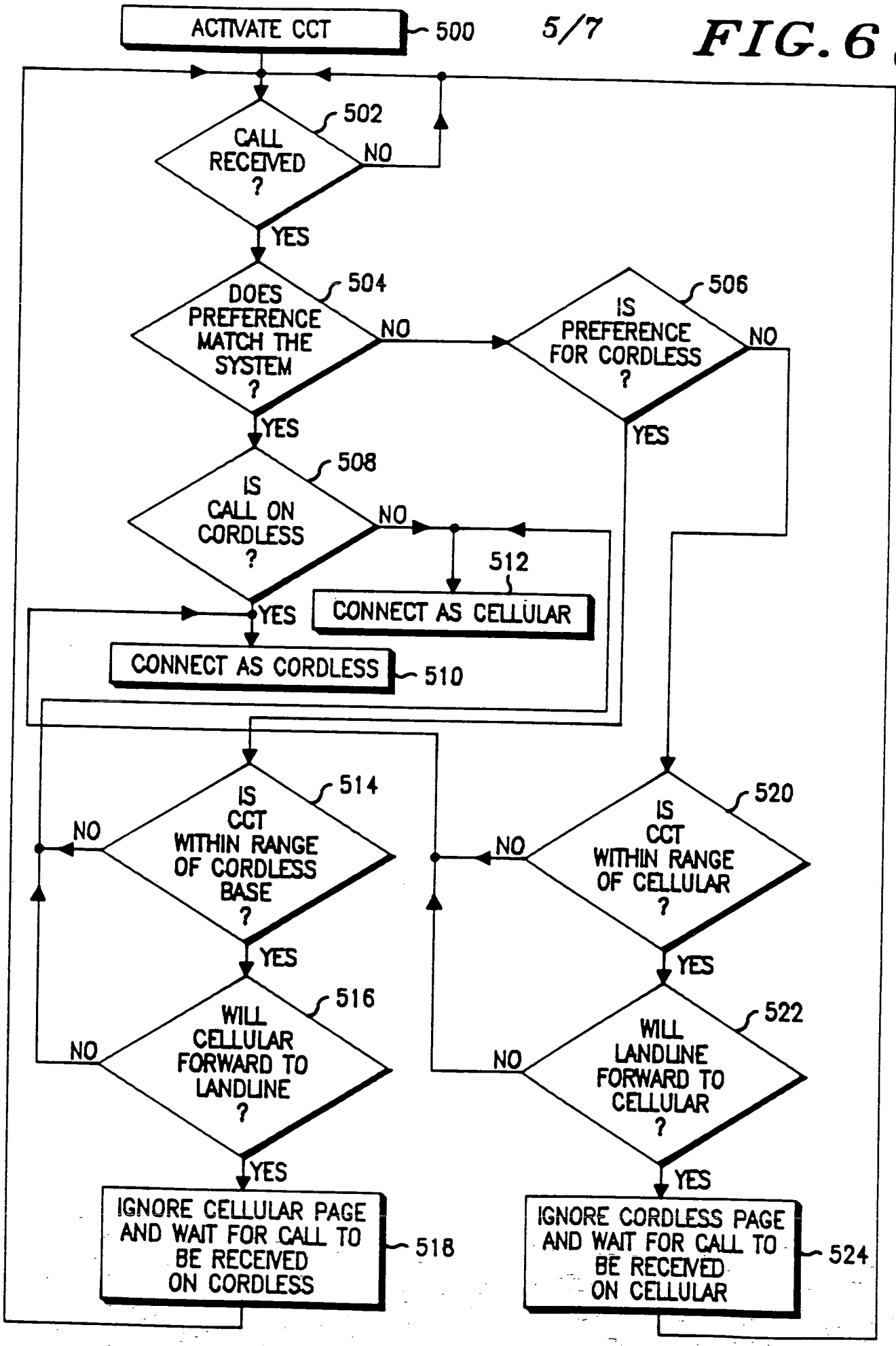

ACTIVATE CCT
500
CALL RECEIVED ?
502
NO
YES
DOES PREFERENCE MATCH THE SYSTEM ?
504
NO
IS PREFERENCE FOR CORDLESS ?
506
NO
YES
YES
IS CALL ON CORDLESS ?
508
NO
512
CONNECT AS CELLULAR
YES
CONNECT AS CORDLESS
510
IS CCT WITHIN RANGE OF CORDLESS BASE ?
514
NO
YES
WILL CELLULAR FORWARD TO LANDLINE ?
516
NO
YES
IGNORE CELLULAR PAGE AND WAIT FOR CALL TO BE RECEIVED ON CORDLESS
518
IS CCT WITHIN RANGE OF CELLULAR ?
520
NO
YES
WILL LANDLINE FORWARD TO CELLULAR ?
522
NO
YES
IGNORE CORDLESS PAGE AND WAIT FOR CALL TO BE RECEIVED ON CELLULAR
524

