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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/168,935	01/27/2003	William Stuart Bush	211548-1US	4615
	7590 06/12/2006		EXAMINER HARPER, V PAUL	
Katten Muchin Zavis Rosenman Patent Department Suite 1600 525 West Monroe Street Chicago, IL 60661-3693			ART UNIT	PAPER NUMBER
			2626	
DATE MAILED: 06/12/2006				

Please find below and/or attached an Office communication concerning this application or proceeding.

Samsung v. SpeakWare, Inc.
IPR 2019-01146 U.S. Pat. 6,397,186
Exhibit 1011

Response to Rule 312 Communication	Application No.	Applicant(s)	
	10/168,935	BUSH ET AL.	
	Examiner	Art Unit	
	V. Paul Harper	2626	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

1. The amendment filed on 4/27/06 under 37 CFR 1.312 has been considered, and has been:
- a) entered.
 - b) entered as directed to matters of form not affecting the scope of the invention.
 - c) disapproved because the amendment was filed after the payment of the issue fee.
Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue.
 - d) disapproved. See explanation below.
 - e) entered in part. See explanation below.


DAVID HUDSPETH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600



Enter 312 amendment
OPA 6/7/06

04-27-06 10:28am From-KATTEN MUCHIN ROSEMAN 13129021061 3129021061 T-109 P.04/10 F-781

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APR 27 2006

PATENT
Attorney Docket No. 211548-00001

IN THE U.S. PATENT AND TRADEMARK OFFICE

Application No.: 10/168,935
Filing Date: January 27, 2003
Inventor(s): William Stuart Bush
Group Art Unit: 2654
Examiner Name: V. Paul Harper
Customer No.: 27160
Title: Hands-Free, Voice-Operated Remote Control Transmitter

CERTIFICATE OF TRANSMISSION

I hereby certify that this correspondence is being facsimile transmitted (571) 273-8300 to the United States Patent and Trademark Office on:

4-27-06

Date

Janelle A. Wiggins
(Signature)

Janelle A. Wiggins
(Typed or Printed Name of Person Signing Certificate)

Confirmation No.: 4615

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

PRELIMINARY AMENDMENT

Sir:

Before examining the above-identified case on the merits, please enter the following preliminary amendment.

Amendment to the Specification is reflected on page 2.

Remarks begin on page 3 of this paper.

04/28/2006 JBALINRN 00000088 501214 10168935
01 FC:2051 65.00 DA

Page 1 of 3

PAGE 4/10 * RCVD AT 4/27/2006 11:28:04 AM (Eastern Daylight Time) * SVR:USPTO-EFAXF-6/15 * DNIS:2738300 * CSID:3129021061 * DURATION (mm-ss):03-02

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Bib Data Sheet

CONFIRMATION NO. 4615

SERIAL NUMBER 10/168,935	FILING DATE 01/27/2003 RULE	CLASS 704	GROUP ART UNIT 2654	ATTORNEY DOCKET NO. 211548-1US
-----------------------------	---------------------------------------	--------------	------------------------	--------------------------------------

APPLICANTS

William Stuart Bush, Manhattan Beach, CA;
 Carlos Ferdinand Roura, Tustin, CA;

UPA 3/8/06

** CONTINUING DATA **

This application is a 371 of PCT/US00/35107 12/21/2000

*which is a continuation of U.S Patent application 09/469,707
 filed 12/22/1999 now U.S.
 Patent 6,397,186*

UPA 3/8/06

** FOREIGN APPLICATIONS **

** SMALL ENTITY **

Foreign Priority claimed <input type="checkbox"/> yes <input type="checkbox"/> no	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
35 USC 119 (a-d) conditions met <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> Met after Allowance	CA	30	22	6
Verified and Acknowledged	Examiner's Signature	Initials		

ADDRESS

Katten Muchin Zavis Rosenman
 Patent Department
 Suite 1600
 525 West Monroe Street
 Chicago , IL
 60661-3693

TITLE

HANDS-FREE, VOICE-OPERATED REMOTE CONTROL TRANSMITTER

FILING FEE RECEIVED 879	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:	<input type="checkbox"/> All Fees <input type="checkbox"/> 1.16 Fees (Filing) <input type="checkbox"/> 1.17 Fees (Processing Ext. of time) <input type="checkbox"/> 1.18 Fees (Issue)
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<http://neo:8000/PrexServlet/PrexAction?serviceName=BibDataSheet&Action=display&brows...> 3/9/06

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PATENT
Attorney Docket No. 211548-00001

IN THE U.S. PATENT AND TRADEMARK OFFICE

Application No.: 10/168,935
Filing Date: January 27, 2003
Inventor(s): William Stuart Bush
Group Art Unit: 2654
Examiner Name: V. Paul Harper
Customer No.: 27160
Title: Hands-Free, Voice-Operated Remote Control Transmitter

CERTIFICATE OF TRANSMISSION

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Date

Janette A. Wiggins
(Signature)

Janette A. Wiggins
(Typed or Printed Name of Person Signing Certificate)

Confirmation No.: 4615

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

PRELIMINARY AMENDMENT

Sir:

Before examining the above-identified case on the merits, please enter the following preliminary amendment.

Amendment to the Specification is reflected on page 2.

Remarks begin on page 3 of this paper.

04/28/2006 JBALINAN 00000088 501214 10168935
01 FC:2051 65.00 DA

Preliminary Amendment dated: April 27, 2006
Title: Hands-Free, Voice-Operated Remote-Control Transmitter
Applicant: William Stuart Bush
Attorney Docket No.: 211548-00001

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APR 27 2006

AMENDMENT TO THE SPECIFICATION

On page 1, please amend the following in the specification as follows:

CROSS-REFERENCE TO RELATED APPLICATIONS

This ~~is a national~~ application under ~~35 U.S.C. § 371~~ based on is a continuation of PCT International Application No. PCT/US00/35107, filed December 21, 2000, which ~~claims priority~~ is a continuation of U.S. Patent Application No. 09/469,707, filed on December 22, 1999, now U.S. Patent No. 6,397,186.

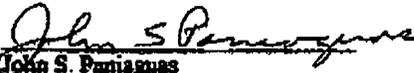
Preliminary Amendment dated: April 27, 2006
Title: Hands-Free, Voice-Operated Remote-Control Transmitter
Applicants: William Stuart Bush
Attorney Docket No.: 311548-00001

REMARKS

It is respectfully requested that the instant Preliminary Amendment be entered prior to examination.

Respectfully submitted,

KATTEN MUCHIN ROSENMAN LLP

By: 
John S. Pannagone
Registration No. 31,051
Attorney for Applicant(s)

KATTEN MUCHIN ROSENMAN LLP
525 W. Monroe Street
Chicago, Illinois 60661-3693
Telephone: (312) 902-5200
Facsimile: (312) 902-1061
Customer No.: 27160

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Atty. Docket No: 211548-00001

DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name; I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled "**HANDS-FREE, VOICE-OPERATED REMOTE CONTROL TRANSMITTER**" the specification of which was filed on **January 27, 2003** as Application Serial No. **10/168,935** and was amended on _____ (if applicable); () was filed as PCT International Application No. _____ on _____ and was amended under Article 19 on _____ (if applicable). I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above. I acknowledge the duty to disclose to the Patent and Trademark Office all information known to me to be material to patentability as defined in 37 C.F.R. §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

			Priority Claimed	
			Yes	No
09/469,707	United States	12/22/1999		<input type="checkbox"/>
(Application Serial Number)	(Country)	(Month/Day/Year Filed)	Yes	No
_____	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>
(Application Serial Number)	(Country)	(Month/Day/Year Filed)		

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below:

_____	_____
(Application Serial Number)	(Month/Day/Year Filed)

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s) or PCT international application(s) designating the United States of America listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior application(s) in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in 37 C.F.R. §1.56 which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PCT/US00/35107	December 21, 2000	Pending
(Application Serial Number)	(Month/Day/Year Filed)	(Status-Patented, Pending or Abandoned)
09/469,707	December 22, 1999	Patented
(Application Serial Number)	(Month/Day/Year Filed)	(Status-Patented, Pending or Abandoned)

*Not yet assigned, entitled _____ by _____ (Inventor)

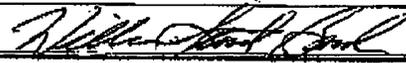
Declaration for Patent Application

Attorney Docket No 211548-1

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Send correspondence to:

FIRM NAME	PHONE NO.	STREET	CITY & STATE	ZIP CODE
Katten Muchin Rosenman LLP Attn: Patent Administrator	312-902-5200	525 West Monroe Street	Chicago, Illinois	60661-3693

Full Name of First or Sole Inventor William Stuart Bush	Citizenship U.S.A.
Residence Address - Street 2611 Alma Avenue	Post Office Address - Street 2511 Alma Avenue
City (Zip) Manhattan Beach 90266	City (Zip) Manhattan Beach 90266
State or Country California	State or Country California
Date APRIL 4, 2006	Signature 

Full Name of Second Inventor Carlos Ferdinand Roura	Citizenship U.S.A.
Residence Address - Street 1262 Langdale Lane	Post Office Address - Street 1262 Langdale Lane
City (Zip) Tustin 92780	City (Zip) Tustin 92780
State or Country California	State or Country California
Date	Signature <input type="checkbox"/>

Full name of Third Inventor	Citizenship
Residence Address - Street	Post Office Address - Street
City (Zip)	City (Zip)
State or Country	State or Country
Date <input type="checkbox"/>	Signature <input type="checkbox"/>

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Declaration for Patent Application

Attorney Docket No. 211548-1

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C §1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Send correspondence to:

FIRM NAME	PHONE NO.	STREET	CITY & STATE	ZIP CODE
Katten Muchin Rosenman LLP Attn: Patent Administrator	312-902-5200	525 West Monroe Street	Chicago, Illinois	60661-3693

Full Name of First or Sole Inventor Wilham Stuart Bush	Citizenship U.S.A.
Residence Address - Street 2611 Alma Avenue	Post Office Address - Street 2611 Alma Avenue
City (Zip) Manhattan Beach 90266	City (Zip) Manhattan Beach 90266
State or Country California	State or Country California
Date	Signature <input checked="" type="checkbox"/>

Full Name of Second Inventor Carlos Ferdinand Roura	Citizenship U.S.A.
Residence Address - Street 1262 Langdale Lane	Post Office Address - Street 1262 Langdale Lane
City (Zip) Tustin 92780	City (Zip) Tustin 92780
State or Country California	State or Country California
Date 4/25/06	Signature <input checked="" type="checkbox"/> <i>Carlos Roura</i>

Full Name of Third Inventor	Citizenship
Residence Address - Street	Post Office Address - Street
City (Zip)	City (Zip)
State or Country	State or Country
Date <input checked="" type="checkbox"/>	Signature <input checked="" type="checkbox"/>

Declaration for Patent Application

Attorney Docket No 211548-1

APPLICABLE RULES AND STATUTES

37 CFR 1.56 DUTY OF DISCLOSURE - INFORMATION MATERIAL TO PATENTABILITY (Applicable Portion)

(b) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b) (4) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

- (1) prior art cited in search reports of a foreign patent office in a counterpart application, and
(2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentability defines, to make sure that any material information contained therein is disclosed to the Office

Information relating to the following factual situations enumerated in 35 USC 102 and 103 may be considered material under 37 CFR 1.56(a).

35 U.S.C. 102 CONDITIONS FOR PATENTABILITY, NOVELTY AND LOSS OF RIGHT TO PATENT

A person shall be entitled to a patent unless -

- (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent, or
(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States, or
(c) he has abandoned the invention, or
(d) the invention was first patented or caused to be patented, or was the subject of an inventor's certificate, by the applicant or his legal representatives or assigns in a foreign country prior to the date of the application for patent in this country on an application for patent or inventor's certificate filed more than twelve months before the filing of the application in the United States, or
(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraph (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent, or
(f) he did not himself invent the subject matter sought to be patented, or
(g) before the applicant's invention thereof the invention was made in this country by another who had not abandoned, suppressed, or concealed it. In determining priority of invention there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by the other.

35 U.S.C. 103. CONDITIONS FOR PATENTABILITY, NON-OBVIOUS SUBJECT MATTER (Applicable Portion)

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made. Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

35 U.S.C. 112. SPECIFICATION (Applicable Portion)

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

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KATTEN MUCHIN ROSENMAN LLP

525 West Monroe Street
Chicago, IL 60661-3893
312 902 5200 office 312 902 1061 fax

Facsimile

To	Company	Fax Number	Phone Number
Mail Stop Amendment - Commissioner for Patents	USPTO	(571) 273-8300	
Date		Client/Matter Number	
April 27, 2006		211548-00001	
From		Attorney Number	
John S. Paniaguas		32347	
Phone		Fax	
312.902.5312		312.577.4532	

Total number of pages, including cover letter: pages
If you do not receive all of the pages, please call: 312.902.5312 *10 pages*

Comments

RE: Patent Application No.: 10/168,935
Filing Date: January 27, 2003
Inventor: William Stuart Bush
Title: Hands-Free, Voice-Operated Remote Control Transmitter
Confirmation No.: 4615

Please file the attached:
Transmittal Form (1 p.)
Fee Transmittal Form (1 p.)
Preliminary Amendment (3 pp.)
Executed Declaration (4 pp.)

Certificate of Transmission

I hereby certify that this correspondence is being transmitted to the U.S. Patent and Trademark Office ((571) 273-8300) on April 27, 2006

Janette A. Wiggins
(Type or printed name of person signing this certificate)
Signature *Janette A. Wiggins*

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PTO/USPTO 09-04
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U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

Under the Patent Act of 1952, an inventor, applicant, or assignee is required to deposit a copy of the application with the USPTO.

TRANSMITTAL FORM	Application Number	10/188,936
	Filing Date	January 27, 2005
	Filed Invented Inventor	William Steven Boren
	AS LINE	2559
	Examiner Name	v. Paul Harper
Total Number of Pages in This Submission		Attorney Docket Number 311548-0001

Do not check for all communications after initial filing.

ENCLOSURES (Check all that apply)		
<input checked="" type="checkbox"/> Fee Transmittal Form <input type="checkbox"/> Fee Advance <input type="checkbox"/> Amendment/Reply <input type="checkbox"/> AIA/First <input type="checkbox"/> AIA/Supplemental (S) <input type="checkbox"/> Extension of Time Request <input type="checkbox"/> Express Amendment Request <input type="checkbox"/> Information Disclosure Statement <input type="checkbox"/> Certified Copy of Priority Document(s) <input type="checkbox"/> Reply to Missing Parts/Incomplete Application <input type="checkbox"/> Reply to Missing Parts under 37 CFR 1.55 or 1.53	<input type="checkbox"/> Drawing(s) <input type="checkbox"/> Licensing-related Papers <input type="checkbox"/> Petition <input type="checkbox"/> Petition to Convert to a Provisional Application <input type="checkbox"/> Power of Attorney, Revision <input type="checkbox"/> Change of Correspondence Address <input type="checkbox"/> Terminal Disclaimer <input type="checkbox"/> Request for Refund <input type="checkbox"/> CD, Number of CD(s) <input type="checkbox"/> Landscape Table on CD <input type="checkbox"/> Remarks	<input type="checkbox"/> After Allowance Communication to TC <input type="checkbox"/> Appeal Communication in Scope of Appeal and References <input type="checkbox"/> Appeal Communication to TC Requested (Mandatory Reply Form) <input type="checkbox"/> Proprietary Information <input type="checkbox"/> Status Letter <input checked="" type="checkbox"/> Other Enclosures (please specify below) <input type="checkbox"/> Enclosed Declaration <input type="checkbox"/> Preliminary Amendment
SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT		
Firm Name	Katten Muchin Rosenman LLP	
Signature	<i>John S. Partridge</i>	
Printed name	John S. Partridge	
Date	April 27, 2006	Reg. No. 31,051

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Signature	<i>Janele A. Wiggins</i>
Typed or printed name	Janele A. Wiggins
Date	April 27, 2006

This collection of information is required by 37 CFR 1.5. The information is required to obtain or retain a benefit for the public which is in the public interest. The collection of information is authorized by 35 U.S.C. 132 and 37 CFR 1.11 and 1.12. The collection of information is authorized as it relates to collection, including gathering, analyzing, and reviewing the submitted information for the USPTO. This will vary depending upon the information that is submitted on the basis of any information to complete the form and to determine if the information is required for the public interest. U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1462, Alexandria, VA 22313-1462. DO NOT WRITE OR COMPLETED FORMS TO THIS ADDRESS SEND TO: Commissioner for Patents, P.O. Box 1462, Alexandria, VA 22313-1462.

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FEE TRANSMITTAL
For FY 2006

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Application covers small entity status. See 37 CFR 1.27.

TOTAL AMOUNT OF PAYMENT (\$)	\$65.00
-------------------------------------	----------------

METHOD OF PAYMENT (check all that apply)

Check Credit Card Money Order Note Other (please identify)

Deposit Account: Deposit Account Name: 58-1214 Deposit account number: Katten Muchin
 For the above-identified deposit account, the payee is hereby authorized to (check all that apply):

Charge fee(s) mentioned below Charge fee(s) mentioned below, except for the filing fee

Charge any amount of fees or underpayments of fees Credit any overpayments

WARNING: Information on this form will become public. Credit card information should not be included on this form. Provide bank card information and instructions on PTO-5026.

FEE CALCULATION (All fees listed are due when filing or may be subject to a surcharge.)

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

Application Type	FILING FEES		SEARCH FEES		EXAMINATION FEES		Exam. Date (S)
	Fee (S)	Small Entity Fee (S)	Fee (S)	Small Entity Fee (S)	Fee (S)	Small Entity Fee (S)	
Utility	300	150	300	250	300	100	
Design	200	100	100	50	130	65	
Plant	300	100	300	150	160	80	
Reissue	300	150	300	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee (S)	Small Entity Fee (S)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	300	100
Multiple dependent claims	360	180

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.5(e)), the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(a).