FIG. 7

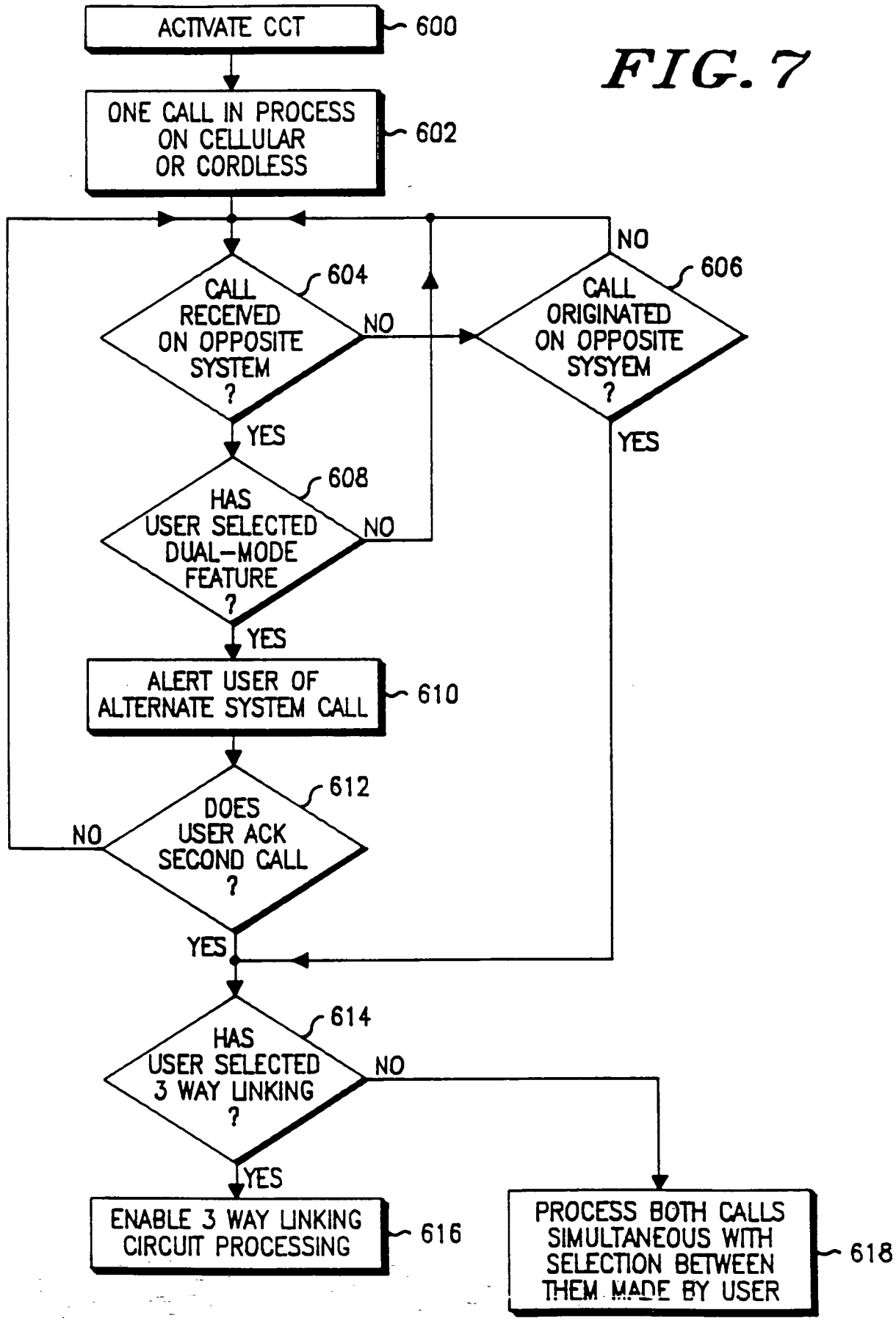
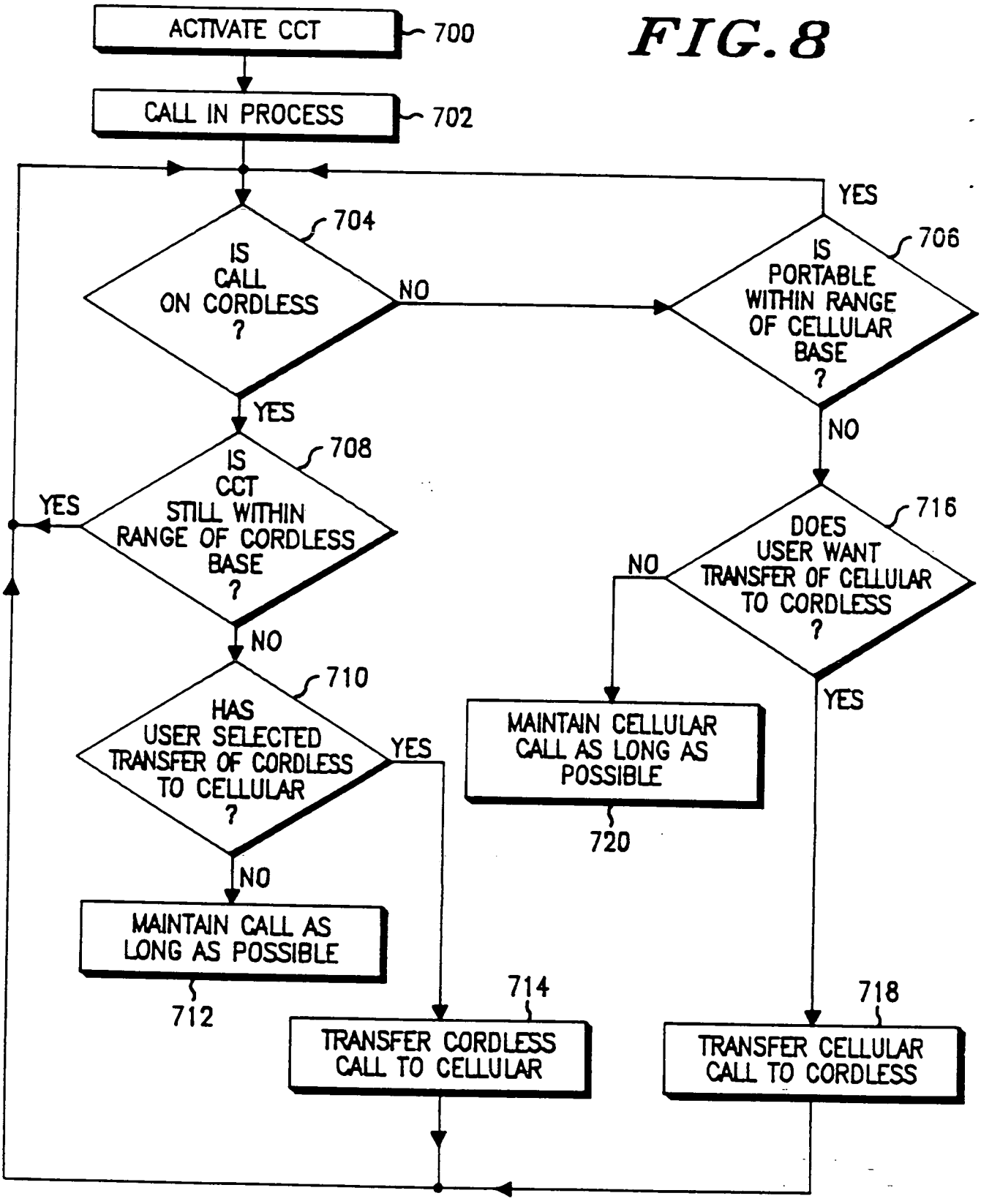

ACTIVATE CCT
600
ONE CALL IN PROCESS ON CELLULAR OR CORDLESS
602
CALL RECEIVED ON OPPOSITE SYSTEM ?
604
NO
CALL ORIGINATED ON OPPOSITE SYSYEM ?
606
NO
YES
YES
HAS USER SELECTED DUAL-MODE FEATURE ?
608
NO
YES
ALERT USER OF ALTERNATE SYSTEM CALL
610
DOES USER ACK SECOND CALL ?
612
NO
YES
HAS USER SELECTED 3 WAY LINKING ?
614
NO
YES
ENABLE 3 WAY LINKING CIRCUIT PROCESSING
616
PROCESS BOTH CALLS SIMULTANEOUS WITH SELECTION BETWEEN THEM MADE BY USER
618

FIG. 8


ACTIVATE CCT
700
CALL IN PROCESS
702
IS CALL ON CORDLESS ?
704
NO
YES
IS PORTABLE WITHIN RANGE OF CELLULAR BASE ?
706
YES
NO
IS CCT STILL WITHIN RANGE OF CORDLESS BASE ?
708
YES
NO
DOES USER WANT TRANSFER OF CELLULAR TO CORDLESS ?
716
NO
YES
HAS USER SELECTED TRANSFER OF CORDLESS TO CELLULAR ?
710
YES
NO
MAINTAIN CELLULAR CALL AS LONG AS POSSIBLE
720
MAINTAIN CALL AS LONG AS POSSIBLE
712
TRANSFER CORDLESS CALL TO CELLULAR
714
TRANSFER CELLULAR CALL TO CORDLESS
718

CELLULAR CORDLESS TELEPHONE

Background of the Invention

The present invention is generally related to cellular telephones and more particularly to an improved cellular cordless telephone for providing both cellular and cordless telephone services.