4. OTHER FEES

Non-English Specification: \$130 fee (no small entity discount)

Other (e.g., MIC filing with-fee): see schedule for Description: \$65.00

Signature: [Signature] Registration No. 31.051 Telephone: (312) 902-5200
 Name (Print/Type): S. Panagiotis (31.051) Fax: April 27, 2006

The collection of information is required by 37 CFR 1.106. The information is required to assess or when a benefit by the public which is to be used by the USPTO in processing an application. Collection of this information is authorized by 35 U.S.C. 150 and 37 CFR 1.106. The collection is required under 35 U.S.C. 150 and 37 CFR 1.106. The information is required to assess or when a benefit by the public which is to be used by the USPTO in processing an application. This is the USPTO. You will not incur penalties under the Federal Debt Collection Act. Any comments on this notice of collection should be sent to the Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1500, Alexandria, VA 22304-1500. Do not include fees on computerized forms to this address. SEND TO: Commissioner for Patents, P.O. Box 1500, Alexandria, VA 22304-1500.
 If you need assistance in completing this form, call 1-800-PTO-5175 and select option 2.

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● PRINTER RUSH ●

(PTO ASSISTANCE)

Application : <u>10/168,935</u>	Examiner : <u>Harper</u>	GAU : <u>2634</u>
From : <u>MR</u>	Location : <u>IDC</u> FMF FDC	Date : <u>02-23-06</u>

Tracking #: EPM 10168935 Week Date: 11-14-05

DOC CODE	DOC DATE	MISCELLANEOUS
<input type="checkbox"/> 1449	_____	<input checked="" type="checkbox"/> Continuing Data
<input type="checkbox"/> IDS	_____	<input type="checkbox"/> Foreign Priority
<input type="checkbox"/> CLM	_____	<input type="checkbox"/> Document Legibility
<input type="checkbox"/> IIFW	_____	<input type="checkbox"/> Fees
<input type="checkbox"/> SRFW	_____	<input type="checkbox"/> Other
<input type="checkbox"/> DRW	_____	
<input type="checkbox"/> OATH	_____	
<input type="checkbox"/> 312	_____	
<input type="checkbox"/> SPEC	_____	

[RUSH] MESSAGE: Serial no. 09/469,707 is listed as
claim priority in paper SPEC 07-28-05.
If this application is a continuity data,
please provide relationship (DIV, con, cop) in
specification and palm sheet.

Thank you,
MR

[XRUSH] RESPONSE: _____

INITIALS:

NOTE: This form will be included as part of the official USPTO record, with the Response document coded as XRUSH.
 REV 10/04



02-08-06 01:59pm From:KATTEN MUCHIN ROSENMAN 13129021061 3129021061 T-720 P.02/02 F-377

Complete and send this form, together with applicable fees, to: Mail

Mail Stop 158112 PER
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P.O. Box 1400
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(571) 273-2885

INSTRUCTIONS: This form should be used for submitting for REVIEW ONLY and SUBMITTING FOR PUBLICATION ONLY...
Note: A certificate of mailing can only be used for domestic mailings of the Patent Commission. This certificate cannot be used for any other mailings...

Katten Muchin Zavis Rosenman
Patent Department
Suite 1600
325 West Monroe Street
Chicago, IL 60661-3693

Certificate of Mailing or Transmittal
I hereby certify that this Patent Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail of an airmail certificate to the address shown on the certificate above, or being airmail transmittal to the address (571) 273-2885 on the date indicated below.
Janella A. Higgins
February 8, 2006

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/148,933	01/17/2003	William Stuart Rupp	311540-113	6615

TITLE OF INVENTION: H-NDS-FREE, VOICE-OPERATED REMOTE CONTROL TRANSMITTER

APPLN TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEES/DUES	DATE DUE
unprovisional	YES	\$700	\$300	\$1000	02/08/2006

EXAMINER	ART UNIT	CLASS-SUBCLASS
HARPER V PAUL	2654	704-075000

1. Change of correspondence address of inventor of "For Address" (37 CFR 1.301)
2. For printing on the patent from page fee:
(1) the name of up to 3 registered patent attorneys or agents for identification.
(2) the name of a single firm (change of a registered or unregistered agency of agent) and the name of up to 3 registered patent attorneys or agents. If no name is listed, no name will be printed.

3. ASSIGNOR NAMES AND RESIDENCE DATA TO BE PRINTED ON THIS PATENT (print or type)
PLEASE NOTE: Unless an assignor is identified below, no assignor data will appear on the patent. If an assignor is identified below, the document has been filed for publication to set forth 1.37 CFR 1.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNOR: Amush Interactive, Inc.
(B) RESIDENCE (CITY and STATE OR COUNTRY): Mahanah Beach, CA

Please check the appropriate assignor category or categories (37 CFR 1.301) to be printed on the patent: Individual Corporation or other private group entity Government
4. The following fee(s) is/are enclosed:
 Search fee
 Publication fee (No small entity discount permitted)
 Advance Copy - 10
 Payment of Patent
 A check to the amount of the fee(s) is enclosed
 Payment by credit card. Form PTO-3099 is attached
 The Director is hereby authorized by check (to request fee), or credit card authorization, or deposit account number 31-1216. (Attach in this copy of this form a U.S. O.

5. Change to Small Entity - (from what indicated above)
 a. Applicant claims SMALL ENTITY status. See 37 CFR 1.37. b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.37(d).
6. Applicant of the USPTO is requested to apply the same Fee and Assignment Fee (if any) as to regularly and primarily paid upon fee to the application (classified above).
NOTE: The Late Fee and Publication Fee (if applicable) will not be assessed when a document other than the application, a registered agency or agent, or the assignor or other party is named as filer in the transmittal of the United States Patent and Trademark Office.

Authorized Signature: John S. Panagias
Signature No. 31,051
Date: February 8, 2006

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PTOL-86 (Rev. 07/05) Approved for use through 04/08/2007. OMB 0651-0033 U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

02/09/2006 TBESHAH2 00000007 501214 10168935
01 FC:2501 700.00 DA
02 FC:1504 300.00 DA
03 FC:8001 30.00 DA

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KATTEN MUCHIN ROSENMAN LLP

525 West Monroe Street
Chicago, IL 60661-3893
312.902.5200 office 312.902.1061 fax

Facsimile To Mail Stop Issue Fee - Commissioner for Patents	Company USPTO	Fax Number (571) 273-2885	Phone Number
---	-------------------------	-------------------------------------	--------------

Date February 8, 2006	Client/Matter Number 211548-00001
From John S. Paniaguas	Attorney Number 32347
Phone 312.902.5312	Fax 312.577.4532

Total number of pages, including cover letter: pages
If you do not receive all of the pages, please call: 312.902.5312 *2 pages*

Comments

RE: Parent Application No.: 10/168,935
Filing Date: January 27, 2003
Inventor: William Stuart Bush
Title: Hands-Free, Voice-Operated Remote Control Transmitter
Confirmation No.: 4615

Please file the attached:
Part B -- Fee(s) Transmittal

Certificate of Transmission

I hereby certify that this correspondence is being facsimile transmitted to the U.S. Patent and Trademark Office ((571) 273-2885) on February 8, 2006.

Janell A. Wiggins
(Typed or printed name of person signing this certificate)
Janell A. Wiggins Signature

For Messenger Department Use Only

Your fax has been sent. Attached is your original.

Date	Time
Signature	

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NOTICE OF ALLOWANCE AND FEE(S) DUE

7590 11/08/2005

Katten Muchin Zavis Rosenman
Patent Department
Suite 1600
525 West Monroe Street
Chicago, IL 60661-3693

EXAMINER: HARPER, V PAUL
ART UNIT: 2654 PAPER NUMBER:
DATE MAILED: 11/08/2005

Table with 5 columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO.

TITLE OF INVENTION: HANDS-FREE, VOICE-OPERATED REMOTE CONTROL TRANSMITTER

Table with 6 columns: APPLN. TYPE, SMALL ENTITY, ISSUE FEE, PUBLICATION FEE, TOTAL FEE(S) DUE, DATE DUE

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE REFLECTS A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE APPLIED IN THIS APPLICATION. THE PTOL-85B (OR AN EQUIVALENT) MUST BE RETURNED WITHIN THIS PERIOD EVEN IF NO FEE IS DUE OR THE APPLICATION WILL BE REGARDED AS ABANDONED.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

- A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.
B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

- A. Pay TOTAL FEE(S) DUE shown above, or
B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL should be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). Even if the fee(s) have already been paid, Part B - Fee(s) Transmittal should be completed and returned. If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax **(571) 273-2885**

INSTRUCTIONS: This form should be used for transmitting the **ISSUE FEE** and **PUBLICATION FEE** (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

7590 11/08/2005

Katten Muchin Zavis Rosenman
Patent Department
Suite 1600
525 West Monroe Street
Chicago, IL 60661-3693

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/168,935	01/27/2003	William Stuart Bush	211548-IUS	4615

TITLE OF INVENTION: HANDS-FREE, VOICE-OPERATED REMOTE CONTROL TRANSMITTER

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	\$700	\$300	\$1000	02/08/2006

EXAMINER	ART UNIT	CLASS-SUBCLASS
HARPER, V PAUL	2654	704-275000

<p>1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).</p> <p><input type="checkbox"/> Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.</p> <p><input type="checkbox"/> "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.</p>	<p>2. For printing on the patent front page, list</p> <p>(1) the names of up to 3 registered patent attorneys or agents OR, alternatively, _____ 1</p> <p>(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. _____ 2</p> <p>_____ 3</p>
--	---

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE _____ (B) RESIDENCE: (CITY and STATE OR COUNTRY) _____

Please check the appropriate assignee category or categories (will not be printed on the patent) : Individual Corporation or other private group entity Government

<p>4a. The following fee(s) are enclosed:</p> <p><input type="checkbox"/> Issue Fee</p> <p><input type="checkbox"/> Publication Fee (No small entity discount permitted)</p> <p><input type="checkbox"/> Advance Order - # of Copies _____</p>	<p>4b. Payment of Fee(s):</p> <p><input type="checkbox"/> A check in the amount of the fee(s) is enclosed.</p> <p><input type="checkbox"/> Payment by credit card. Form PTO-2038 is attached.</p> <p><input type="checkbox"/> The Director is hereby authorized by charge the required fee(s), or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).</p>
--	---

5. Change in Entity Status (from status indicated above)

a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above. NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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Table with 5 columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO.
10/168,935 01/27/2003 William Stuart Bush 211548-IUS 4615

7590 11/08/2005
Katten Muchin Zavis Rosenman
Patent Department
Suite 1600
525 West Monroe Street
Chicago, IL 60661-3693

EXAMINER

HARPER, V PAUL

ART UNIT PAPER NUMBER

2654

DATE MAILED: 11/08/2005

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)

(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 268 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 268 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571) 272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (703) 305-8283.

Notice of Allowability	Application No.	Applicant(s)	
	10/168,935	BUSH ET AL.	
	Examiner	Art Unit	
	V. Paul Harper	2654	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. This communication is responsive to 9/28/05.
2. The allowed claim(s) is/are 17 and 23-30.
3. Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) All b) Some* c) None of the:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) hereto or 2) to Paper No./Mail Date _____.
 - (b) including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. <input type="checkbox"/> Notice of References Cited (PTO-892) 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) 3. <input checked="" type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____ 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit of Biological Material | <ol style="list-style-type: none"> 5. <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) 6. <input type="checkbox"/> Interview Summary (PTO-413), Paper No./Mail Date _____ 7. <input type="checkbox"/> Examiner's Amendment/Comment 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance 9. <input type="checkbox"/> Other _____ |
|--|--|

BY

Reasons for Allowance

Claims 17, 23-30 are allowed.

1. Regarding **claim 17**, it is noted that the closest prior art of record, Knittel (U.S. Patent 6,606,280) teaches the muting of devices being controlled, but Knittel does not teach that one of the submodes is a recognition error muting mode for automatically muting an appliance upon detection of one or more types of recognition errors. Thus, independent claim 17 is allowable over the prior art of record because the cited prior art alone or in combination, does not fairly suggest or disclose the claimed combination of features.

2. Regarding **claim 23**, it is noted that the closest prior art of record, Knittel (U.S. Patent 6,606,280) teaches the muting of devices being controlled, but Knittel does not teach the activation of a volume control mode for reducing the volume of an appliance upon detection of one or more types of recognition errors. Thus, independent claim 23 is allowable over the prior art of record because the cited prior art alone or in combination, does not fairly suggest or disclose the claimed combination of features.

Conclusion

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably

Art Unit: 2654

accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement for Reasons of Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to V. Paul Harper whose telephone number is (571) 272-7605. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richemond Dorvil can be reached on (571) 272-7602. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

10/19/05

V. Paul Harper
Patent Examiner
Art Unit 2654



RICHEMOND DORVIL
SUPERVISORY PATENT EXAMINER



Form PTO-1449 INFORMATION DISCLOSURE CITATION IN AN APPLICATION (Use several sheets if necessary)	Docket Number 211548-00001	Application Number 10/168,935
	Applicant Bush, et al..	
	Filing Date January 27, 2003	Group Art Unit 2654

U. S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER							DATE	NAME	CLASS	SUB CLASS	FILING DATE IF APPROP.
	4	3	2	2	7	1	8					
DDA	4	3	2	2	7	1	8	March 30, 1982				
DDA	4	7	2	5	8	2	7	February 16, 1988				
DDA	4	7	7	1	2	8	3	September 13, 1988				
DDA	4	7	7	4	5	1	1	September 27, 1988				
DDA	4	9	0	5	2	7	9	February 27, 1990				
DDA	5	1	4	2	3	9	8	August 25, 1992				
DDA	5	2	2	6	0	9	0	July 6, 1993				
DDA	5	2	4	7	5	8	0	September 21, 1993				
DDA	5	2	6	7	3	2	3	November 30, 1993				
DDA	5	4	4	4	6	7	3	August 22, 1995				
DDA	5	4	5	2	2	7	4	September 19, 1995				
DDA	5	4	7	1	5	5	7	November 28, 1995				
DDA	5	6	9	1	7	1	0	November 25, 1997				
DDA	5	7	7	4	8	5	9	June 30, 1998				
DDA	5	7	7	7	5	7	1	July 7, 1998				
DDA	5	7	9	0	7	5	4	August 4, 1998				
DDA	5	8	5	2	8	0	4	December 22, 1998				

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUB CLASS	Translation	
						Yes	No
DDA	DE19740406 A1	April 1, 1999	Germany				X

OTHER DOCUMENTS

(Including Author, Title, Date, Pertinent Pages, Etc.)

DM1000 Component Directional Microphone published by Lucent Technologies, pp. 1-2

EXAMINER <i>C. Paul Harpe</i>	DATE CONSIDERED 10/15/05
EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP § 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.	



Form PTO-1449 INFORMATION DISCLOSURE CITATION IN AN APPLICATION (Use several sheets if necessary)	Docket Number 211548-00001	Application Number 10/168,935
	Applicant Bush, et al..	
	Filing Date January 27, 2003	Group Art Unit 2654

U. S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER							DATE	NAME	CLASS	SUB CLASS	FILING DATE IF APPROP.
<i>OPH</i>	5	8	7	8	3	9	4	March 2, 1999				
<i>OPB</i>	5	9	5	9	7	5	1	September 28, 1999				
<i>OPB</i>	6	0	1	2	0	2	9	January 4, 2000				
<i>OPB</i>	6	0	5	2	6	6	6	April 18, 2000				
<i>OPB</i>	6	0	7	0	1	4	0	May 30, 2000				
<i>OPB</i>	6	1	1	9	0	8	8	September 12, 2000				

FOREIGN PATENT DOCUMENTS

DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUB CLASS	Translation	
					Yes	No

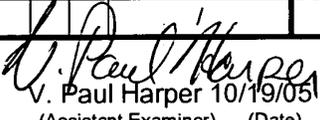
OTHER DOCUMENTS

(Including Author, Title, Date, Pertinent Pages, Etc.)

- OPB* MACH 4 CPLD Family High Performance EE CMOS Programmable Logic, Publication 17466, published by Lattice Semiconductor Corporation, May 1999 pp. 1-62
- Preliminary Product Specification Z86L81/86/98 28-Pin Low-Voltage Infrared Microcontroller, Document No. DS000701-IRX1298, published by Zilog, Inc. 1999, pp. 1-55
- RSC-300/364 DataBook published by Sensory, Inc. August 1999, pp. 1-50.
- RSC-300/364 Recognition • Synthesis • Control, datasheet part No. 80-0111-6, published by Sensory, Inc. 1999, pp. 1-8
- Build a Voice-Activated Tape Recorder Switch by Marc Spiwak, *Popular Electronics* magazine, January 1996, pp. 35-36, 79
- Voice Direct™ Speech Recognition IC, datasheet part No. 80-0022-5, published by Sensory Inc. September 8, 1998, pp. 1-4
- 24AA64/24LC64 64K 1st CMOS Serial EEPROM published by Microchip Technology Inc. 1999, Document No. DS21189C, pp. 1-12
- CMOS Low Voltage 2Ω SPST Switches ADG701/ADG702 published by Analog Devices, Inc. 1998, pp. 1-8
- CMOS Low Voltage 4Ω SPDT Switch ADG719 published by Analog Devices, Inc. 1998, pp. 1-8

EXAMINER <i>OPB</i>	DATE CONSIDERED 10/15/05
EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP § 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.	

Issue Classification 	Application/Control No.	Applicant(s)/Patent under Reexamination	
	10/168,935	BUSH ET AL.	
Examiner	Art Unit		
V. Paul Harper	2654		

ISSUE CLASSIFICATION									
ORIGINAL				CROSS REFERENCE(S)					
CLASS	SUBCLASS			CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
704	275			704	233				
INTERNATIONAL CLASSIFICATION									
G	1	0	L	15/20					
				/					
				/					
				/					
 V. Paul Harper 10/19/05 (Assistant Examiner) (Date)				RICHEMOND DORVIL SUPERVISORY PATENT EXAMINER (P. Paul Harper) (Date)				Total Claims Allowed: 9	
(Legal Instruments Examiner) (Date)				(Primary Examiner) (Date)				O.G. Print Claim(s)	O.G. Print Fig.
								2	1

<input type="checkbox"/> Claims renumbered in the same order as presented by applicant		<input type="checkbox"/> CPA		<input type="checkbox"/> T.D.		<input type="checkbox"/> R.1.47							
Final	Original	Final	Original	Final	Original	Final	Original						
	1		31		61		91		121		151		181
	2		32		62		92		122		152		182
	3		33		63		93		123		153		183
	4		34		64		94		124		154		184
	5		35		65		95		125		155		185
	6		36		66		96		126		156		186
	7		37		67		97		127		157		187
	8		38		68		98		128		158		188
	9		39		69		99		129		159		189
	10		40		70		100		130		160		190
	11		41		71		101		131		161		191
	12		42		72		102		132		162		192
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	16		46		76		106		136		166		196
1	17		47		77		107		137		167		197
	18		48		78		108		138		168		198
	19		49		79		109		139		169		199
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3	24		54		84		114		144		174		204
4	25		55		85		115		145		175		205
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6	27		57		87		117		147		177		207
8	28		58		88		118		148		178		208
9	29		59		89		119		149		179		209
7	30		60		90		120		150		180		210

Index of Claims



Application No.

10/168,935

Examiner

V. Paul Harper

Applicant(s)

BUSH ET AL.

Art Unit

2654

√	Rejected
=	Allowed

-	(Through numeral) Cancelled
+	Restricted

N	Non-Elected
I	Interference

A	Appeal
O	Objected

Claim	Final	Original	Date
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Search History 10/19/05 8:59:48 AM Page 2

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L10	133	((voice or speech) near (recognizer or recognition)) and ((auto or automatically or mode) with (volume or level) same error)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/10/19 07:35
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PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2001

Application or Docket Number

10-168,935

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS		
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	22 minus 20 = *	2
INDEPENDENT CLAIMS	6 minus 3 = *	3
MULTIPLE DEPENDENT CLAIM PRESENT	<input type="checkbox"/>	

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE

OR OTHER THAN SMALL ENTITY

RATE	FEE
BASIC FEE	370
X\$ 9=	18
X42=	126
+140=	
TOTAL	514

RATE	FEE
BASIC FEE	
X\$18=	
X84=	
+280=	
TOTAL	

CLAIMS AS AMENDED - PART II

	(Column 1)	(Column 2)	(Column 3)
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
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	Independent	2 Minus ***	6 = -
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <input type="checkbox"/>			

SMALL ENTITY OR

OTHER THAN SMALL ENTITY

RATE	ADDITIONAL FEE
X\$ 9=	
X42=	
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TOTAL ADDIT. FEE	

RATE	ADDITIONAL FEE
X\$18=	
X84=	
+280=	
TOTAL ADDIT. FEE	

	(Column 1)	(Column 2)	(Column 3)
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
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	Independent	2 Minus ***	6 = -
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <input type="checkbox"/>			

RATE	ADDITIONAL FEE
X\$ 9=	
X42=	
+140=	
TOTAL ADDIT. FEE	

RATE	ADDITIONAL FEE
X\$18=	
X84=	
+280=	
TOTAL ADDIT. FEE	

	(Column 1)	(Column 2)	(Column 3)
AMENDMENT C	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
	Total	9 Minus **	22 = -
	Independent	2 Minus ***	6 = -
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <input type="checkbox"/>			

RATE	ADDITIONAL FEE
X\$ 9=	
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RATE	ADDITIONAL FEE
X\$18=	
X84=	
+280=	
TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
 ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
 *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
 The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.



PATENT
Attorney Docket No. 211548-00001

IN THE U.S. PATENT AND TRADEMARK OFFICE

Application No.: 10/168,935
Filing Date: January 27, 2003
Inventor(s): William S. Bush
Group Art Unit: 2654
Examiner Name: V. Paul Harper
Customer No.: 27160
Confirmation No.: 4615
Title: HANDS-FREE VOICE-OPERATED
REMOTE CONTROL TRANSMITTER

Mail Stop Non-Fee Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT

Sir:

In response to the Official Action mailed on March 25, 2005, please enter the following amendment.

Amendments to the Specification are reflected on pages 2 and 3 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 4 of this paper.

Remarks/Arguments begin on page 6 of this paper.

In the Specification:

Please revise the specification as follows:

Page 1:

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a national application under 35 U.S.C. § 371 based on PCT International Application No. PCT/US00/35107, filed December 21, 2000, which claims priority to US Patent Application No. 09/469,707, filed on December 22, 1999, now US Patent No. 6,397,186.

Please revise paragraph [0014] as set forth below.

[00014] There are various other problems with known systems which utilize ~~voice~~ speech recognition to control appliances. For example, one problem occurs as the list of voice commands grows. Generally, each time a speech recognition product detects a spoken word, it compares the word to those in a recognition vocabulary. In general, as a recognition vocabulary increases in size, recognition time increases and accuracy decreases. The more words in a recognition vocabulary, the more likely the speech recognition circuit will make a mistake and accuracy generally diminishes. Without the capability to utilize multiple vocabulary recognition sets, the commands available for selection must all be available at the same time, meaning they must all reside in the same recognition vocabulary set. Thus, the user may be inconvenienced by the limited command availability of a small recognition vocabulary or the diminishing speech recognition accuracy and longer recognition times resulting as the single recognition vocabulary is increased in size. Another disadvantage of a single recognition vocabulary is that the recognition of voice command always yields the same response. In a multiple recognition vocabulary set scheme, the same voice command may yield different results upon recognition if placed within different vocabulary recognition sets. A still further disadvantage of a single

recognition vocabulary is that the recognition vocabulary words must be phonetically distinctive from each other which may limit the use of words that may be intuitive for their intended function but are too phonetically similar to other words in the recognition vocabulary, forcing the user to remember a word that is less intuitive. In a multiple recognition vocabulary set scheme, words that are not phonetically distinctive from each other may still be used by placing such words in different recognition vocabulary sets.

This listing of claims will replace all prior versions, and listings, of claims in the application. Please amend the following claims as set forth below:

Listing of Claims

Claims 1-16 (Cancelled):

Claim 17 (Currently Amended): ~~The voice recognition system as recited in claim 14, A~~ speech recognition control system for controlling appliances, the control system comprising:

a microphone for receiving audio signals;

a speech recognition system for receiving audio signals from said microphone and converting said audio signals to control signals for controlling a selected appliance, the speech recognition system having a speech recognition mode for decoding said audio signals and generating control signals for controlling an appliance and a MUTE mode for the selected appliance in order to reduce background noise; wherein said MUTE mode includes a plurality of submodes; and wherein one of said submodes is a recognition error muting mode for automatically muting an appliance upon detection of one or more types of recognition errors.

Claims 18 -22 (Cancelled):

Claim 23 (New) An audio signal activated control system for controlling appliances comprising:

a microphone for receiving audio signals and converting said audio signals to electrical signals;

a speech recognition system for receiving said electrical signals, said speech recognition system having a volume control mode for generating control signals for reducing the volume level of sound produced by one or more appliances and a speech recognition mode for decoding said electrical signals and generating control signals for controlling said one or more appliances and for detecting one or more types of recognition error conditions, said speech recognition system configured to activate said volume control mode if said one or more types of error conditions are detected; and

an appliance control circuit which includes a transmitter, said appliance control circuit configured to receive said control signals from said speech recognition system and generate and transmit one or more appliance control signals to said one or more appliances.

Claim 24 (New) The audio signal activated control system as recited in claim 23, wherein said transmitter is configured to wirelessly transmit said controls signals to said one or more appliances.

Claim 25 (New) The audio signal activated control system as recited in claim 24, wherein said transmitter is an infrared transmitter.

Claim 26 (New) The audio signal activated control system as recited in claim 24, wherein said transmitter is an RF transmitter.

Claim 27 (New) The audio signal activated control system as recited in claim 23, wherein said volume control mode is an appliance muting mode.

Claim 28 (New) The audio signal activated control system as recited in claim 23, wherein said speech recognition system is further configured to automatically terminate said volume control mode.

Claim 29 (New) The audio signal activated control system as recited in claim 23, wherein said speech recognition system is further configured to automatically terminate said volume control mode and generate control signals for increasing said volume level of sound produced by said one or more appliances.

Claim 30 (New) The audio signal activated control system as recited in claim 27, wherein said appliance muting mode includes automatic mute function canceling for an appliance.

REMARKS/ARGUMENTS

Upon entry of the instant amendment, claim 17 and new claims 23-30 are pending. Claims 1-16 and 18-22 have been cancelled. The Applicant notes with appreciation the allowance of claim 17. Accordingly, claim 17 has been converted to independent form and includes all of the limitations of the base claim and intervening claims with the exception of the sound activation mode. Notwithstanding, it is respectfully submitted that claim 17 should still be allowable. New claims 23-30 have been added. These claims 23-30 are based on allowed claim 17 and should also be allowable. It is respectfully submitted that claim 17 as well as new claims 23-30 are allowable.

Objections to the Specification

Page 5 of the specification is being amended to replace the phrase “voice recognition” with the phrase “speech recognition” as suggested by the Examiner. Accordingly, this objection is obviated.

Claim Objections

Claims 1, 2, 5, 8, 12, 14, 18 and 21 have been cancelled. Accordingly, these objections should be obviated.

Double Patenting

Claims 1-8 have been rejected under the judicially-created doctrine of obviousness by double patenting as being unpatentable over claims 1-5 of U.S. Patent No. 6,397,186. Claims 1-8 have been cancelled. Accordingly, this rejection should be obviated.

Claim Rejections – 35 U.S.C. § 102

Claims 9, 10, 18 and 19 have been rejected under 35 U.S.C. § 102(e) as being anticipated by Knittel et al., U.S. Patent No. 6,606,280, hereinafter referred to as Knittel. Claims 9, 10, 18 and 19 have been cancelled. Thus, this rejection is obviated.

Claim Rejections – 35 U.S.C. § 103

Claims 1-3 have been rejected under 35 USC § 103 as being unpatentable over Kimura et al., U.S. Patent No. 5,199,080, hereinafter referred to as Kimura, in view of Miyazawa et al., U.S. Patent 5,983,186, hereinafter referred to as Miyazawa. Claims 5 and 6 have been rejected under 35 USC § 103 as being unpatentable over Kimura in view of Miyazawa and Wells et al., U.S. Patent 5,603,036, hereinafter referred to as Wells. Claims 7 and 8 have been rejected under 35 USC § 103 as being unpatentable over Kimura in view of Miyazawa, Wells and further in view of Knittel. Claim 11 has been rejected under 35 USC § 103 as being unpatentable over Knittel in view of Thrift et al., U.S. Patent 6,188,985, hereinafter Thrift. Claims 4 and 12-15 have been rejected as unpatentable under 35 USC § 103 over Kimura in view of Miyazawa and Knittel. Claim 16 and 20 have been rejected as unpatentable under 35 USC § 103 over Kimura in view of Miyazawa and Knittel and further in view of Irumano, Japanese Patent Application Publication JP 6317071, hereinafter referred to as Irumano. Claim 21 has been rejected as unpatentable under 35 USC § 103 over Knittel in view of Andrea et al., U.S. Patent No. 5,715,321, hereinafter referred to as Andrea. Claim 22 has been rejected as unpatentable under 35 USC § 103 over Kimura in view of Miyazawa and Wells, and further in view of Oppendahl, U.S. Patent 5,008,954, hereinafter Oppendahl. Claims 1-16 and 18-22 have been cancelled. Thus, these rejections are obviated.

Moreover, it is respectfully submitted that none of the references of record disclose or suggest the subject matter of new claims 23-30. Accordingly, it is respectfully submitted that the application is in condition for allowance.

Respectfully submitted,

KATTEN MUCHIN ROSENMAN LLP

By: 
John S. Paniaguas
Registration No. 31,051
Attorney for Applicant

Katten Muchin Rosenman LLP
525 W. Monroe Street
Chicago, Illinois 60661-3693
(312) 902-5200
(312) 902-1061



IN THE U.S. PATENT AND TRADEMARK OFFICE

Application No.: 10/168,935 PATENT
Filing Date: January 27, 2003 Attorney Docket No.: 211548-00001
Inventor(s): William S. Bush; et al. Customer No.: 27160
Group Art Unit: 2654
Examiner Name: Harper, V. Paul
Title: Hands-Free Voice-Operated Remote Control Transmitter

Confirmation No.: 4615

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.

The requested extension and appropriate non-small-entity fee are as follows:

Table with 3 columns: Extension period, CFR reference, and Fee amount. Options include One month (\$120.00), Two months (\$450.00), Three months (\$1020.00), Four months (\$1590.00), and Five months (\$2160.00). The Three months option is marked with an 'X'.

X Applicant claims small entity status. See 37 CFR 1.27. Therefore, the fee amount shown above is reduced by one-half, and the resulting fee is: \$510

A check in the amount of \$ is enclosed.

Payment by credit card. Form PTO-2038 is attached.

X The Director is authorized to charge \$450.00 in this application to Deposit Account No. 50-1214.

X The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 50-1214.

I have enclosed a duplicate copy of this sheet.

I am the attorney or agent of record (check below if applicable)

X under 37 CFR 1.34(a); registration number is listed beneath my name.

Date: 9-26-05

By: John S. Paniaguas
Registration No.: 31,051
Telephone No.: (312) 902-5200

09/29/2005 BABRAHA1 00000118 501214 10168935
01 FC:2253 510.00 DA

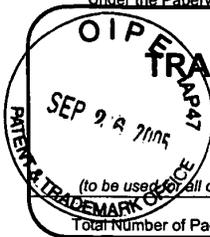
Appl. No.: 10/168,935
Amdt. dated: September 26, 2005
Reply to Office Action of March 25, 2005
Petition for Extension of Time Under 37 CFR 1.136(a)

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this date: .

Date: 09-26-05 By: 

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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Total Number of Pages in This Submission **226**

Application Number	10/168,935
Filing Date	January 27, 2003
First Named Inventor	William S. Bush
Art Unit	2654
Examiner Name	Harper, V. Paul
Attorney Docket Number	21548-00001

ENCLOSURES (Check all that apply)		
<input type="checkbox"/> Fee Transmittal Form	<input type="checkbox"/> Drawing(s)	<input type="checkbox"/> After Allowance Communication to TC
<input type="checkbox"/> Fee Attached	<input type="checkbox"/> Licensing-related Papers	<input type="checkbox"/> Appeal Communication to Board of Appeals and Interferences
<input checked="" type="checkbox"/> Amendment/Reply	<input type="checkbox"/> Petition	<input type="checkbox"/> Appeal Communication to TC (Appeal Notice, Brief, Reply Brief)
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<input type="checkbox"/> Affidavits/declaration(s)	<input type="checkbox"/> Power of Attorney, Revocation Change of Correspondence Address	<input type="checkbox"/> Status Letter
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Remarks		

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	Katten Muchin Rosenman LLP		
Signature			
Printed name	John S. Paniaguas		
Date	September 26, 2005	Reg. No.	31,051

CERTIFICATE OF TRANSMISSION/MAILING

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PATENT
Attorney Docket No. 211548/1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Bush, et al.)
)
Appln. No.: 09/469,707)
)
Filed: December 22, 1999)
)
Title: Hands-Free, Voice-Operated Remote)
Control Transmitter)
)
Group)
Art Unit: 2641)
)
Examiner: Dorvil, R.)
)

CERTIFICATE OF MAILING

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9-26-09 *John S. Paniaguas*
Date John S. Paniaguas
Registration No. 31,051

Commissioner for Patents
Washington, D.C. 20231

INFORMATION DISCLOSURE STATEMENT

Dear Sir:

Pursuant to the provisions of 37 C.F.R. §§ 1.56, 1.97 and 1.98, Applicant submits the documents listed on the attached Form PTO-1449 and enclosed herewith for consideration during the prosecution of the subject application. This document is being filed in accordance with 37 C.F.R. §§ 1.97(c) before a Final Office Action or Notice of Allowance and after the first Official Action. A check in the amount of \$180.00 is enclosed pursuant to 37 C.F.R. §1.17(p). Accordingly, Applicant respectfully requests that the enclosed documents be considered and made of record.

The Commissioner is hereby authorized to charge any additional fees which may be required with respect to this communication or credit any overpayment to Deposit Account No. 50-1214. Should no proper payment for this communication be enclosed, as by a check being in the wrong amount, unsigned, postdated, otherwise improper or informal, or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 50-1214.

Attorney Docket No. 11548/1

The above constitutes information that an Examiner may find material to the examination of the subject application; however, it does not negate the patentability of the subject invention. Furthermore, it is not intended that submission of this information be taken as a representation that a search has been made or that no information which is more material exists.

Respectfully submitted,

Date: 9-26-05

By: 
John S. Paniaguas
Reg. No. 31,051

KATTEN MUCHIN ZAVIS
525 West Monroe Street
Suite 1600
Chicago, IL 60661-3693
Tele: (312) 902-5312
Fax: (312) 577-4532

Doc #:CHI01 (211548-00001) 20757746v1;09/26/2005/Time:9:55



Form PTO-1449 INFORMATION DISCLOSURE CITATION IN AN APPLICATION (Use several sheets if necessary)	Docket Number 211548-00001	Application Number 10/168,935
	Applicant Bush, et al..	
	Filing Date January 27, 2003	Group Art Unit 2654

U. S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER							DATE	NAME	CLASS	SUB CLASS	FILING DATE IF APPROP.
	4	3	2	2	7	1	8					
							March 30, 1982					
	4	7	2	5	8	2	February 16, 1988					
	4	7	7	1	2	8	September 13, 1988					
	4	7	7	4	5	1	September 27, 1988					
	4	9	0	5	2	7	February 27, 1990					
	5	1	4	2	3	9	August 25, 1992					
	5	2	2	6	0	9	July 6, 1993					
	5	2	4	7	5	8	September 21, 1993					
	5	2	6	7	3	2	November 30, 1993					
	5	4	4	4	6	7	August 22, 1995					
	5	4	5	2	2	7	September 19, 1995					
	5	4	7	1	5	5	November 28, 1995					
	5	6	9	1	7	1	November 25, 1997					
	5	7	7	4	8	5	June 30, 1998					
	5	7	7	7	5	7	July 7, 1998					
	5	7	9	0	7	5	August 4, 1998					
	5	8	5	2	8	0	December 22, 1998					

FOREIGN PATENT DOCUMENTS

DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUB CLASS	Translation	
					Yes	No
DE19740406 A1	April 1, 1999	Germany				

OTHER DOCUMENTS

(Including Author, Title, Date, Pertinent Pages, Etc.)

DMI000 Component Directional Microphone published by Lucent Technologies, pp. 1-2

EXAMINER	DATE CONSIDERED
EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP § 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.	