In the prior art, cordless telephones typically are used in the home to allow the user to place and receive telephone calls at any point throughout the house. Such cordless telephones are connected to the user's telephone landline. However, due to their limited range, such cordless telephones are not suitable for use in vehicles. Vehicular communications are typically achieved by means of radio telephone systems, the most prevalent being cellular telephone systems. A cellular telephone allows the user to place and receive telephone calls at any point throughout a large metropolitan area. However, the cost of a cellular telephone call is as much as seven times the cost of a cordless telephone call, since cordless telephone calls are made by way of the user's telephone landline and cost the same as landline telephone calls, while cellular telephone calls are made by way of expensive cellular base stations and cellular switching equipment and cost much more than landline telephone calls.

Summary of the invention

The present invention provides a cellular cordless telephone in accordance with claim 1. The invention provides an improved cellular cordless telephone that may place both cellular calls and cordless telephone calls. In this manner, the telephone may automatically operate as a cordless telephone whenever it is in range of its corresponding cordless base station.

The invention also provides a method of originating telephone calls in a cellular cordless telephone, a method of receiving incoming telephone calls and a method of automatically transferring a telephone call between a cellular telephone system and a cordless telephone system, in accordance with the independent method claims.

A principal distinction between a cellular telephone and a cordless telephone is that the cellular telephone generally operates at higher power levels. A further distinction is that a cellular telephone generally, but not always, operates at higher frequencies.

Brief Description of the Drawings

Figure 1 is a block diagram of a cellular cordless telephone system embodying the present invention.

Figure 2 is a block diagram of a cellular cordless telephone embodying the present invention.

Figure 3 is a block diagram of another embodiment of a cellular cordless telephone according to the present invention.

Figure 4 is a flow chart for the process used by the cellular cordless telephones in Figures 2 and 3 for placing and receiving cellular and cordless telephone calls.

Figure 5 is a flow chart for the process used by the cellular cordless telephones in Figures 2 and 3 for originating a telephone call as a cellular telephone call or a cordless telephone call according to user selectable preference.

Figure 6 is a flow chart for the process used by the cellular cordless telephones in Figures 2 and 3 for receiving a telephone call as a cellular telephone call or a cordless telephone call according to user selectable preference.

Figure 7 is a flow chart for the process used by the cellular cordless telephones in Figures 2 and 3 for simultaneously processing both a cellular telephone call and a cordless telephone call and three-way linking both calls.

Figure 8 is a flow chart for the process used by the cellular cordless telephones in Figures 2 and 3 for automatically transfering between a cellular telephone call and a cordless telephone call.

Figure 9 is a block diagram of audio switch 150 in the cellular cordless telephone in Figure 2.

Description of the Preferred Embodiment

In Figure 1, there is illustrated a block diagram of a cellular cordless telephone system embodying the present invention. The system includes a telephone company phone system (TELCO) 184, connected by telephone landlines to a cordless base station 180 located in a home or office 181 and to a community cordless base station 188 in another office, building, or other geographical location. Cordless base stations 180 and 188 communicate with the cellular cordless telephone (CCT) 10 through antennas 182 and 189. Antennas 182 and 189 may be implemented as telescoping whip antennas. Cordless base stations 180 and 188 may be any conventional cordless base station, such as, for example, the base station shown and described in Panasonic operating instructions, entitled "Cordlessphone Model No. KX-T3000 EASA-PHONE", published by and available from the Panasonic Company, One Panasonic Way, Secaucus, New Jersey, 07094. Additional community cordless base stations 188 may be located throughout a metropolitan area for providing shared telephone service to CCTs 10. In this case, cordless base station 188 may include additional equipment for billing calls to the telephone number of CCT 10.

Also connected through telephone landlines to the same or a different telephone company phone system (TELCO) 198 is the cellular control terminal 196 (see U.S. patent no. 4,268,722) with its associated cellular base station(s) 190 (see U.S. patent no. 4,485,486 incorporated herein by reference). Cellular base station 190 incorporates both a receive antenna 192 and a transmit antenna 194 (see U.S. patent no. 4,369,520 incorporated herein by reference) for communicating with CCTs 10.

CCT 10 may be a mobile unit installed in a vehicle, a transportable unit which is a mobile unit and battery installed in a carrying case, or a hand-held portable unit. CCT 10 includes an antenna 118 for the cordless radio channels and an antenna 128 for the cellular radio channels as illustrated by the embodiment of CCT 200 in Figure 3, or may include a single antenna, is illustrated by the embodiment of CCT 100 in Figure 2. In the U.S.A., the cordless radio channels are in the frequency band from 46-49 mHz and the cellular radio channels are in the frequency band from 824-894 mHz.