Form PTO-1449 INFORMATION DISCLOSURE CITATION IN AN APPLICATION (Use several sheets if necessary)	Docket Number 211548-00001	Application Number 10/168,935
	Applicant Bush, et al..	
	Filing Date January 27, 2003	Group Art Unit 2654

U. S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER							DATE	NAME	CLASS	SUB CLASS	FILING DATE IF APPROP.
	5	8	7	8	3	9	4					
								March 2, 1999				
	5	9	5	9	7	5	1	September 28, 1999				
	6	0	1	2	0	2	9	January 4, 2000				
	6	0	5	2	6	6	6	April 18, 2000				
	6	0	7	0	1	4	0	May 30, 2000				
	6	1	1	9	0	8	8	September 12, 2000				

FOREIGN PATENT DOCUMENTS

DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUB CLASS	Translation	
					Yes	No

OTHER DOCUMENTS

(Including Author, Title, Date, Pertinent Pages, Etc.)

- MACH 4 CPLD Family High Performance EE CMOS Programmable Logic, Publication 17466, published by Lattice Semiconductor Corporation, May 1999 pp. 1-62
- Preliminary Product Specification Z86L81/86/98 28-Pin Low-Voltage Infrared Microcontroller, Document No. DS000701-IRX1298, published by Zilog, Inc. 1999, pp. 1-55
- RSC-300/364 DataBook published by Sensory, Inc. August 1999, pp. 1-50.
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- Voice Direct™ Speech Recognition IC, datasheet part No. 80-0022-5, published by Sensory Inc. September 8, 1998, pp. 1-4
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- CMOS Low Voltage 2Ω SPST Switches ADG701/ADG702 published by Analog Devices, Inc. 1998, pp. 1-8
- CMOS Low Voltage 4Ω SPDT Switch ADG719 published by Analog Devices, Inc. 1998, pp. 1-8

EXAMINER	DATE CONSIDERED
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19 BUNDESREPUBLIK
DEUTSCHLAND



DEUTSCHES
PATENT- UND
MARKENAMT

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71 Anmelder:
Kaiser, Michael, 80687 München, DE

74 Vertreter:
Graf Lambsdorff, M., Dipl.-Phys.Dr.rer.nat.,
Pat.-Anw., 80798 München

72 Erfinder:
gleich Anmelder

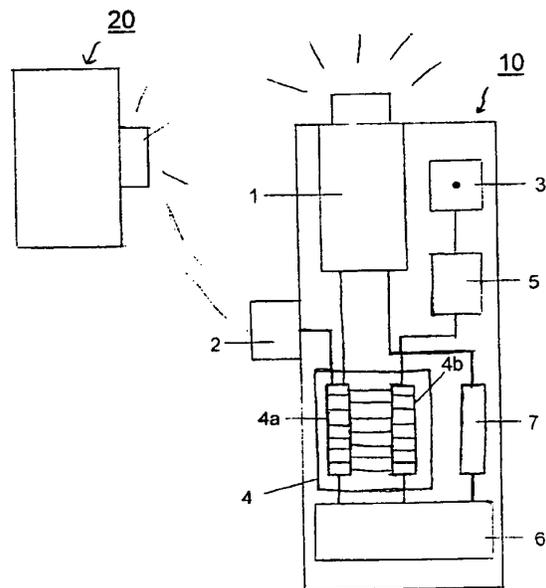
56 Entgegenhaltungen:
WO 94 03 020 A1

Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

Prüfungsantrag gem. § 44 PatG ist gestellt

54 Sprachgesteuertes Fernbedienungsgerät

57 Ein lernfähiges Fernbedienungsgerät (10), in welches mehrere Fernbedienungsfunktionen einer Vielzahl von individuellen Fernbedienungsgeräten (20) gespeichert werden können, die zu einer entsprechenden Vielzahl von anzusteuern elektronischen Geräten gehören, wird dertart weitergebildet, daß die Programmierung und Benutzung des Geräts sprachgesteuert durchgeführt werden kann. Dazu wird das lernfähige Fernbedienungsgerät (10) mit einem Mikrophon (4) ausgestattet, durch das die Spracheingabe vorgenommen werden kann. Bei der Programmierung werden Fernbedienungsfunktionen in Form von Codierungssignalen der individuellen Fernbedienungsgeräte zusammen mit inhaltlich entsprechenden Sprachsignalen in einem Speicher (4) gespeichert. Bei der Verwendung wird das Sprachsignal erneut in das Mikrophon eingegeben, worauf nach Vergleich mit den Speicherinhalten das zugehörige Codierungssignal durch einen Sender (1) des lernfähigen Fernbedienungsgeräts (10) ausgesandt wird.



DE 197 40 706 A 1

Beschreibung

Die Erfindung betrifft ein Fernbedienungsgerät nach dem Oberbegriff des Patentanspruchs 1 und ein Verfahren zur Programmierung und Fernbedienung elektronischer Geräte, insbesondere Fernsehgeräte, Audiogeräte, Videorecorder nach dem Oberbegriff des Patentanspruchs 6.

Seit neuestem sind im Bereich der Unterhaltungsbranche sogenannte lernfähige Fernbedienungsgeräte entwickelt worden, mit denen es möglich ist, nach vorheriger Programmierung eine Vielzahl unterschiedlicher elektronischer Geräte, wie Fernsehgeräte, Audiogeräte, Videorecorder und dergleichen anzusteuern. Diese Fernbedienungsgeräte und ihre Programmierung basieren im wesentlichen darauf, daß die Ansteuerung elektronische Geräte üblicherweise und fast durchgängig durch einzeln zugehörige Fernbedienungsgeräte unter Aussendung infraroter Strahlung aufgrund von Tastendruck erfolgt. Die Fernbedienungsfunktionen der einzelnen Fernbedienungsgeräte, die unterschiedlichen elektronischen Geräten zugeordnet sind, können nun in ein einzelnes lernfähiges Fernbedienungsgerät eingeschrieben werden. Zu diesem Zweck wird das lernfähige Fernbedienungsgerät mit einem Infrarotsender und einem Infrarotempfänger ausgestattet. Die Fernbedienungsfunktionen der einzelnen Fernbedienungsgeräte werden durch Druck entsprechender Funktionstasten aktiviert und bewirken die Aussendung eines jeweiligen Infrarot-Codierungssignals. Bei der Programmierung werden die einzelnen Fernbedienungsgeräte nacheinander in Richtung auf das lernfähige Fernbedienungsgerät ausgerichtet und entweder sämtliche oder nur einige gewünschte Infrarot-Codierungssignale von dem jeweiligen Infrarotsender des einzelnen Fernbedienungsgeräts an den Infrarotempfänger des lernfähigen Fernbedienungsgeräts gesandt. Diese Infrarot-Codierungssignale können dann in dem lernfähigen Fernbedienungsgerät in einem Speicher abgelegt und gleichzeitig mit einer bestimmten Funktionstaste des lernfähigen Fernbedienungsgeräts kombiniert werden. Nach Vollendung der Programmierung können die in dem lernfähigen Fernbedienungsgerät programmierten Fernbedienungsfunktionen der einzelnen Fernbedienungsgeräte durch Druck der beim Abspeichern betätigten Funktionstasten aktiviert werden. Somit können je nach Speicherkapazität des lernfähigen Fernbedienungsgeräts eine Vielzahl unterschiedlicher elektronischer Geräte durch ein- und dasselbe Fernbedienungsgerät bedient werden.

Dieser Stand der Technik ist jedoch insofern von Nachteil, als in dem programmierten lernfähigen Fernbedienungsgerät eine Vielzahl unterschiedlicher Fernbedienungsfunktionen nur durch entsprechend viele Funktionstasten oder Kombinationen von Funktionstasten des lernfähigen Fernbedienungsgeräts aufrufbar sind. Dies macht es erforderlich, entweder die Tastatur des Geräts mit einer entsprechenden Beschriftung zu versehen oder die bei der Programmierung gewählte Belegung der Funktionstasten gesondert zu notieren. Als ein weiterer Nachteil des gattungsgemäßen lernfähigen Fernbedienungsgeräts kann es angesehen werden, daß es in jedem Fall manuell zu bedienen ist und somit von körperlich diesbezüglich behinderten Menschen nicht verwendet werden kann.

Es ist somit Aufgabe der vorliegenden Erfindung, ein verbessertes lernfähiges Fernbedienungsgerät anzugeben, das sich durch vereinfachten Bedienungscomfort auszeichnet. Insbesondere ist es Aufgabe der vorliegenden Erfindung, ein verbessertes lernfähiges Fernbedienungsgerät anzugeben, welches eine vereinfachte Aktivierung der Fernbedienungsfunktionen, insbesondere aber nicht nur, für körperlich behinderte Menschen ermöglicht.

Diese Aufgabe wird durch die kennzeichnenden Merk-

male der Patentansprüche 1 und 6 gelöst. Vorteilhafte Ausgestaltungen der Erfindung sind in den Unteransprüchen angegeben.

Das erfindungsgemäße Fernbedienungsgerät enthält einen Sender, einen Empfänger und einen Speicher zur Speicherung von Fernbedienungsfunktionen individueller Fernbedienungsgeräte, die den anzusteuern den elektronischen Geräten zugeordnet sind. Weiterhin ist das Gerät mit einem Mikrophon zur Eingabe von Sprachsignalen verbunden. Der Speicher ist derart ausgeführt, daß Sprachsignale und Fernbedienungsfunktionen mit einer festen Zuordnung zueinander speicherbar oder bereits vorab gespeichert sind. Bei dem erfindungsgemäßen Verfahren werden Fernbedienungsfunktionen individueller Fernbedienungsgeräte, die den anzusteuern den elektronischen Geräten zugeordnet sind, in einem einzigen Fernbedienungsgerät gespeichert. Dabei wird eine Fernbedienungsfunktion eines individuellen Fernbedienungsgeräts durch Tastendruck aktiviert, wobei ein Codierungssignal ausgesandt wird, welches von einem Empfänger des einzigen Fernbedienungsgeräts empfangen und gespeichert wird, und ein der Fernbedienungsfunktion entsprechendes Sprachsignal wird aufgenommen und gespeichert, wobei die Speicherung derart erfolgt, daß bei Wiedereingabe des Sprachsignals in das einzige Fernbedienungsgerät das zugeordnete gespeicherte Codierungssignal ausgesandt wird.

Die beigefügte Zeichnung zeigt ein Blockschaltbild einer Ausführungsform eines erfindungsgemäßen Fernbedienungsgeräts und eines handelsüblichen individuellen Fernbedienungsgeräts, das zu einer bestimmten elektronischen Vorrichtung gehört.

Das erfindungsgemäße sprachgesteuerte lernfähige Fernbedienungsgerät 10 der in der Zeichnung dargestellten Ausführungsform weist als Verbindungen zur Außenwelt einen Infrarotsender 1, einen Infrarotempfänger 2 und ein Mikrophon 3 auf. In den Infrarotempfänger 2 können die von einem einzelnen Fernbedienungsgerät 20 ausgesandten Infrarot-Codierungssignale, die bestimmten Fernbedienungsfunktionen für das von dem Fernbedienungsgerät 20 anzusteuern den elektronische Gerät entsprechen, eingespeist werden. In Korrelation mit dieser Eingabe wird nun über das Mikrophon eine entsprechende Spracheingabe vorgenommen. Diese Spracheingabe ist frei wählbar und sollte vorzugsweise die auszuwählende Funktion in kurzer Form sprachlich geeignet kennzeichnen. Beide Signale werden in einem Speicher 4 abgespeichert. Der Speicher 4 enthält beispielsweise einen Infrarot-Codierungssignal-Speicher 4a und einen Sprachsignalspeicher 4b, deren Speicherplätze wechselseitig in einer festen Zuordnung zueinander stehen, wie in der Zeichnung ersichtlich.

Wenn beispielsweise die Funktion für das Anschalten des Videorecorders programmiert werden soll, so wird beispielsweise in einer ersten Eingabe durch Betätigung der Einschalttaste auf dem dem Videorecorder zugehörigen Fernbedienungsgerät 20 das entsprechende Infrarot-Codierungssignal in den Empfänger 2 des Fernbedienungsgeräts 10 eingegeben, worauf in einer zweiten Eingabe ein Sprachsignal, beispielsweise "Video an" oder "V an" in das Mikrophon gesprochen wird. Das Infrarot-Codierungssignal wird auf einen ersten Speicherplatz des Infrarot-Codierungssignal-Speichers 4a geschrieben. Das Sprachsignal wird zunächst in einem Sprachprozessor 5 analysiert, d. h. in seine Frequenzbestandteile zerlegt, und dann auf den diesem Speicherplatz zugeordneten ersten Speicherplatz des Sprachsignalspeichers 4b geschrieben.

Auf diese Weise verfährt man mit allen gewünschten Fernbedienungsfunktionen aller anzusteuern den Geräte.

Nach erfolgter Programmierung können diese elektroni-

schen Geräte durch Spracheingabe in das Fernbedienungs-
 gerät 10 angesteuert werden. Dazu wird das entsprechende
 Sprachsignal für die gewünschte Fernbedienungsfunktion in
 das Mikrophon 3 gesprochen. Um nun den richtigen Spei-
 cherplatz wiederaufzufinden, enthält der Sprachprozessor 5
 weiterhin eine Signalvergleichsschaltung, welche dazu
 dient, ein eingegebenes und analysiertes Sprachsignal mit
 den abgespeicherten Signalen zu vergleichen. Entspre-
 chende Vergleichsschaltungen sind im Stand der Technik
 beispielsweise von Spracherkennungsprogrammen bekannt
 und brauchen aus diesem Grund hier nicht näher erörtert
 werden. Sobald die Signalvergleichsschaltung eine im Rah-
 men vorgegebener mathematischer Abweichungen befindliche
 Übereinstimmung zwischen dem eingegebenen Sprach-
 signal und einem der in dem Sprachspeicher 4b abge-
 speicherten Sprachsignale erkennt, wird das in dem zuge-
 ordneten Infrarot-Codierungssignal-Speicher 4a gespei-
 cherte Infrarot-Codierungssignal an den Sender 1 übertra-
 gen. Der Sender überträgt dann das Infrarot-Codierungssi-
 gnal an das anzusteuende elektronische Gerät.

Das Blockschaltbild dient lediglich der Erläuterung des
 erfinderischen Prinzips. Beispielsweise erfolgt die Steue-
 rung und Koordinierung der einzelnen Baugruppen und
 Schaltungsteile des Fernbedienungsgeräts vorzugsweise
 durch eine zentrale Steuereinheit, die hier aus Gründen der
 Übersichtlichkeit der Anordnung weggelassen wurde.

Anstelle von Infrarotstrahlung können für die Fernüber-
 tragung auch Funkwellen oder akustische Strahlung wie Ul-
 traschall verwendet werden.

Das Fernbedienungsgerät kann weiterhin einen Funkti-
 onstastenblock 6 enthalten. Dieser enthält in erster Linie
 Funktionstasten, welche dazu dienen, die oben beschriebene
 Programmierung vorzunehmen, d. h. das Gerät entweder in
 Bereitschaft für den Empfang eines Infrarot-Codierungssi-
 gnals oder in Bereitschaft für den Empfang eines Sprachsi-
 gnals zu bringen oder die Speicherung beider Signale in die
 Speicher 4a und 4b zu bewirken. Der Funktionstastenblock
 6 kann aber auch darüberhinaus weitere Funktionstasten
 enthalten, welche dazu dienen, das Gerät auf die eingangs
 beschriebene konventionelle Art zu verwenden, d. h. durch
 Belegung der Funktionstasten mit Fernbedienungsfunkti-
 onen. Zu diesem Zweck ist der Tastenspeicher 7 vorgesehen,
 in welchen Fernbedienungsfunktionen und zugehörige
 Funktionstasten gespeichert bzw. programmiert werden
 können. Die Möglichkeit dieser zusätzlichen redundanten
 Funktionstastenspeicherung kann insbesondere unter dem
 Gesichtspunkt sinnvoll sein, daß die Sprachprogrammierung
 grundsätzlich benutzerabhängig ist. Werden die
 Sprachsignale von einer anderen Person zur Steuerung einge-
 gegeben, so kann dies aufgrund der unterschiedlichen aku-
 stischen Frequenzcharakteristik zu Fehlerkennungen füh-
 ren. Es kann zwar auch für weitere Benutzer eine Sprach-
 programmierung vorgenommen werden. Wenn die Benut-
 zerszahl jedoch relativ groß ist, empfiehlt sich eher eine zu-
 sätzliche konventionelle Funktionstastenspeicherung, die
 benutzerunabhängig ist und daher von jedermann abrufbar
 ist.

Bei der Programmierung kann man auch derart vorgehen,
 daß zu einem Sprachsignal mehrere verschiedene Fernbe-
 dienungsfunktionen abgespeichert und beim Eingeben des
 Sprachsignals nacheinander durch Aussenden der entspre-
 chenden Codierungssignale ausgeführt werden. Dies kann
 insbesondere bei Fernsehern in Verbindung mit Videotext
 von Vorteil sein, da man auf diese Weise gleich mit einer
 Spracheingabe die gewünschte Seite im Videotext aufschla-
 gen kann.

Es können mit dem erfindungsgemäßen Fernbedienungs-
 gerät auch fernbedienbare Motoren oder Relais angesteuert

werden. Insbesondere hat die Erfindung den Vorteil, daß
 elektronische Vorrichtungen wie elektrische, fernbedienbare
 Türöffner oder fernbedienbare Fahrstühle angesteuert wer-
 den können. Bei Türöffnern kann die Erfindung vorteilhaft
 eingesetzt werden, indem bei der Programmierung ein Code-
 wort eingegeben wird. Erst wenn also das richtige Code-
 wort mit der passenden akustischen Frequenzcharakteristik,
 also von der richtigen Person, eingegeben werden wird, öff-
 net sich die Tür automatisch.

Die Erfindung ist nicht darauf beschränkt, daß die Fernbe-
 dienungsfunktionen mit den Sprachsignalen programmiert
 werden müssen. Es kann auch vorgesehen sein, daß Fernbe-
 dienungsfunktionen und/oder Sprachsignale fest gespeichert
 und nicht veränderbar bzw. programmierbar sind. Es können
 auch Fernbedienungsfunktionen und/oder Sprachsignale
 zum Teil im Speicher vorgegeben sein, die je nach den indi-
 viduellen Wünschen des Benutzers um weitere Anwendun-
 gen durch Programmierung erweitert werden können.