In Figure 2, there is illustrated a detailed block diagram of a first embodiment of a CCT 100 according to the present invention. CCT 100 includes a cordless telephone transceiver 110, antenna 118, cellular telephone transceiver 120, antenna 128, microcomputer 130, keypad 140, display 180, audio switch 150, and handset 160 including speaker 162 and microphone 164. Alternatively, as shown by dashed-lines in Figure 2, cordless telephone transceiver 110 and cellular telephone transceiver 120 may be coupled to a single antenna 119 in place of antennas 118 and 128 by way of low-pass filter 185 and high-pass filter 187, respectively. Cordless telephone transceiver 110 may be any conventional cordless telephone transceiver, such as, for example the

transceiver shown and described in the aforementioned Panasonic operating instructions, entitled "Cordlessphone Model No. KX-T3000 EASA-PHONE". Cellular telephone transceiver 120, microcomputer 130, keypad 140, and handset 160 likewise may be any commercially available cellular transceiver, such as, for example, the transceiver shown and described in Motorola instruction manual number 68P81049E55, entitled "DYNATAC Cellular Mobile Telephone", published by and available from Motorola C & E Parts, 1313 East Algonquin Road, Schaumburg, Illinois 60196.

Referring to Figure 9, audio switch 150 may be implemented with two-to-one multiplexing analog switches 151-155 which select between audio signals of audio circuitry 116 in cordless transceiver 110 and audio circuitry 126 in cellular transceiver 120 under control of select signals SELECT1, SELECT2 and LINK from microcomputer 130. Select signal SELECT2 enables switches 151 and 152 when it has a binary one state, select signal SELECT1 enables switches 153 and 154 when it has a binary one state, and select signal LINK enables switches 152, 154 and 155 when it has a binary one state. Depending on which is enabled, analog switches 151 and 153 couple speaker 162 to receive audio from audio circuitry 116 and audio circuitry 126, respectively. Similarly, depending on which is enabled, analog switches 152 and 154 couple microphone 164 to transmit audio of audio circuitry 116 and audio circuitry 126, respectively. If three-way linking is selected, analog switches 152 and 154 couple microphone 164 to transmit audio of both audio circuitry 116 and audio circuitry 126, and analog switch 155 couples speaker 162 to receive audio of both audio circuitry 116 and audio circuitry 126 by way of summing amplifier 159.

Referring to CCT 100 in Figure 2, microcomputer 130 is programmed in accordance with Figures 4-8 for operating as a cellular telephone, a cordless telephone, or a cellular cordless telephone. That is, according to the present invention, CCT 100 may simultaneously operate as a cellular telephone and a cordless telephone. When operating as a cellular telephone, control signals 131 TX ENABLE and 132 RX ENABLE of microcomputer 130 enable cellular transmitter 124 and cellular receiver 122, respectively. In addition to control signals 131 and 132 to cellular transceiver 120, microcomputer 130 also monitors control signals 133 RSSI, 134 RX DATA and 135 TX DATA for detecting signal strength, for detecting receive data and for sending transmit data, respectively, used in operation of cellular transceiver 120. When operating as a cordless telephone, control signals 141 and 146 of microcomputer 130 enable cordless receiver 112 and cordless transmitter 114, respectively. In addition to control signals 141 and 146 to cordless transceiver 110, microcomputer 130 also monitors control signals 142 SIGNAL QUALITY, 143 RING, 144 RX SECURITY CODE and 145 TX SECURITY CODE for detecting signal strength, ringing, and the receive security code, and for sending the transmit security code and dialed digits, respectively, used in operation of cordless transceiver 110. Dialed digits may also be encoded by keypad 140 as conventional multi-frequency tones which are coupled to transmit audio of cordless transceiver 110 by audio switch 150 during cordless operation.

Referring next to Figure 3, there is illustrated a block diagram of another embodiment of a cellular cordless telephone (CCT) 200 according to the present invention. CCT 200 includes a cordless telephone transceiver 210 in a separate housing with antenna 218

and connector 270, and a cellular telephone 220 in a separate housing with antenna 228 and connector 272. Cordless telephone transceiver 210 may be a plug-in accessory which couples via connectors 270 and 272 to cellular telephone 220. When cordless telephone transceiver 210 is plugged into microcomputer 230 of cellular telephone 220, it operates in accordance with Figures 4-8. Cellular telephone 220 includes cellular transmitter 222, cellular receiver 224, microcomputer 230, keypad 240, display 280, audio circuitry 226, audio switch 250 and handset 260 including speaker 262 and microphone 264. Cordless telephone transceiver 210 may be any conventional cordless telephone transceiver, such as, for example the transceiver shown and described in the aforementioned Panasonic operating instructions, entitled "Cordlessphone Model No. KX-T3000 EASA-PHONE". Cellular telephone 220 likewise may be any commercially available cellular transceiver, such as, for example, the transceiver shown and described in the aforementioned Motorola instruction manual number 68P81049E55, entitled "DYNATAC Cellular Mobile Telephone".

Microcomputer 230 of cellular telephone 220 is coupled to the cordless telephone transceiver 210 via the same control signals used in Figure 2. These control signals are TX/RX enable signals, signal quality signal, ring signal and TX/RX security code signals.

Audio circuitry 226 of cellular telephone 220 is coupled to audio switch 250 which can be implemented with two-to-one multiplexing analog switches (see Figure 9) which select between audio signals from the cellular receiver 224 and transmitter 222 and cordless telephone receiver 214 and transmitter 212.

Referring now to Figure 4, there is illustrated a flow chart for the process used by the CCTs 100 and 200 in Figures 2 and 3, respectively, for placing and

receiving cellular and cordless telephone calls. Entering at block 302, the user activates the CCT. The microcomputer 130 and 230 monitors both the cellular and cordless systems for availability thereof and for incoming and outgoing calls. If the cellular system and/or cordless system are available, a corresponding availability indicator is enabled in display 180 and 280. In cellular systems, the microcomputer scans pre-selected signalling channels to determine if cellular service is available. Next, at decision block 304, a check is made to determine if a call has been received. If not, NO branch is taken to decision block 316 to determine if a call has been initiated by the user of the CCT. If not, NO branch is taken back to block 304 to continue monitoring both the cellular and cordless systems for telephone calls.

Returning to decision block 304, if an incoming call has been received, YES branch is taken to decision block 306 where a check is made to determine if the incoming call is a cellular call. If so, YES branch is taken to block 308 where a cellular call indicator is activated or entered in display 180 and 280, and the incoming call is connected as a cellular call (e.g., in Figure 2, cellular transceiver 120 is enabled by microcomputer 130). If the incoming call is not a cellular call, NO branch is taken from block 306 to block 320 where a cordless call indicator is activated or entered in display 180 and 280, and the incoming call is connected as a cordless call (e.g., in Figure 2, cordless transceiver 110 is enabled by microcomputer 130).

Returning to decision block 316, if a call has been initiated by the user of the CCT, YES branch is taken to decision block 318 where a check is made to determine if the initiated call is a cellular call. If so, YES branch is taken to block 308 where the initiated call is

connected as a cellular call. If the initiated call is not a cellular call, NO branch is taken from decision block 318 to block 320 where the initiated call is connected as a cordless call.

Referring now to Figure 5, there is illustrated a flow chart for the process used by the CCTs 100 and 200 in Figures 2 and 3, respectively, for originating a telephone call as a cellular telephone call or a cordless telephone call according to user selectable preference.

Entering at block 400, the user activates the CCT. Next, at block 402, a check is made to determine if a call has been originated by the CCT. If not, NO branch is taken to wait for a call to be originated. If a call has been originated, YES branch is taken from decision block 402 to decision block 404, where a check is made to determine if the user's preference is for cordless phone operation. If not, NO branch is taken to block 406 to determine if a call can be placed on the cellular system. If so, YES branch is taken to block 416 where the call origination is connected as a cellular call. If not, NO branch is taken to decision block 408 to determine if a call can be successfully placed on the cordless system. Referring back to decision block 404, if preference is for cordless, YES branch is also taken to decision block 408. If a cordless call can be successfully placed, YES branch is taken from decision block 408 to decision block 414 where the call is connected as a cordless call. If not, NO branch is taken to decision block 410 to determine if a call had been tried unsuccessfully on the cellular system. If so, YES branch is taken to block 402 to wait for a call origination. If not, NO branch is taken to decision block 406 to determine if the call can be placed on the cellular system.

Referring now to Figure 6, there is illustrated a flow chart for the process used by the CCTs 100 and 200 in Figures 2 and 3, respectively, for receiving a telephone call as a cellular telephone call or a cordless telephone call according to user selectable preference.

Entering at block 500, the user activates the CCT. Next, at decision block 502, a check is made to determine if a call is being received by the CCT. If not, NO branch is taken back to decision block 502. If a call has been received, YES branch is taken from decision block 502 to decision block 504 to determine if the user's system preference matches the system of the incoming call. If so, YES branch is taken to decision block 508 to determine if the call is on the cordless system. If so, the YES branch is taken to block 510 where the incoming call is connected as a cordless call. If not, the NO branch is taken to block 512 where the incoming call is connected as a cellular call.

Returning to decision block 504, if the user's system preference does not match the system of the incoming call, NO branch is taken to decision block 506 to determine if the preference is for the cordless system. If so, the YES branch is taken to decision block 514 to determine if the CCT is within range of the cordless base station (e.g., by sending the transmit security code and waiting for the receive security code from the cordless base station). If not, the NO branch is taken to block 512 where the incoming call is connected as a cellular call. If the cellular cordless telephone is within range of the cordless base station, YES branch is taken from decision block 514 to decision block 516 to determine if the cellular system will forward the unanswered incoming call to the landline of the cordless base station when the cellular phone cannot be reached. This type of service is generally referred to as "call forwarding" and can be determined by polling stored information in the memory associated with the CCT microcomputer. If not, NO branch is taken to block 512 where the incoming call is connected as a cellular call. If the cellular system will forward the unanswered incoming call, YES branch is

taken from decision block 516 to block 518 where the cellular page from the cellular base station is ignored and thereafter to decision block 502 to wait for the incoming call to be received as a cordless call.