Patentansprüche

1. Fernbedienungsgerät (10) zur Ansteuerung eines
 oder mehrerer elektronischer Vorrichtungen mittels
 elektromagnetischer oder akustischer Signale, umfas-
 send einen Sender (1), einen Empfänger (2) und einen
 Speicher (4) zur Speicherung von Fernbedienungs-
 funktionen individueller Fernbedienungsgeräte (20),
 die den anzusteuenden elektronischen Vorrichtungen
 zugeordnet sind, **dadurch gekennzeichnet**, daß das
 Fernbedienungsgerät mit einem Mikrophon (3) zur
 Eingabe von Sprachsignalen verbunden ist und daß der
 Speicher (4) derart ausgeführt ist, daß Sprachsignale
 und Fernbedienungsfunktionen mit einer festen Zuord-
 nung zueinander durch Programmierung speicherbar
 oder bereits vorab gespeichert sind.
2. Fernbedienungsgerät nach Anspruch 1, dadurch ge-
 kennzeichnet, daß die Fernbedienungsfunktionen in
 Form von Codierungssignalen speicherbar sind und der
 Speicher (4) einen Codierungssignal-Speicher (4a) und
 einen Sprachspeicher (4b) enthält und jeder Spei-
 cherplatz des einen Speichers in einer festen Zuord-
 nung zu einem Speicherplatz des anderen Speichers
 steht.
3. Fernbedienungsgerät nach Anspruch 1, gekenn-
 zeichnet durch einen Sprachprozessor (5) zur Analyse
 und Digitalisierung der Sprachsignale und zum Ver-
 gleich eingegebener mit gespeicherten Sprachsignalen.
4. Fernbedienungsgerät nach Anspruch 1, gekenn-
 zeichnet durch einen Funktionstastenblock (6) mit
 Funktionstasten, deren Belegung mit Fernbedienungs-
 funktionen in einem Tastenspeicher (7) speicherbar
 oder bereits vorab gespeichert sind.
5. Fernbedienungsgerät nach einem der vorhergehen-
 den Ansprüche, dadurch gekennzeichnet, daß die Si-
 gnale Infrarotsignale und die Codierungssignale Infra-
 rot-Codierungssignale sind.
6. Verfahren zur Programmierung und Ansteuerung ei-
 nes oder mehrerer elektronischer Vorrichtungen mittels
 elektromagnetischer oder akustischer Signale, bei wel-
 chem Fernbedienungsgeräten individueller Fernbe-
 dienungsgeräte (20), die den anzusteuenden elektroni-
 schen Geräten zugeordnet sind, in einem einzigen
 Fernbedienungsgerät (10) gespeichert werden, dadurch
 gekennzeichnet, daß eine Fernbedienungsfunktion ei-
 nes individuellen Fernbedienungsgeräts (20) durch Tas-
 tendruck aktiviert wird, wobei ein Codierungssignal
 ausgesandt wird, welches von einem Empfänger (2)
 des einzigen Fernbedienungsgeräts (10) empfangen

und gespeichert wird, und ein der Fernbedienungsfunktion entsprechendes Sprachsignal aufgenommen und gespeichert wird, wobei die Speicherung derart erfolgt, daß bei Wiedereingabe des Sprachsignals in das einzige Fernbedienungsgeräts (10) das zugeordnete gespeicherte Codierungssignal aus gesandt wird.

7. Verfahren nach Anspruch 6, dadurch gekennzeichnet, daß bei der Ansteuerung ein Sprachsignal eingegeben und mit den gespeicherten Sprachsignalen verglichen wird, und wobei bei Übereinstimmung des eingegebenen mit einem gespeicherten Sprachsignal das zugeordnete gespeicherte Codierungssignal ausgesandt wird.

8. Verfahren nach Anspruch 6 oder 7, dadurch gekennzeichnet, daß das Codierungssignale ein Infrarot-Codierungssignal ist.

Hierzu 1 Seite(n) Zeichnungen

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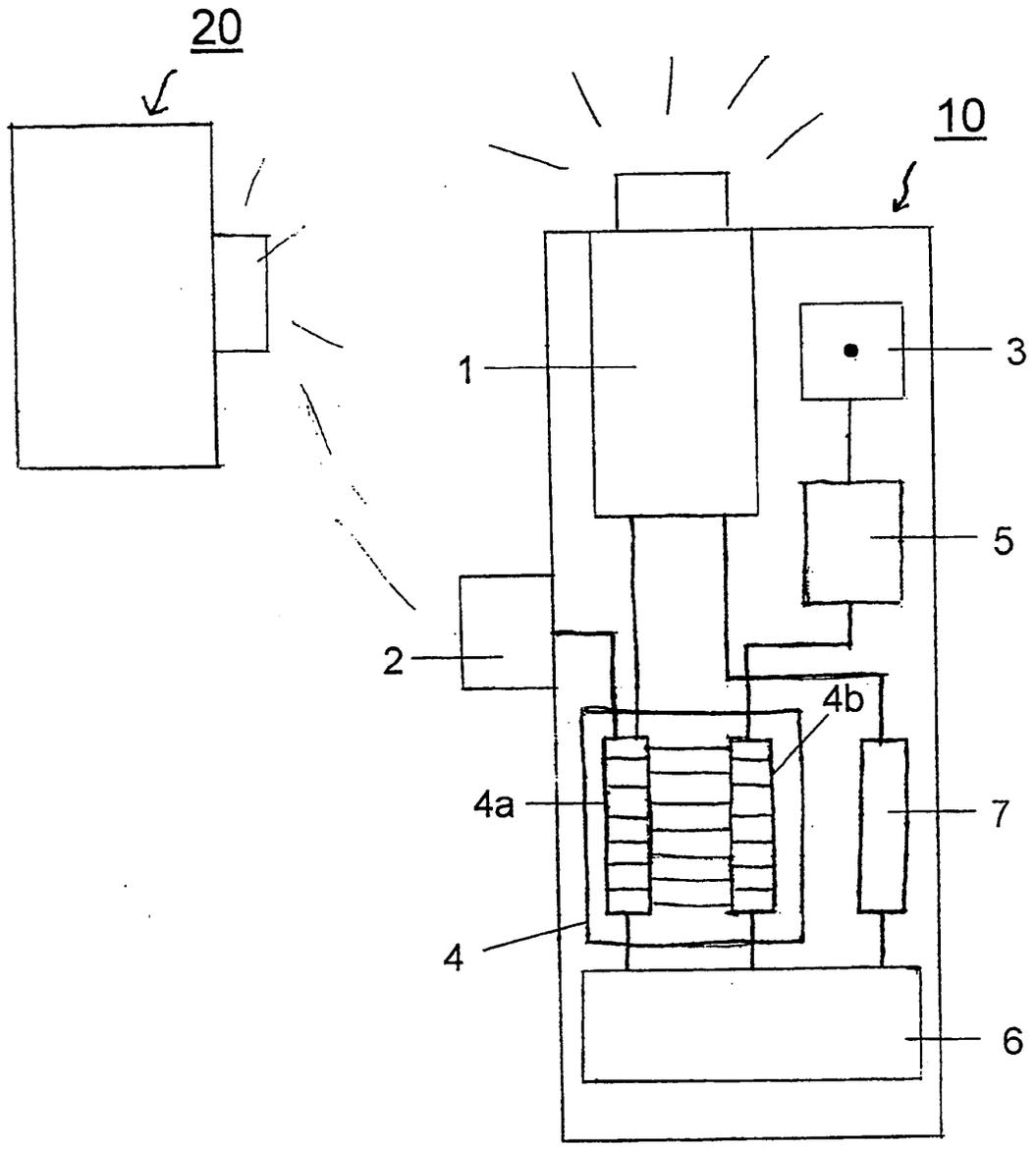
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- Leerseite -



09-28-05

Receipt



IFW PATENT

Attorney Docket No. 211558-00001

IN THE U.S. PATENT AND TRADEMARK OFFICE

Application No.: 10/168,935
Filing Date: January 27, 2003
Inventor(s): William S. Bush; et al.
Group Art Unit: 2654
Examiner Name: V. Paul Harper
Customer No.: 27160

CERTIFICATE OF MAILING

I hereby certify that this paper is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Mail Stop Amendment, Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this date.

Date Mary T. Champion

Title: Hands-Free, Voice-Operated Remote Control Transmitter
Confirmation No.: 4615

Request for Corrected Filing Receipt

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

It has come to our attention that the Filing Receipt is in error in that the domestic priority data of the invention is incorrect. A copy of the filing receipt with corrections shown in pen is attached. Please provide us with a corrected filing receipt.

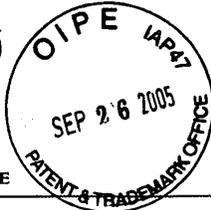
The Commissioner is hereby authorized to charge any fees to Deposit Account No. 50-1214.

Respectfully submitted,

Katten Muchin Rosenman LLP

By: John S. Paniaguas
Registration No. 31,051

Katten Muchin Rosenman LLP
525 West Monroe Street
Chicago, IL 60661-3693
Tel: (312) 902-5200
Fax: (312) 902-1061



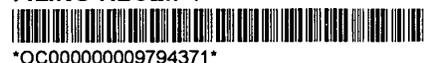
Commissioner for Patents
Washington, DC 20231
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APPLICATION NUMBER	FILING DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	DRAWINGS	TOT CLAIMS	IND CLAIMS
10/168,935	01/27/2003	2654	579	211548-1US	30	22	6

CONFIRMATION NO. 4615

Katten Muchin Zavis Rosenman
Patent Department
Suite 1600
525 West Monroe Street
Chicago, IL 60661-3693

FILING RECEIPT



OC00000009794371

Date Mailed: 04/10/2003

Receipt is acknowledged of this regular Patent Application. It will be considered in its order and you will be notified as to the results of the examination. Be sure to provide the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION when inquiring about this application. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please write to the Office of Initial Patent Examination's Filing Receipt Corrections, facsimile number 703-746-9195. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections (if appropriate).

Applicant(s)

William Stuart Bush, Manhattan Beach, CA;
Carlos Ferdinand Roura, Tustin, CA;

Domestic Priority *a national* data as claimed by applicant

This application is ~~371~~ *under 35 USC § 119* of PCT/US00/35107/12/21/2000, *filed*

based on PCT international Application no

which claims the benefit of US Patent Application No 09/469,707, filed 12/22/99, now US Patent No 6,397,186

Foreign Applications

Projected Publication Date: To Be Determined - pending completion of Security Review

Non-Publication Request: No

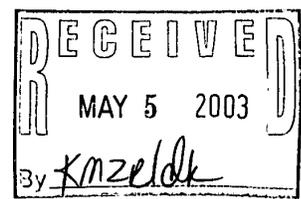
Early Publication Request: No

** SMALL ENTITY **

Title

Hands-free, voice-operated remote control transmitter

Preliminary Class



704

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Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15**

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/168,935	01/27/2003	William Stuart Bush	211548-IUS	4615

7590 03/25/2005
Katten Muchin Zavis Rosenman
Patent Department
Suite 1600
525 West Monroe Street
Chicago, IL 60661-3693

EXAMINER
HARPER, V PAUL

ART UNIT 2654
PAPER NUMBER

DATE MAILED: 03/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

DETAILED ACTION

U.S. National Stage Application

1. Acknowledgement is made of the indication that the present application is filed under 35 U.S.C. 371, of the indication that the required form PCT/DO/EO/903 is present, and of the use of transmittal form PCT/DO/EO/1390. Thus, the present application is being treated as a filing under 35 U.S.C. 371.

Specification

2. The disclosure is objected to because the term "voice recognition" is used for what nowadays is called—**speech recognition**—in the speech signal processing art. While "voice recognition" and "speech recognition" were once used interchangeably, these days the terms must be strictly distinguished. For, the term "voice recognition" now denotes identification of who is doing the speaking, while "**speech** recognition" (or "**word** recognition") denotes identification of what is being said. So, appropriate correction to the proper terms of art is required. In particular, "voice recognition" is used on page 5, line 10 of the specification and in claims 9, 12-18, 20 and 21.

Claim Objections

3. The following claims are objected to because of informalities:

In Claim 1, line 9, "a speech recognition mode" should be replaced with --said speech recognition mode--.

Claim 2 should end in a period.

In claim 5, line 8, "a sound activation circuit" should be --the sound activation circuit--and "a sleep mode" should be --the sleep mode--.

In claim 5, line 11, the phrase "causing circuit to switch to said speech recognition circuit" is confusing. Is circuit the sound activation circuit or the speech recognition circuit? Perhaps the Applicant intended to say --causing said sound activation circuit to switch to the speech recognition mode--

In claim 5, line 12, "a speech recognition circuit" should be --the speech recognition circuit--.

In claim 5, line 13, "a speech recognition mode" should be --the speech recognition mode--.

Claim 8 states that the "control signals are infrared signals," but this claim depends from claim 7, which states that the "control signals are RF signals." Suggest that claim 8 be amended to indicate that it depends from claim 6.

In claim 12, line 9, the phrase "a mute mode" should be replaced with --a MUTE mode--.

In claim 14, line 1, "include" should be --includes--.

Claim 14 should end in a period.

In claim 18, line 2 "comprising;" should be replaced with --comprising:--.

In claim 21, line 2, "comprising;" should be replaced with --comprising:--.

In claims 9, 12-18, 20 and 21 the phrase "voice recognition" should be replaced by --speech recognition--(see comment above under the Specification).

Appropriate correction is required.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

4. Claims 1-4 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-4 of U.S. Patent No. 6,397,186, (hereinafter referred to as '186), which was under a restriction requirement where claims 1-4 correspond to the elected invention I from the '186 patent application (09/469,707, office action #10, 7/17/01). Although the conflicting claims are not identical, they are not patentably distinct from each other because of the following:

- a microphone for receiving audio signals ('186, col. 52, lines 5-6);
- a speech recognition system for receiving audio signals ('186, col. 52, line 7);
- said speech recognition system having a low power sound activation mode for detecting the presence of audio signals and a speech recognition mode for decoding said audio signals and generating control signals for controlling one or more appliances, said speech recognition system including a circuit for switching between said sound activation mode and a speech recognition mode as a function of the amplitude of said

audio signals ('186, col. 52, lines 7-22, where a processor is an obvious component for a speech recognizer, because it is almost universally used and more flexible); and

- an appliance control circuit which includes a transmitter, said appliance control unit for receiving said control signals from said speech recognition system and generating and transmitting an appliance control signal to a selected appliance ('186, col. 52, lines 23-28).

- Claim 2 corresponds to patent '186 claim 2;
- Claim 3 corresponds to patent '186 claim 3;
- Claim 4 corresponds to patent '186 claim 4;

5. Claims 5-8 is rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-5 of '186, which was under a restriction requirement where claims 1-5 correspond to elected invention I from the '186 patent application (9/469,707, office action #10, 7/17/01). Although the conflicting claims are not identical, they are not patentably distinct from each other because of the following:

- a microphone for receiving audio signals and converting said audio signals to electrical signals ('186, col. 52, lines 5-6);
- an audio circuit for receiving said electrical signals from said microphone and coupling said microphone to a sound activation circuit in one or more modes including a sleep mode and a speech recognition mode ('186, col. 52, lines 7-23, where the speech

recognition system includes the activation circuit function and the sleep mode corresponds to the low power state);

- a sound activation circuit coupled to said microphone in a sleep mode configured to detect when electrical signals from said microphone exceed a predetermined threshold and generate a wake-up signal to said speech recognition circuit, causing circuit to switch to said speech recognition circuit ('186 col. 52, lines 7-23, where the low power state corresponds to the sleep mode; lines 37-43 where the signal must exceed a threshold level for automatic switching to the speech recognition mode);
 - a speech recognition circuit having one or more modes of operation including a speech recognition mode for generating first control signals when the electrical signals from said microphone represent one or more predetermined command signals or alternatively generating a sleep signal to cause said audio circuit to return to sleep mode after a predetermined time period when no command signals are detected ('186, col. 52, lines 56-64); and
 - an appliance control circuit for receiving said first control signals from said speech recognition circuit and generating second control signals to cause the appliance to perform the desired command ('186, col. 52, lines 23-28).
- Claim 6 corresponds to patent '186 claim 2;
 - Claim 7 corresponds to patent '186 claim 4;
 - Claim 8 corresponds to patent '186 claim 3;

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 9, 10, 18 and 19 are rejected under 35 U.S.C. 102(e) as being anticipated by Knittel (U.S. Patent 6,606,280), hereinafter referred to as Knittel.

Regarding **claim 9**, Knittel discloses a voice-operated remote control (title).

Knittel's apparatus includes the following:

- a voice recognition system for receiving representative voice signals and converting said representative voice signals to one or more command signals for controlling one or more selected appliances (col. 2, lines 7-19; Fig. 3, item 59; compares the user's voice with spoken command data, commands are transmitted to the entertainment system);
- the voice recognition system including a plurality of linked speech recognition vocabulary sets (col. 12, lines 30-36; a separate vocabulary for each user can be maintained with inherent ability to select from among the collection of vocabularies).

Regarding **claim 10**, Knittel teaches everything claimed, as applied above (see claim 9); in addition, Knittel teaches “at least one of said linked speech vocabulary sets is speaker dependent” (col. 12, lines 26-36; the vocabulary does not need to be speaker independent and a separate vocabulary for each user can be maintained, i.e., speaker dependence).

Regarding **claim 18**, Knittel discloses a voice-operated remote control (title). Knittel's apparatus includes the following:

- a voice recognition system for receiving representative voice signals and converting said representative voice signals to one or more command signals for controlling one or more selected appliances (col. 2, lines 7-19; Fig. 3, item 59; compares the user's voice with spoken command data, commands are transmitted with one or more devices being controlled);
- the voice recognition system including a command signal receiver and memory for receiving and storing command signal data to be associated with said representative voice signals (col. 2, lines 14-19; voice data can be stored in memory).

Regarding **claim 19**, Knittel teaches everything claimed, as applied above (see claim 18); in addition, Knittel teaches “said command signal receiver is configured as an infrared signal receiver” (col. 2, lines 19-23; Fig. 3, item 61).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 1-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kimura et al. (U.S. Patent 5,199,080), hereinafter referred to as Kimura, in view of Miyazawa et al. (U.S. Patent 5,983,186), hereinafter referred to as Miyazawa.

Regarding **claim 1**, Kimura discloses a voice-operated remote control system.

Kimura's system includes the following:

- a microphone for receiving audio signals (Fig. 3, microphone);
- a speech recognition system for receiving audio signals (Fig. 3, speech recognition circuit, item 15; Fig. 5, item 15A; col. 1, lines 62-64); a speech recognition mode for decoding said audio signals and generating control signals for controlling one or more appliances (Fig. 1, controlled device; col 2, lines 6-15; Fig. 9, **RECOGNITION MODE**; col. 1, lines 64-65);
- an appliance control circuit which includes a transmitter, said appliance control unit for receiving said control signals from said speech recognition system and generating and transmitting an appliance control signal to a selected appliance (Fig. 3, items 16, 17, and D₁; col. 3, lines 36-49; col. 1, lines 65-67; col 2, lines 10-15, Fig. 1, item 101).

But Kimura fails to specifically disclose that “said speech recognition system having a low power sound activation mode for detecting the presence of audio signals [a]” and “said speech recognition system including a circuit for switching between said sound activation mode and a speech recognition mode as a function of the amplitude of said audio signals [b]”. However, the examiner contends that these concepts were well known in the art, as taught by Miyazawa.

In the same field of endeavor, Miyazawa discloses a voice activated interactive speech recognition device (title). Miyazawa’s device has a low-power sleep mode that can detect sound, [a] above, (col. 4, lines 13-18) where the mode switches to an active recognition mode when the background sound exceeds a threshold, [b] above, (col. 4, lines 14-22).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Kimura by specifically providing the features, as taught by Miyazawa, because they were well known in the art at the time of invention for the purpose of minimizing power consumption (Miyazawa, col. 2, lines 48-50).

Regarding **claim 2**, Kimura in view of Miyazawa teaches everything claimed, as applied above (see claim 1); in addition, Kimura teaches that “said transmitter is configured to wirelessly transmit appliance control signals to said selected appliance” (col. 1, lines 65-67, transmitting a remote control signal; Fig. 1, item RC; col. 3, lines 42-46; infrared transmission).

Regarding **claim 3**, Kimura in view of Miyazawa teaches everything claimed, as applied above (see claim 2); in addition, Kimura teaches that "said transmitter is an infrared transmitter" (col. 3, lines 42-46; Fig. 3, item D₁).

8. Claims 5, and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kimura in view of Miyazawa and Wells et al. (U.S. 5,603,036), hereinafter referred to as Wells.

Regarding **claim 5**, Kimura discloses a voice-operated remote control system. Kimura's system includes the following:

- a microphone for receiving audio signals and converting said audio signals to electrical signals (Fig. 3, microphone; Fig. 5, item M; col. 1, lines 61-62);
- a speech recognition circuit having one or more modes of operation including a speech recognition mode for generating first control signals when the electrical signal from said microphone represent one or more predetermined command signals or ... (col 2, lines 6-15; Fig. 9, **RECOGNITION MODE**; col. 1, lines 64-65);
- an appliance control circuit for receiving said first control signals from said speech recognition circuit and generating second control signals to cause the appliance to perform the desired command (Fig. 3, items 16, 17, D₁; col. 3, lines 36-49; col. 1, lines 65-67; col. 2, lines 10-15, Fig. 1, item 101).

But Kimura fails to specifically disclose that "an audio circuit for receiving said electrical signals from said microphone and coupling said microphone to a sound

activation circuit in one or more modes including a sleep mode and a speech recognition mode [a]" and "a sound activation circuit coupled to said microphone in a sleep mode configured to detect when electrical signals from said microphone exceed a predetermined threshold and generate a wake-up signal to said speech recognition circuit, causing circuit to switch to said speech recognition circuit [b]". However, the examiner contends that these concepts were well known in the art, as taught by Miyazawa.

In the same field of endeavor, Miyazawa discloses a voice activated interactive speech recognition device (title). Miyazawa's device has a sound signal input unit coupled to an input sound signal level detector that can switch from a low-power mode to a recognition mode, [a] above, (Fig. 1, items 1 and 9; col. 4, lines 13-19) when the background sound exceeds a threshold, [b] above, (col. 4, lines 16-22).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Kimura by specifically providing the functions, as taught by Miyazawa, because these functions were well known in the art at the time of invention for the purpose of minimizing power consumption (Miyazawa, col. 2, lines 48-50).

Furthermore, Kimura fails to specifically teach "... alternatively generating a sleep signal to cause said audio circuit to return to sleep mode after a predetermined time period when no command signals are detected." However, the examiner contends that these concepts were well known in the art, as taught by Wells.

In the same field of endeavor, Wells discloses a power management system for components used in battery-powered applications. Wells' system includes a function to place a device in a low power mode after some period of time if no active operation has occurred (col. 4, lines 35-40).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Kimura by specifically providing the feature, as taught by Wells, because it was well known in the art at the time of invention for the purpose of minimizing power consumption (Wells, col. 1, lines 13-18).

Regarding **claim 6**, Kimura in view of Miyazawa and Wells teaches everything claimed, as applied above (see claim 5); in addition, Kimura teaches that "the appliance control unit is configured to wirelessly transmit said second control signals to said, select appliance" (col. 1, lines 65-67, transmitting a remote control signal; Fig. 1. item RC; col. 3, lines 42-46, infrared).

9. Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kimura in view of Miyazawa, Wells and further in view of Knittel.

Regarding **claim 7**, Kimura in view of Miyazawa and Wells teaches everything claimed, as applied above (see claim 6), but Kimura does not specifically teach "said second control signals are RF signals." However, the examiner contends that this concept was well known in the art, as taught by Knittel.

In the same field of endeavor, Knittel discloses a voice-operated remote control that uses RF transmission (col. 4, lines 30-33).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Kimura in view of Miyazawa and Wells by specifically providing the feature, as taught by Knittel, because it was well known in the art at the time of invention that RF transmission is not limited to line-of-sight transmission.

Regarding **claim 8**, Kimura in view of Miyazawa, Wells and Knittel teaches everything claimed, as applied above (see claim 7); in addition, Kimura teaches that "said second control signals are infrared signals" (col. 3, lines 42-46; Fig. 3, item D₁).

10. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Knittel in view of Thrift et al. (U.S. Patent 6,188,985), hereinafter referred to as Thrift.

Regarding **claim 11**, Knittel teaches everything claimed, as applied above (see claim 9); in addition, Knittel does not specifically teach "at least one of said linked speech vocabulary sets in speaker independent." However, the examiner contends that these concepts were well known in the art, as taught by Thrift.

In the same field of endeavor, Thrift discloses a wireless voice-activated device for control of a processor-based host system. Thrift's system includes a speaker

independent recognizer with speaker independent models (col. 5, line 67 through col. 6, line 1).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Knittel by specifically providing the feature, as taught by Thrift, because it was well known in the art at the time of invention for having the advantage of being usable by many different users without training.

11. Claims 4, and 12-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kimura in view of Miyazawa and Knittel.

Regarding **claim 4**, Kimura in view of Miyazawa teaches everything claimed, as applied above (see claim 2), but Kimura does not specifically teach that "said transmitter is an R.F transmitter." However, the examiner contends that this concept was well known in the art, as taught by Knittel.

In the same field of endeavor, Knittel discloses a voice-operated remote control that uses RF transmission (col. 4, lines 30-33).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Kimura in view of Miyazawa by specifically providing the feature, as taught by Knittel, because it was well known in the art at the time of invention that RF transmission is not limited to line-of-sight transmission.

Regarding **claim 12**, Kimura discloses a voice-operated remote control system.

Kimura's system includes the following:

- a microphone for receiving audio signals (Fig. 5, item M; col. 1, lines 61-62);
- a speech recognition system for receiving audio signals from said microphone and converting said audio signals to control signals for controlling a[n] ... appliance (Fig. 5, item 15A; col. 1, lines 62-64; Fig. 1, item 103, **CONTROLLED DEVICE**);
- a speech recognition mode for decoding said audio signals and generating control signal and generating control signals for controlling an appliance (col 2, lines 6-15; Fig. 9, **RECOGNITION MODE**; col. 1, lines 64-65).

But Kimura fails to specifically disclose, "the speech recognition system having a sound activation low power mode for detecting the presence of audio signals." However, the examiner contends that these concepts were well known in the art, as taught by Miyazawa.

In the same field of endeavor, Miyazawa discloses a voice activated interactive speech recognition device (title). Miyazawa's device has a low-power sleep mode that can detect sound and switch to an active mode after the detection of sound (col. 4, lines 13-16).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Kimura by specifically providing the features, as taught by Miyazawa, because it was well known in the art at the time of invention for the purpose of minimizing power consumption (Miyazawa, col. 2, lines 48-50).

In addition, Kimura fails to specifically disclose that the device is “for controlling a selected appliance [a]” and includes “a mute mode for the selected appliance in order to reduce background noise [b].” However, the examiner contends that these concepts were well known in the art, as taught by Knittel.

In the same field of endeavor, Knittel discloses a voice-operated remote control. Knittel’s control is a “universal” and has the ability to control a plurality of devices requiring selection, [a] above, (col. 2, lines 27-31) and has the ability to mute devices, [b] above (col. 8, lines 30-39).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Kimura by specifically providing the features, as taught by Knittel, because they were well known in the art at the time of invention for the purposes replacing multiple remotes, [a] above, (Knittel, col. 1, lines 23-25) and reducing interfering noise, [b] above (Knittel, col. 8, lines 35-38).

Regarding **claim 13**, Kimura in view of Miyazawa and Knittel teaches everything claimed, as applied above (see claim 12), but Kimura does not specifically teach that “said voice recognition system is configured to enable said MUTE mode by way of a voice command.” However, the examiner contends that this concept was well known in the art, as taught by Knittel.

Knittel further discloses that the remote can be trained to recognize specific commands, which includes the MUTE commands for the various devices supported

(col. 8, lines 32-39; col. 11, lines 28-67, "learning spoken commands" which includes any specific device MUTE commands).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Kimura in view of Miyazawa and Knittel by specifically providing the feature, as taught by Knittel, because it was well known at the time of invention that the voice training of a universal remote will allow it to support a variety of commands for multiple devices (Knittel, col. 2, lines 26-32, universal remote).

Regarding **claim 14**, Kimura in view of Miyazawa and Knittel teaches everything claimed, as applied above (see claim 12). But Kimura does not specifically teach that "said MUTE mode include[s] a plurality of submodes." However, the examiner contends that this concept was well known in the art, as taught by Knittel.

Knittel further discloses that the remote supports a mute [ON] mode, which will necessarily support a mute OFF mode for any device that has a mute command, also Knittel's [universal] remote supports multiple devices many with MUTE capability (i.e., multiple submodes of mute—one for each device that has a mute capability) (col. 8, lines 32-39).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Kimura in view of Miyazawa and Knittel by specifically providing the features, as taught by Knittel, because it was well known at the time of invention that following the muting of a device (e.g., a stereo, TV, etc.) the audio will eventually need to be re-enabled (i.e., MUTE OFF).

Regarding **claim 15**, Kimura in view of Miyazawa and Knittel teaches everything claimed, as applied above (see claim 14); in addition, Kimura in view of Miyazawa and Knittel teaches that “one of said submodes is an OFF mode” (see rejection of claim 14).

12. Claims 16 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kimura in view of Miyazawa and Knittel and further in view of Irumano (Japanese Patent Application Publication JP 63171071), hereinafter referred to as Irumano.

Regarding **claim 16**, Kimura in view of Miyazawa and Knittel teaches everything claimed, as applied above (see claim 14). But Kimura in view of Miyazawa and Knittel does not specifically teach that “one of said submodes is an automate muting mode for muting an appliance in order to reduce the background noise.” However, the examiner contends that this concept was well known in the art, as taught by Irumano.

In the same field of endeavor, Irumano discloses a speech controller (title) that performs automatic muting at the time of inputting of speech ([English translation of] abstract, PURPOSE).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Kimura in view of Miyazawa and Knittel by specifically providing this feature, as taught by Irumano, because it was well known in the art at the time of invention for the purpose of reducing noise during speech recognition and improving the recognition rate (Irumano, [English translation of] abstract).

Regarding **claim 20**, Kimura in view of Miyazawa, Knittel and Irumano teaches everything claimed, as applied above (see claim 16). But Kimura does not specifically teach that the “automatic muting mode includes automatic mute canceling for an appliance.” However, the examiner contends that this concept was well known in the art, as taught by Irumano.

Irumano further discloses the automatic canceling of the muting at the completion of the recognition process (at the end of the [English translation of the] abstract)

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Kimura in view of Miyazawa, Knittel and Irumano by specifically providing this feature, as taught by Irumano, because it was well known in the art at the time of invention for the purpose making the mute operation more convenient (i.e., automatically mute during recognition—to improve recognition rate, and then automatically cancel muting once a command has been entered).

13. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Knittel in view of Andrea et al. (U.S. Patent 5,715,321), hereinafter referred to as Andrea.

Regarding **claim 21**, Knittel discloses a voice-operated remote control. Knittel’s device includes the following:

- a voice recognition system for receiving representative voice signals and converting said representative voice signals to one or more command signals for controlling one or more selected appliances (col. 2, lines 7-18).

Knittel's system includes a microphone (col. 2, lines 7-8), but Knittel does not specifically disclose "the voice recognition system including a pivotally adjustable directional microphone for positioning said microphone." However, the examiner contends that these concepts were well known in the art, as taught by Andrea.

In the same field of endeavor, Andrea discloses a pivotally connected boom microphone that can be used with a speech recognition system (col. 1, lines 20-23, lines 40-47).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Knittel by specifically providing the feature, as taught by Andrea, because it was well known in the art at the time of invention for the purpose of providing good fidelity in noisy environments (Andrea, col. 3, lines 5-9).

14. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kimura in view of Miyazawa and Wells, and further in view of Oppendahl (U.S. Patent 5,008,954), hereinafter referred to as Oppendahl.

Regarding **claim 22**, Kimura in view of Miyazawa and Wells teaches everything claimed, as applied above (see claim 5). But Kimura does not specifically teach that the "said predetermined threshold level of said sound activation circuit is user-adjustable." However, the examiner contends that these concepts were well known in the art, as taught by Oppendahl.

In the same field of endeavor (audio signal processing), Oppendahl discloses a voice-activated radio transceiver that uses VOX (Voice Operated eXchange) circuitry to monitor a signal from a microphone and enable a transmit function when the signal exceeds a predetermined threshold (col. 1, lines 25-30 where the VOX circuit corresponds to the sound activation circuit). Oppendahl also teaches that the threshold may be manually adjusted by the user (col. 4, lines 22-24).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Kimura in view of Miyazawa and Wells by specifically providing the features, as taught by Oppendahl, because it was well known in the art at the time of invention for the purpose reducing the effects of intermittent loud noises by allowing the user to set the threshold higher than the normal background noise levels would require.

Allowable Subject Matter

15. Claim 17 is objected to as being dependent upon a rejected base claim, but would be allowable over prior art if rewritten in independent form including all of the limitations of the base claim and any intervening claims. It is noted that the closest prior art of record, Knittel teaches the muting of devices being controlled, but Knittel does not teach that one of said submodes is a recognition error muting mode for automatically muting an appliance upon detection of one or more types of recognition errors.

Citation of Pertinent Art

16. The following prior art made of record but not relied upon is considered pertinent to the applicant's disclosure:

- Bush et al. (U.S. Patent 6,397,186 B1) discloses a hands-free, voice-operated remote control transmitter.

Conclusion

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. V. Paul Harper whose telephone number is 703 305-4197. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richemond Dorvil can be reached on 703 305-9645. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

12/15/2004

V. Paul Harper
Examiner
Art Unit 2654



Notice of References Cited	Application/Control No. 10/168,935	Applicant(s)/Patent Under Reexamination BUSH ET AL.	
	Examiner V. Paul Harper	Art Unit 2654	Page 1 of 1

U.S. PATENT DOCUMENTS

*	Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
A	US-5,715,321	02-1998	Andrea et al.	381/92
B	US-6,397,186 B1	05-2002	Bush et al.	704/274
C	US-5,199,080 A	03-1993	Kimura et al.	381/110
D	US-6,606,280 B1	08-2003	Knittel, Guenter	367/198
E	US-5,983,186 A	11-1999	Miyazawa et al.	704/275
F	US-5,008,954	04-1991	Oppendahl, Carl	455/79
G	US-6,188,985 B1	02-2001	Thrift et al.	704/275
H	US-5,603,036 A	02-1997	Wells et al.	713/322
I	US-			
J	US-			
K	US-			
L	US-			
M	US-			

FOREIGN PATENT DOCUMENTS

*	Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
N	JP363171071A	07-1988	Japan	Irumano, Takao	H04N005/00
O					
P					
Q					
R					
S					
T					

NON-PATENT DOCUMENTS

*	Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
U	
V	
W	
X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

PAT-NO: JP363171071A
DOCUMENT-IDENTIFIER: JP 63171071 A
TITLE: SPEECH CONTROLLER
PUBN-DATE: July 14, 1988

INVENTOR-INFORMATION:
NAME
IRUMANO, TAKAO

ASSIGNEE-INFORMATION:
NAME MATSUSHITA COMMUN IND CO LTD COUNTRY
N/A

APPL-NO: JP62002424
APPL-DATE: January 8, 1987

INT-CL (IPC): H04N005/00, G10L003/00 , H03G001/02 , H04Q009/00

ABSTRACT:

PURPOSE: To obtain a high recognition rate without burdening an operator so much by automatically muting the speech uttered from a television, etc., at the time of inputting the speech.

CONSTITUTION: When a speech input button 10 is pushed, the signal is transmitted from a remote control part 2 to the reception part 6, the speech recognition part 3 and the muting part 7 of a television main body 1 through an input instruction signal transmission part 11. Receiving the signal, the speech recognition part 3 becomes in a mode where the speech recognition is possible. At the same time the muting part 7 mutes a sound signal. Next, if the operator utters a channel number, the speech is inputted in a microphone 8

and transmitted to the speech recognition part 3 through a sound signal transmission part 9 and a sound signal reception part 4. Recognizing the inputted speech, the speech recognition part 3 transmits the channel number to a channel control part 5 so as to switch a channel. The speech recognition part 3, at the same time, transmits a recognizing process completion signal to the muting part 7 and automatically cancel the muting, so that the speech from a new channel can be heard.