Returning to decision block 506, if the preference is for a cellular call, NO branch is taken to decision block 520 to determine if the CCT is within range of the cellular base stations (does it have cellular service). This is typically determined by scanning and selecting the strongest signalling channel from the surrounding cellular base stations. If not, NO branch is taken to block 510, where the incoming call is connected as a cordless call. If the CCT is within range of the cellular base stations, YES branch is taken from decision block 520 to decision block 522 to determine if the landline system will forward the unanswered incoming call to the cellular system. This type of service is generally referred to as "call forwarding" and can be determined by polling stored information in the memory associated with the CCT microcomputer. If not, NO branch is taken to block 510 where the incoming call is connected as a cordless call. If the landline telephone system will forward the unanswered incoming call, YES branch is taken from decision block 522 to block 524 where the cordless page from the cordless base station is ignored and thereafter back to decision block 502 to wait for the incoming call to be received as a cellular call.

Referring now to Figure 7, there is illustrated a flow chart for the process used by the CCTs 100 and 200 in Figures 2 and 3, respectively, for simultaneously processing both a cellular telephone call and a cordless telephone call and, if desired, three-way linking both calls.

Entering at block 600, the user activates the CCT. Next, at block 602, one call is assumed to be in process

on either the cellular system or cordless system. Proceeding from block 602 to decision block 604, a check is made to determine if a call has been received on the opposite system from the call in process. If so, YES branch is taken to decision block 608 to determine if the user has selected the dual-mode feature (e.g., by entering a predetermined code from the keypad). If not, NO branch is taken back to decision block 604 and the current call remains in process. If the user has selected the dual-mode feature, YES branch is taken from decision block 608 to block 610 which alerts the user of an incoming call on the alternate system. This type of service is generally referred to as "call waiting". Next, at decision block 612, a check is made to see if the user acknowledges the second call. If not, NO branch is taken back to decision block 604 and the current call remains in process. If the user acknowledges the second call (e.g., by flashing the hookswitch), YES branch is taken from decision block 612 to decision block 614 to determine if the user has selected three-way linking (e.g., by entering a predetermined code from the keypad). If so, YES branch is taken to block 616 which enables three-way linking of the user and the two calls, each of which is on a different system. Three-way linking may be accomplished by switchably coupling the combined receive audio signals from summing amplifier 159 via analog gate 155 to the speaker, and enabling both transmit audio switches 152 and 154 in Figure 9. If the user has not selected three-way linking, NO branch is taken from decision block 614 to block 618 to process both calls simultaneously, one over each system, but selection between them is made by the user so that only one party is in conversation with the user at a time. Selection between the calls may be made pressing a pre-selected key or set of keys on the keypad.

Returning to decision block 604, if a call has not been received on the opposite system, NO branch is taken to decision block 606 to determine if a call has been originated on the opposite system. If not, NO branch is taken back to decision block 604. If a call has been originated on the opposite system, YES branch is taken from decision block 606 to decision block 614 to determine if the user wants three-way linking, as described hereinabove.

Referring now to Figure 8, there is illustrated a flow chart for the process used by the CCTs 100 and 200 in Figures 2 and 3, respectively, for automatically transfering between a cellular telephone call and a cordless telephone call.

Entering at block 700, the user activates the CCT. Next at block 702, a call is assumed to be in process on one of the two systems. Proceeding from block 702 to decision block 704, a check is made to determine if the call in process is on the cordless system. If so, YES branch is taken to decision block 708 to determine if the CCT is still within range of the cordless base stations (e.g., signal quality is good). If so, YES branch is taken back to decision block 704. If the cellular cordless telephone is out of range of the cordless base stations, NO branch is taken from decision block 708 to decision block 710 to determine if the user has selected transfer of the cordless call to the cellular system (e.g., by entering a predetermined code from the keypad). If so, YES branch is taken to block 714 where an attempt is made to transfer the cordless call to the cellular system. Assuming the called party has "call waiting", the transfer is attempted by placing another call on the cellular system and waiting for the called party to answer. Thereafter, the path returns to decision block 704. If the user has not selected call transfer, NO

branch is taken from decision block 710 to block 712 where the cordless call is maintained as long as possible.

Returning to decision block 704, if the call is not on the cordless system, NO branch is taken to decision block 706 to determine if the CCT is still within range of the cellular base stations (e.g., signal quality is good). If so, YES branch is taken back to decision block 704. If the CCT is out of range of the cellular base stations, NO branch is taken from decision block 706 to decision block 716 to determine if the user has selected transfer of the cellular call to the cordless system (e.g., by entering a predetermined code from the keypad). If not, NO branch is taken to block 720 where the cellular call is maintained as long as possible. If the user has selected call transfer, YES branch is taken from decision block 716 to block 718 where an attempt is made to transfer the cellular call to the cordless system. Assuming the called party has "call waiting", the transfer is attempted by placing another call on the cordless system and waiting for the called party to answer. Thereafter, the path returns to decision block 704.