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Commissioner for Patents
Washington, DC 20231
www.uspto.gov



CONFIRMATION NO. 4615

Bib Data Sheet

SERIAL NUMBER 10/168,935	FILING DATE 01/27/2003 RULE	CLASS 704	GROUP ART UNIT 2654	ATTORNEY DOCKET NO. 211548-1US
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APPLICANTS
William Stuart Bush, Manhattan Beach, CA;
Carlos Ferdinand Roura, Tustin, CA;

OPA 12/20/04

**** CONTINUING DATA ****
This application is a 371 of PCT/US00/35107 12/21/2000

OPH 12/20/04

**** FOREIGN APPLICATIONS ****

**** SMALL ENTITY ****

Foreign Priority claimed <input type="checkbox"/> yes <input checked="" type="checkbox"/> no	STATE OR COUNTRY CA	SHEETS DRAWING 30	TOTAL CLAIMS 22	INDEPENDENT CLAIMS 6
35 USC 119 (a-d) conditions met <input type="checkbox"/> yes <input checked="" type="checkbox"/> no <input type="checkbox"/> Met after Allowance	Verified and Acknowledged <i>[Signature]</i> Examiner's Signature	<i>[Initials]</i>		

ADDRESS
Katten Muchin Zavis Rosenman
Patent Department
Suite 1600
525 West Monroe Street
Chicago, IL 60661-3693

TITLE
Hands-free, voice-operated remote control transmitter

FILING FEE RECEIVED 579	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:	<input type="checkbox"/> All Fees
		<input type="checkbox"/> 1.16 Fees (Filing)
		<input type="checkbox"/> 1.17 Fees (Processing Ext. of time)
		<input type="checkbox"/> 1.18 Fees (Issue)
		<input type="checkbox"/> Other _____
		<input type="checkbox"/> Credit

Index of Claims



Application No.

10/168,935

Examiner

V. Paul Harper

Applicant(s)

BUSH ET AL.

Art Unit

2654

√	Rejected
≡	Allowed

-	(Through numeral) Cancelled
+	Restricted

N	Non-Elected
I	Interference

A	Appeal
O	Objected

Claim		Date									
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Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	5	("5199080" "5444673" "4725827" "6012029" "4771283").pn.	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/08 13:24
S2	29	("5199080").URPN.	USPAT	OR	ON	2004/12/08 14:00
S3	148	((voice or speech)adj recognition). ti,ab. and (voice adj activated)	USPAT	OR	ON	2004/12/08 14:00
S4	13	((voice or speech)adj recognition). ti,ab. and (voice adj activated).ab. and @ad<"20001221"	USPAT	OR	ON	2004/12/08 14:03
S5	0	((voice or speech)adj recognition). ti,ab. and (((voice or sound) adj (activated or activation)) near (power or amplitude)).ab,bsum. and @ad<"20001221"	USPAT	OR	ON	2004/12/08 14:04
S6	12	((voice or speech)adj recognition). ti,ab. and (((voice or sound) adj (activated or activation)) same (power or amplitude or level)).ti,ab, bsum. and @ad<"20001221"	USPAT	OR	ON	2004/12/08 14:04
S7	11	("2338551" "4052568" "5218668" "5278944" "5562453" "5577164" "5668929" "5704009" "5794198" "5799279").PN.	US-PGPUB; USPAT; USOCR	OR	ON	2004/12/08 14:09
S8	10	("5983186").URPN.	USPAT	OR	ON	2004/12/08 14:10
S9	4	("5689715" "5765001" "5983186" "6012029").PN.	US-PGPUB; USPAT; USOCR	OR	ON	2004/12/08 14:14
S10	16	(US-4725827-\$ or US-4771283-\$ or US-5199080-\$ or US-5444673-\$ or US-5777571-\$ or US-5818328-\$ or US-5832439-\$ or US-5890123-\$ or US-5983186-\$ or US-6012029-\$ or US-6188985-\$ or US-6327343-\$ or US-6397186-\$ or US-6407779-\$ or US-6594630-\$ or US-6606280-\$). did.	USPAT	OR	ON	2004/12/09 08:00
S11	14	S10 and (time or mode or inactive)	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 08:01
S12	13	S10 and (time or interval or (mode near (inactive or active)))	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 08:02

S13	2	S10 and ((time or interval) and (mode near (inactive or active)))	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 08:04
S14	5	S10 and ((time or interval) and ((low adj power) or (power adj off)or(mode near (inactive or active))))	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 08:12
S16	4	((speech or voice)near (recognition or recognizer)) or (audio near recorder)).ti,ab. and ((time or interval) and ((low adj power) or (power adj off)or(mode near (inactive or active))))).ti,ab.	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 08:15
S17	33	((speech or voice)near (recognition or recognizer)) or (audio near recorder)).ti,ab. and ((time or interval) and ((low adj power) or (power adj off)or(mode near (inactive or active))))).ti,ab,bsum.	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 08:43
S18	32	((speech or voice)near (recognition or recognizer)) or (audio near recorder)).ti,ab. and ((time or interval) and ((low adj power) or (power adj off)or(mode near (sleep or inactive or lowpower or "low power")))).ti,ab,bsum.	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 08:49
S19	46	((sleep adj mode) or (low adj power adj mode)) near after near (interval or time or period))	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 08:51
S20	20	((sleep adj mode) or (low adj power adj mode)) near after near (interval or time or period)) and (speech or audio or recorder)	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 08:52
S21	4	("5689715" "5765001" "5983186" "6012029").PN.	US-PGPUB; USPAT; USOCR	OR	ON	2004/12/09 08:54
S22	17	(US-4725827-\$ or US-4771283-\$ or US-5199080-\$ or US-5444673-\$ or US-5777571-\$ or US-5818328-\$ or US-5832439-\$ or US-5890123-\$ or US-5983186-\$ or US-6012029-\$ or US-6188985-\$ or US-6327343-\$ or US-6397186-\$ or US-6407779-\$ or US-6594630-\$ or US-6606280-\$ or US-5603036-\$).did.	USPAT	OR	ON	2004/12/09 09:12
S23	3	S22 and ((off near command) or (recognition adj error))	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 09:19

S24	1	((speech or voice) adj (recognition or recognizer)) and ((mute or muting) near (error))	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 09:20
S25	10	((speech or voice) adj (recognition or recognizer)) and ((mute or muting or disable) near (error or unrecogniz\$))	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 09:22
S26	59	((speech or voice) adj (recognition or recognizer)) and ((stop or halt or off) near (error or unrecogniz\$))	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 09:25
S27	16	((speech or voice) adj (recognition or recognizer)) and ((stop or halt or off) near (unrecogniz\$ or ("not" adj recognized) or noise))	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 09:45
S28	99	((speech or voice) adj (recognition or recognizer)) and ((stop or halt or off or mute or disable) near (unrecogniz\$ or ("not" adj recognized) or recogniz\$ or noise))	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 09:46
S29	25	((speech or voice) adj (recognition or recognizer)).ti,ab. and ((stop or halt or off or mute or disable) near (unrecogniz\$ or ("not" adj recognized) or recogniz\$ or noise))	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 09:50
S30	21	((speech or voice) adj (recognition or recognizer)).ti,ab. and ((stop or halt or off or mute or disable) near (sound))	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 09:50
S31	20	(US-20040138882-\$).did. or (US-4725827-\$ or US-4771283-\$ or US-5199080-\$ or US-5444673-\$ or US-5777571-\$ or US-5818328-\$ or US-5832439-\$ or US-5890123-\$ or US-5983186-\$ or US-6012029-\$ or US-6188985-\$ or US-6327343-\$ or US-6397186-\$ or US-6407779-\$ or US-6594630-\$ or US-6606280-\$ or US-5603036-\$ or US-6594632-\$ or US-6394278-\$).did.	US-PGPUB; USPAT	OR	ON	2004/12/09 09:58
S32	14	S31 and (radio or RF)	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 10:04
S33	16	S31 and (radio or RF or infrared)	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 10:14

S34	1	((speech or voice) near (recognizer or recognition)) and ((disable or halt or stop or suspend or pause) near (recognition adj error))	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 10:16
S35	552	((speech or voice) near (recognizer or recognition)) and ((disable or halt or stop or suspend or pause) near ((recognizer or recognition) adj error) or unrecogniz\$)	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 10:19
S36	244	((speech or voice) near (recognizer or recognition)) and ((disable or halt or stop or suspend or pause) near ((recognizer or recognition) adj error) or unrecogniz\$) and @ad<"19991222"	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 10:19
S37	73	((speech or voice) near (recognizer or recognition)).ti,ab. and ((disable or halt or stop or suspend or pause) near ((recognizer or recognition) adj error) or unrecogniz\$) and @ad<"19991222"	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 10:20
S38	0	((speech or voice) near (recognizer or recognition)).ti,ab. and ((disable or halt or stop or suspend or pause) near (((recognizer or recognition) adj error) or unrecogniz\$)) and @ad<"19991222"	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 10:20
S39	22	((speech or voice) near (recognizer or recognition)).ti,ab. and ((disable or halt or stop or suspend or pause) same (((recognizer or recognition) adj error) or unrecogniz\$)) and @ad<"19991222"	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/09 10:21
S40	21	(US-20040138882-\$).did. or (US-4725827-\$ or US-4771283-\$ or US-5199080-\$ or US-5444673-\$ or US-5483579-\$ or US-5603036-\$ or US-5777571-\$ or US-5818328-\$ or US-5832439-\$ or US-5890123-\$ or US-5983186-\$ or US-6012029-\$ or US-6188985-\$ or US-6327343-\$ or US-6394278-\$ or US-6397186-\$ or US-6407779-\$ or US-6594630-\$ or US-6594632-\$ or US-6606280-\$). did.	US-PGPUB; USPAT	OR	ON	2004/12/10 07:12
S41	13	S40 and (vocabulary or context or (user adj specific) or (speaker adj (dependent or independent)))	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/10 07:47
S42	16	S40 and (vocabulary or mute or disable or link or context or (user adj specific) or (speaker adj (dependent or independent)))	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/10 09:05

S43	4	S40 and (mute)	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/10 10:07
S44	3	((speech or voice)adj recognition) and (automatic adj (muting or mute))	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/10 10:10
S45	52	((speech or voice)adj recognition) and ((automatic or mode or during)near (muting or mute))	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/10 10:11
S46	23	((speech or voice)adj recognition) and ((automatic or mode or during)near (muting or mute)) and @ad<"19991225"	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/10 10:15
S47	92	((speech or voice)adj recognition) and ((automatic or automatically or mode or during)near (muting or mute or silence or surpress)) and @ad<"19991225"	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/10 10:15

S48	92	(US-20030120483-\$ or US-20030093281-\$ or US-20030055639-\$ or US-20020193989-\$ or US-20020154210-\$ or US-20020044199-\$ or US-20020012353-\$).did. or (US-6714534-\$ or US-6711536-\$ or US-6615171-\$ or US-6584439-\$ or US-6583806-\$ or US-6570974-\$ or US-6560575-\$ or US-6549130-\$ or US-6546016-\$ or US-6516467-\$ or US-6510152-\$ or US-6496983-\$ or US-6493429-\$ or US-6480825-\$ or US-6480748-\$ or US-6453020-\$ or US-6452923-\$ or US-6437818-\$ or US-6426769-\$ or US-6411925-\$ or US-6397187-\$ or US-6397186-\$ or US-6396544-\$ or US-6396480-\$ or US-6359970-\$ or US-6359636-\$). did. or (US-6351762-\$ or US-6343314-\$ or US-6292210-\$ or US-6282268-\$ or US-6240299-\$ or US-6237025-\$ or US-6219639-\$ or US-6212547-\$ or US-6208356-\$ or US-6137879-\$ or US-6028537-\$ or US-5995155-\$ or US-5978835-\$ or US-5978756-\$ or US-5963912-\$ or US-5953700-\$ or US-5949886-\$ or US-5930347-\$ or US-5920838-\$ or US-5917405-\$ or US-5915091-\$ or US-5905969-\$ or US-5900867-\$ or US-5896500-\$ or US-5890109-\$ or US-5884039-\$ or US-5867816-\$). did. or (US-5867654-\$ or US-5864803-\$ or US-5854893-\$ or US-5842023-\$ or US-5809462-\$ or US-5802294-\$ or US-5758079-\$ or US-5749066-\$ or US-5724106-\$ or US-5717387-\$ or US-5689641-\$ or US-5675390-\$ or US-5650831-\$ or US-5646839-\$ or US-5617539-\$ or US-5598505-\$ or US-5561712-\$ or US-5528725-\$ or US-5392343-\$ or US-5335261-\$ or US-5291479-\$ or US-5249219-\$ or US-5099509-\$ or US-4866777-\$ or US-4820059-\$ or US-4813076-\$ or US-4790002-\$). did. or (US-4704696-\$ or US-4592085-\$ or US-4591928-\$ or US-4142066-\$).did. or (JP-63171071-\$).did.	US-PGPUB; USPAT; JPO	OR	ON	2004/12/10 12:40
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S49	26	(US-20040138882-\$ or US-20020044199-\$).did. or (US-4725827-\$ or US-4771283-\$ or US-5199080-\$ or US-5444673-\$ or US-5483579-\$ or US-5603036-\$ or US-5777571-\$ or US-5818328-\$ or US-5832439-\$ or US-5890123-\$ or US-5983186-\$ or US-6012029-\$ or US-6188985-\$ or US-6327343-\$ or US-6394278-\$ or US-6397186-\$ or US-6407779-\$ or US-6594630-\$ or US-6594632-\$ or US-6606280-\$ or US-6452923-\$ or US-6396480-\$ or US-6396544-\$).did. or (JP-63171071-\$).did.	US-PGPUB; USPAT; JPO	OR	ON	2004/12/10 12:40
S50	1	S49 and (microphone near (adjustable or directional))	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/10 12:41
S51	271	((speech or voice) adj (recognition or recognizer)) and (microphone near (adjustable or directional))	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/10 12:42
S53	52	((speech or voice) adj (recognition or recognizer)) and (microphone near (adjustable or directional))).ti, ab,bsum. and @ad<"19991225"	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/10 12:43
S54	52	((speech or voice) adj (recognition or recognizer)) and (microphone near (adjustable or directional))).ti, ab,bsum. and @ad<"19991225"	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/10 12:44
S55	23	((speech or voice) adj (recognition or recognizer)) and (microphone near (adjustable or directional))).ti, ab,bsum. and @ad<"19991225" and (remote or portable)	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/10 12:46
S56	24	((speech or voice) adj (recognition or recognizer)) and (microphone near (pivotabl or adjustable or directional))).ti,ab,bsum. and @ad<"19991225" and (hand-held or remote or portable)	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/10 12:55
S58	43	((speech or voice) adj (recognition or recognizer)) and (microphone near (pivotally or pivot or adjustable or directional))).ti,ab,bsum. and @ad<"19991225" and control	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/10 12:57

S59	32	(US-20040138882-\$ or US-20020044199-\$).did. or (US-4725827-\$ or US-4771283-\$ or US-5199080-\$ or US-5444673-\$ or US-5483579-\$ or US-5603036-\$ or US-5777571-\$ or US-5818328-\$ or US-5832439-\$ or US-5890123-\$ or US-5983186-\$ or US-6012029-\$ or US-6188985-\$ or US-6327343-\$ or US-6394278-\$ or US-6397186-\$ or US-6407779-\$ or US-6594630-\$ or US-6594632-\$ or US-6606280-\$ or US-6452923-\$ or US-6396480-\$ or US-6396544-\$ or US-6420975-\$ or US-6301050-\$ or US-6061456-\$). did. or (US-5732143-\$ or US-5715321-\$ or US-5289544-\$). did. or (JP-63171071-\$).did.	US-PGPUB; USPAT; JPO	OR	ON	2004/12/10 14:09
S60	17	S59 and independent	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/10 14:10
S61	32	(US-20020044199-\$ or US-20040138882-\$).did. or (US-4725827-\$ or US-4771283-\$ or US-5199080-\$ or US-5289544-\$ or US-5444673-\$ or US-5483579-\$ or US-5603036-\$ or US-5715321-\$ or US-5732143-\$ or US-5777571-\$ or US-5818328-\$ or US-5832439-\$ or US-5890123-\$ or US-5983186-\$ or US-6012029-\$ or US-6061456-\$ or US-6188985-\$ or US-6301050-\$ or US-6327343-\$ or US-6394278-\$ or US-6396480-\$ or US-6396544-\$ or US-6397186-\$ or US-6407779-\$ or US-6420975-\$ or US-6452923-\$). did. or (US-6594630-\$ or US-6594632-\$ or US-6606280-\$). did. or (JP-63171071-\$).did.	US-PGPUB; USPAT; JPO	OR	ON	2004/12/13 09:43
S62	0	S61 and atlanta	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/13 09:44
S63	0	S61 and scientific.AS.	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/13 09:45
S64	2	(speech adj recognition) and remote and rf and infrared and scientific.AS.	US-PGPUB; USPAT; EPO; JPO; IBM_TDB	OR	ON	2004/12/13 09:45
S65	18	("5771064").URPN.	USPAT	OR	ON	2004/12/13 09:47



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10/168,935	William Stuart Bush	211548-IUS

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PCT/US00/35107

I.A. FILING DATE

PRIORITY DATE

12/21/2000

Katten Muchin Zavis Rosenman
 Patent Department
 Suite 1600
 525 West Monroe Street
 Chicago, IL 60661-3693

CONFIRMATION NO. 4615

371 ACCEPTANCE LETTER



OC00000009794372

Date Mailed: 04/10/2003

NOTICE OF ACCEPTANCE OF APPLICATION UNDER 35 U.S.C 371 AND 37 CFR 1.495

The applicant is hereby advised that the United States Patent and Trademark Office in its capacity as a Designated / Elected Office (37 CFR 1.495), has determined that the above identified international application has met the requirements of 35 U.S.C. 371, and is ACCEPTED for national patentability examination in the United States Patent and Trademark Office.

The United States Application Number assigned to the application is shown above and the relevant dates are:

01/27/2003

DATE OF RECEIPT OF 35 U.S.C. 371(c)(1), (c)(2) and
(c)(4) REQUIREMENTS

01/27/2003

DATE OF RECEIPT OF ALL 35 U.S.C. 371
REQUIREMENTS

A Filing Receipt (PTO-103X) will be issued for the present application in due course. **THE DATE APPEARING ON THE FILING RECEIPT AS THE " FILING DATE" IS THE DATE ON WHICH THE LAST OF THE 35 U.S.C. 371 REQUIREMENTS HAS BEEN RECEIVED IN THE OFFICE. THIS DATE IS SHOWN ABOVE.** *The filing date of the above identified application is the international filing date of the international application (Article 11(3) and 35 U.S.C. 363).* Once the Filing Receipt has been received, send all correspondence to the Group Art Unit designated thereon.