In summary, a unique cellular cordless telephone has been described that may be advantageously utilized for making both cellular telephone calls and cordless telephone calls. Whenever the cellular cordless telephone is within range of the cordless base station, telephone calls are preferably originated on the cordless system, or if currently in process, are transferred to the cordless telephone system.

Claims

1. A cellular cordless telephone for making and receiving cellular telephone calls on cellular radio channels of a cellular telephone system and cordless telephone calls on at least one cordless radio channel of a base station coupled to a telephone landline, said cellular cordless telephone comprising:

a cellular telephone including an antenna, cellular transceiver means coupled to said antenna for communicating cellular telephone calls on cellular radio channels, and control means coupled to said cellular transceiver for making and receiving cellular telephone calls; and cordless transceiver means including an antenna for communicating cordless telephone calls on the cordless radio channel, and said control means further being coupled to said cordless transceiver means for making and receiving cordless telephone calls.

2. The cellular cordless telephone according to claim 1, further including first housing means for enclosing said cellular telephone and second housing means for enclosing said cordless transceiver means, said first housing means including first connector means coupled to said control means, and said second housing means including second connector means coupled to said cordless transceiver means and adapted to be coupled to said first connector means.

3. The cellular cordless telephone according to claim 1 or 2, further including display means for providing a first visual indication of a cellular telephone call and a second visual indication of a cordless telephone call.

4. The cellular cordless telephone according to claim 1 or 2, further including display means for providing a first visual indication of the availability of one of the cellular radio channels and a second visual indication of the availability of the cordless radio channel.

5. A cellular cordless telephone according to any one of the preceding claims, further comprising a handset, and audio switching means responsive to said control means for coupling said cellular transceiver means to said handset during cellular telephone calls and coupling said cordless transceiver means to said handset during cordless telephone calls.

6. A cellular cordless telephone according to any one of the preceding claims, wherein the antenna of the cellular telephone is a first antenna and the antenna of the cordless telephone is a second, separate antenna.

7. A cellular cordless telephone according to any one of claims 1 to 5, wherein the antenna of the cellular telephone is the same antenna as that of the cordless telephone.

8. A method of originating telephone calls in a cellular cordless telephone that can originate a cellular telephone call and a cordless telephone call in a pre-selected sequence stored therein, comprising:

selecting a first call of said cellular telephone call or said cordless telephone call in said stored pre-selected sequence;

attempting to originate said first call; and

attempting to originate a second call of said cellular telephone call or said cordless telephone call in said stored pre-selected sequence when said first call can not be successfully originated.

9. A method of receiving incoming telephone calls in a cellular cordless telephone that can receive a pre-selected preferred call of cellular or cordless telephone calls stored therein, comprising:

accepting an incoming telephone call when said incoming telephone call matches said stored preferred call; and

ignoring an incoming telephone call when said incoming telephone call does not match said stored preferred call.

10. The method according to claim 9, further including the steps of:

forwarding said incoming telephone call when ignored by said cellular cordless telephone; and

accepting a subsequent incoming call when said subsequent incoming call matches said stored preferred call.

11. A method of receiving a second telephone call during a first telephone call in a cellular cordless telephone that can originate and receive cellular and cordless telephone calls in response to input signals from telephone input means comprising:

generating a perceptible indication that said second telephone call has been received;

monitoring said telephone input means for a first predetermined input signal; and

accepting said second telephone call in response to detection of said first predetermined input signal.

12. The method according to claim 11, further including the steps of:

monitoring said telephone input means for a second predetermined input signal; and

three-way linking said first telephone call and said second telephone call in response to detection of said second predetermined input signal.

13. The method according to claim 11, further including the steps of:

monitoring said telephone input means for a third predetermined input signal; and

switching between said first telephone call and said second telephone call in response to detection of said third predetermined input signal.

14. A method of automatically transferring a telephone call between a cellular telephone system and a cordless telephone system in a cellular cordless telephone that can originate and receive cellular and cordless telephone calls in response to input signals from telephone input means comprising:

determining availability of the cellular telephone system and the cordless telephone system;

monitoring the quality of said telephone call; and

transferring said telephone call between said cellular telephone system and said cordless telephone system in response to a change in the quality of said telephone call.

15. The method according to claim 14, wherein said cordless telephone system includes a cordless base station radio, said cellular telephone system includes at least one cellular base station radio, and said step of monitoring the quality of said telephone call includes the step of:

monitoring the signal strength of the cordless telephone base station radio and the cellular base station radio.

16. The method according to claim 14, wherein said cordless telephone system includes a cordless base station radio, said cellular telephone system includes at least one cellular base station radio, and said step of transferring said telephone call between a cellular telephone system and a cordless telephone system in response to a change in the quality of said telephone call includes the steps of:

monitoring said telephone input means for a predetermined input signal; and

transferring said telephone call between said cellular telephone system and said cordless telephone system in response to a change in the quality of said telephone call and detection of said predetermined input signal from said telephone input means.

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