The following items have been received:

- Indication of Small Entity Status
- Copy of the International Application filed on 06/21/2002
- Copy of the International Search Report filed on 06/21/2002
- Copy of IPE Report filed on 06/21/2002
- Oath or Declaration filed on 01/27/2003
- U.S. Basic National Fees filed on 06/21/2002

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed

to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

ANITA D JOHNSON
Telephone: (703) 305-3661

PART 3 - OFFICE COPY

FORM PCT/DO/EO/903 (371 Acceptance Notice)

DT17 Rec'd PCT/PTO JUN 21 2002

FORM PTO-1190 (REV. 9-2001)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER 211548-IUS
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371				U.S. APPLICATION NO. (If known, see 37 CFR 1.5 10/168935)
INTERNATIONAL APPLICATION NO. PCT/US00/35107	INTERNATIONAL FILING DATE 21 December 2000	PRIORITY DATE CLAIMED 22 December 1999		
TITLE OF INVENTION Hands-Free, Voice Operated Remote Control Transmitter				
APPLICANT(S) FOR DO/EO/US William Stuart BUSH and Carlos Ferdinand ROURA				
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:				
<p>1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.</p> <p>2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.</p> <p>3. <input type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.</p> <p>4. <input type="checkbox"/> The US has been elected by the expiration of 19 months from the priority date (Article 31).</p> <p>5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))</p> <p> a. <input type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau).</p> <p> b. <input checked="" type="checkbox"/> has been communicated by the International Bureau.</p> <p> c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</p> <p>6. <input type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).</p> <p> a. <input type="checkbox"/> is attached hereto.</p> <p> b. <input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4).</p> <p>7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))</p> <p> a. <input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau).</p> <p> b. <input type="checkbox"/> have been communicated by the International Bureau.</p> <p> c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</p> <p> d. <input type="checkbox"/> have not been made and will not be made.</p> <p>8. <input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).</p> <p>9. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</p> <p>10. <input type="checkbox"/> An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</p> <p> Items 11 to 20 below concern document(s) or information included:</p> <p>11. <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</p> <p>12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.</p> <p>13. <input type="checkbox"/> A FIRST preliminary amendment.</p> <p>14. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.</p> <p>15. <input type="checkbox"/> A substitute specification.</p> <p>16. <input type="checkbox"/> A change of power of attorney and/or address letter.</p> <p>17. <input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.</p> <p>18. <input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4).</p> <p>19. <input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).</p> <p>20. <input checked="" type="checkbox"/> Other items or information: <i>postcard</i></p>				

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HANDS-FREE, VOICE-OPERATED REMOTE CONTROL TRANSMITTER

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BACKGROUND OF THE INVENTION**1. Field of Invention**

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This invention relates to devices for remotely controlling electronic equipment, and more particularly, to a wireless, user-programmable, voice-activated and voice-operated remote control system for controlling appliances.

2. Description of Prior Art

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Historically, appliances, for example, electronic appliances, such as, televisions, VCRs, digital satellite systems, audio systems, and related accessories, have been remotely controlled by hand-held transmitters used to generate signals to receivers incorporated into the electronics of the remotely controlled appliances. Signals for such appliances correspond to control commands, such as channel selection/tuning, power on/off, audio volume adjustment, and muting controls, typically generated by the user by depressing buttons on a remote control transmitter keypad. The basic composition and operation of such remote control systems are well known in the art.

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For convenience, such remote control transmitters are generally designed to be sufficiently small to be hand-held during operation. There are several disadvantages in using such hand-held transmitters. For example, the small size and mobility often contribute to misplacement or loss of the transmitter. Also, for device operators with restricted physical mobility or sight limitations, hand-held remote controls may not provide sufficient access to the command controls of the remotely controlled

5 appliances. Also, if an operator's hands are engaged in an activity, an interruption in the activity may be required to operate the hand-held remote control, causing inconvenience to the operator and potentially having an adverse effect on productivity.

Additional problems occur as a consumer acquires various remotely controlled appliances, where each is typically supplied with a separate remote control transmitter. As the number of separate remote control transmitters increases, locating, 10 distinguishing, and locating the appropriate transmitters becomes increasingly difficult. In response to this problem, universal remote control transmitters, pre-programmed by the manufacturers with control commands, typically coded infrared signals, have been developed to operate many different remotely controlled electronic appliances, for 15 example, as disclosed in U.S. Pat. No. 4,774,511. In addition to universal remote control transmitters, learning remote control transmitters have been developed which receive the control command signals, typically infrared codes, from the remote control transmitters provided with remotely controlled appliances and generally store the frequencies and pulses into memory, with the signals becoming associated with buttons located on the 20 keypad of the learning remote control transmitter. After programming is complete, depressing the keypad buttons prompts the learning remote control transmitter to re-transmit the codes stored within its memory. This allows the user to consolidate the control of several remotely controllable appliances into a single hand-held remote control transmitter. An example of such a system is disclosed in U.S. Patent No. 5,142,398. For 25 additional convenience to the user, the learning capability has been combined with universal remote control transmitters which are pre-programmed by the manufacturers with control commands necessary to operate many different remotely controlled electronic appliances, for example as disclosed in U.S. Pat. No. 5,691, 710.

All of the above-mentioned systems require the user to establish physical 30 contact, typically in the form of manually depressing keypad buttons, to transmit a control command to the remotely controlled appliance. As such, the above-mentioned systems due to their small size are often misplaced causing frustration to the user.

5 As such, voice-operated remote control systems have recently been developed which operate in response to user-spoken commands instead of commands selected by manually depressing keypad buttons. U.S. Pat. Nos. 5,199,080; 5,247,580; 10 5,267,323 and 5,226,090 disclose various embodiments of voice-operated remote control systems which employ voice control commands instead of control commands entered through buttons on a keypad. Unfortunately, such systems are not truly hands-free, requiring manual intervention by the user during use. In particular, such remote control systems as disclosed in the above-mentioned patents, are all based upon the use of a "talk switch"; which must be manually depressed to enter a voice command when the transmission of a remote control signal is desired.

15 U.S. Pat. No. 5,226,090 further discloses a voice-operated remote control system which contains a detector for detecting whether a voice command is received or not. A detected signal from the detector is applied to a power supply circuit. When there is no voice command received as detected by the detector, the power supply control circuit cuts off electric energy supplied to a speech recognition circuit. The voice 20 command detector circuit is implemented by a detecting program stored in the ROM in a controller. The detecting program determines whether the talk switch has been depressed. The transmitter operates depending on whether the talk switch has been depressed. If the talk switch has been depressed, the transmitter is enabled to remote control signals. Once the talk switch is released, the transmitter is kept in a low power consumption mode, waiting for voice commands to be applied. As indicated above, the means for generating and transmitting a remote control signal based on the recognized 25 spoken voice command is not hands-free, requiring the manual intervention of pressing a talk switch to accomplish these functions.

30 Various other systems are known which use speech recognition to control appliances. For example, U.S. Patent No. 5,852,804 discloses a system for controlling several external appliances connected to a speech recognition system. However, the system disclosed in the '804 patent requires physical interconnections between the

5 control system and the appliance which makes it difficult for a user to add additional appliances or change controlled appliances.

U.S. Patent No. 5,878,394 discloses a system which includes connections to a remote control network for transmitting infrared codes and a graphical user interface on a personal computer (PC). In addition to the inconvenience of establishing the remote control network, a user must have access to a PC and desire to make the PC available for 10 such control functions. The system disclosed in the '394 patent has only limited utility for consumers who have access to a PC or can afford the expense of a PC and thus excludes a significant portion of consumers who may otherwise desire to add speech recognition control to their electronic appliances if an inexpensive alternative is available.

15 U.S. Patent No. 5,774,859 discloses a subscriber information system with a speech interface, similar to the system disclosed in U.S. Patent No. 5,878,394 the system in the '859 patent is based upon a PC-class processor. Operation of this system is dependent upon receiving information from an information distribution center or head-end installation and therefore lacks the advantages of a stand-alone device. 20 Unfortunately, the remote control is not capable of independently completing the speech recognition process and transmitting infrared signals indicated by such recognition results to controlled appliances. Furthermore, this system also requires a PC-class processor.

Inconvenience is another problem that occurs as a user intends to perform multiple control functions involving one or more controlled appliances and must recall and enter a series of voice commands to a voice-operated remote control system. U.S. 25 Patent No. 5,852,804 discloses a system, where one speech command may be defined which is capable of manipulation of more than one connected appliance. However, this system requires that each controlled appliance be physically connected to the system and that the controlled appliance be manually manipulated during setup for each function to be executed upon recognition of the speech command. Also, if a single command is to 30 be used to execute a series of controlled appliance functions, its capability is limited unless time delays of variable lengths may be inserted within the series of control functions to accommodate the initialization periods for certain controlled appliances. For

5 example, if a voice command sends signals to a television to power it on and turn to a specified channel, a period of time may elapse between the receipt of the power on command until the television warms up and is ready to receive additional commands. Such initialization periods vary from appliance to appliance and therefore means is needed to allow a user to adjust the time delay as necessary.

10 There are various other problems with known systems which utilize voice recognition to control appliances. For example, one problem occurs as the list of voice commands grows. Generally, each time a speech recognition product detects a spoken word, it compares the word to those in a recognition vocabulary. In general, as a recognition vocabulary increases in size, recognition time increases and accuracy decreases. The more words in a recognition vocabulary, the more likely the speech
15 recognition circuit will make a mistake and accuracy generally diminishes. Without the capability to utilize multiple vocabulary recognition sets, the commands available for selection must all be available at the same time, meaning they must all reside in the same recognition vocabulary set. Thus, the user may be inconvenienced by the limited
20 command availability of a small recognition vocabulary or the diminishing speech recognition accuracy and longer recognition times resulting as the single recognition vocabulary is increased in size. Another disadvantage of a single recognition vocabulary is that the recognition of voice command always yields the same response. In a multiple recognition vocabulary set scheme, the same voice command may yield different results
25 upon recognition if placed within different vocabulary recognition sets. A still further disadvantage of a single recognition vocabulary is that the recognition vocabulary words must be phonetically distinctive from each other which may limit the use of words that may be intuitive for their intended function but are too phonetically similar to other words in the recognition vocabulary, forcing the user to remember a word that is less
30 intuitive. In a multiple recognition vocabulary set scheme, words that are not phonetically distinctive from each other may still be used by placing such words in different recognition vocabulary sets.

5 Another problem with known systems occurs when a device is limited to
executing software for a single speech recognition mode for recognizing spoken
commands to remotely control appliances. This problem becomes apparent if an
appliance has the ability to process a series of remote control signals arriving within a
predetermined time of each other differently than if the codes arrive at intervals outside
10 of this predetermined time. For example, many televisions are capable of receiving the
remote control signal transmissions for the digits one, two and three in rapid succession
and responding by switching to channel 123 instead of changing to channel 1, then to
channel 2 and then to channel 3. As such, a user must be able to quickly submit a voice
command following the recognition of a prior voice command, and then the recognition
15 of the latter voice command, the submission of a remote control signal and the detection
of the signal by the appliance must occur within the time limit if the appliance is to
interpret the commands as a related series of commands instead of individual commands.

Thus, there is a need for a stand-alone, wireless remote control that can
be positioned in a location remote to both the user and the controlled appliances, which
20 can be activated and operated entirely via voice commands, conveniently compatible with
commercially available remote controlled appliances, and can be operated by a plurality
of users and can be programmed by a user to operate in a customized manner.

25 SUMMARY OF THE INVENTION

The present invention relates to a method and apparatus that enables a user
to control the function of one or more electric appliances or other electrical equipment
solely with voice commands. An important aspect of the invention relates to voice-
actuated mode switching for switching the present invention from a low power
30 consumption mode.

A hands-free speech recognizing transmitter in accordance with the
invention, which may be a light-weight small base mounted unit, is adapted to be located
near the controlled appliances. A voice-operated selection mechanism is provided for

5 selecting any one of a number of categories of appliances to be controlled. A universal remote control code library may be provided which allows codes to be selected for control of different types of appliances as well as appliances manufactured by different manufacturers. Infrared signal receiving, decoding and storage capabilities further enhance the invention by providing means to learn infrared codes from other remote control transmitters, such as an appliance's original remote control transmitter. This feature is advantageous for appliances whose codes are not contained in the universal library stored in the invention's memory and also serves to render the invention much less susceptible to obsolescence than speech recognizing transmitters disclosed in the prior art.

15 A scheme is provided where both speaker independent and speaker dependent vocabulary may be used as voice commands. A speaker independent vocabulary structure provides the user with the means of navigating multiple linked recognition vocabulary sets. At any one time, a single recognition set is made active by the speech recognition circuit. A voice command in one recognition vocabulary set may be used to activate another recognition vocabulary set. In this fashion, a user may verbally navigate among different types of remote control functions and target appliances in an intuitive fashion, while minimizing the number of alternative words from which the speech recognition circuit must select during any given recognition process.

25 With the total recognition vocabulary partitioned into smaller recognition vocabulary sets, improvements result in recognition time and accuracy because, in general, as a recognition vocabulary increases in size, recognition time increases and accuracy decreases. Furthermore, recognition vocabulary sets are created such that the contents within each set have either functional similarities or otherwise share a relationship that is intuitive to the user. To prevent confusion that may arise with respect to the active recognition vocabulary set at any given time, the present invention monitors conditions with a time-out counter and an error counter to automatically return to a general default mode if certain conditions are met. In other words, a predetermined

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5 number of recognition errors or a period during which no successful recognition occurs will result in a known default state.

Custom speaker dependent voice commands may be trained by the user and associated with infrared signals during product setup processes. These speaker dependent commands may be accessible from the vocabulary structure described above.

10 The present invention has the capability of transmitting multiple control signals, such as infrared signals, to one or more appliances in response to a single voice command by the user. Such macro programs may be programmed by the user during a product setup process. For example, a user may desire that the response to the voice command "Video" is for the invention to issue commands to turn a TV power on, wait
15 for the TV to warm up until it is ready to receive control signals, such as infrared signals, set the channel to "3," select the VCR for control, turn on the VCR, and execute the VCR's play function. As another example, the user may desire that the response to the user-trained voice command "Sports" is for the invention to issue commands to a TV to turn to channel 123.

20 The system may be configured to be self-contained in a single free-standing or stand-alone housing. The housing may contain a directional microphone mounted to be rotationally adjusted by the user to enable the user to adjust the sensitivity of the microphone so that the microphone's high sensitivity region is pointed toward the user and microphone noise generating sources, such as an appliance's loudspeaker are
25 located in a region of low microphone sensitivity. Visual indication lights may be provided in a manner to remain in line of sight with the user to communicate operation status, such as availability for recognition and results of prior recognition attempts. A small keypad may be provided to assist the user during product setup sequences. A speaker is also provided to enable output speech synthesized prompts to further assist the
30 user during setup sequences.

DESCRIPTION OF THE DRAWINGS

5 These and other advantages of the present invention are readily understood with reference to the following specification and attached drawings wherein:

 FIG. 1 is a functional block diagram of the electronic elements and circuits in one embodiment of the present invention;

 FIG. 2a is a functional block diagram showing the details of the speech
10 recognition circuit in one embodiment of the present invention;

 FIG. 2b is a functional block diagram showing the details of the infrared signal controlling circuit in one embodiment of the present invention;

 FIG. 2c is a schematic circuit diagram showing the details of the audio switching circuit and the sound activation circuit in one embodiment of the present
15 invention;

 FIGs. 2d-2f illustrate alternate embodiments of the sound activation circuit illustrated in Fig. 2c.

 FIG. 3 is a perspective view of the physical housing for one embodiment of the present invention;

 FIG. 4a is a side view of the housing illustrated in FIG. 3.

 FIG. 4b is an exploded perspective view of the housing illustrated in FIG.
3.

 FIG. 4c is a partial sectional view of the housing illustrated in FIG. 3.

 FIG. 5 is a functional block diagram showing the default operation modes
25 of one embodiment of the present invention;

 FIG. 6 is a functional block diagram showing the sound activation mode sequence steps for one embodiment of the present invention;

 FIG. 7 is a functional block diagram showing the different recognition modes that may be utilized when different recognition vocabulary sets are activated in
30 one embodiment of the present invention;

 FIG. 8 is a functional block diagram showing the sequence of steps for the response prompting recognition mode for one embodiment of the present invention;

5 FIG. 9 is a functional block diagram showing the sequence of steps for the pattern queuing recognition mode for one embodiment of the present invention;

 FIG. 10 is a functional block diagram showing a continuation of the sequence of steps for pattern queuing recognition mode for one embodiment of the present invention shown in FIG. 9;

10 FIG. 11 is a functional block diagram showing the sequence steps for executing a macro program in one embodiment of the present invention;

 FIGS. 12A and 12B is a functional block diagram showing the sequence steps for initiating the product setup process for one embodiment of the present invention;

15 FIGS. 13A-13C is a functional block diagram showing the sequence steps for selecting a controlled appliance code during a product setup process for one embodiment of the present invention;

 FIGS. 14A and 14B is a functional block diagram showing the sequence steps for learning an infrared signal from another remote control transmitter during a product setup process for one embodiment of the present invention;

20 FIG. 15 is a functional block diagram showing the sequence steps for teaching custom, speaker dependent voice command names during a product setup process for one embodiment of the present invention;

 FIGS. 16A and 16B is a functional block diagram showing the sequence steps for creating a macro program during a product setup process for one embodiment of the present invention;

 FIG. 17 is a schematic circuit diagram showing the details of the power supply circuit of one embodiment of the present invention;

30 FIG. 18a is a functional block diagram of an alternative embodiment of an audio switching circuit in accordance with one embodiment of the present invention;

 FIG. 18b is a functional block diagram of an alternate embodiment utilizing separate microphones for the sound activation circuit and speech recognition circuit in accordance with the present invention;

5 FIG. 18c is a functional block diagram of another alternate embodiment utilizing separate microphones for the sound activation circuit and speech recognition circuit in accordance with the present invention.

DETAILED DESCRIPTION

10 The present invention relates to a truly hands-free universal control unit system for controlling various appliances, such as entertainment appliances, for example, TVs, VCRs, stereo's and the like and may also be used for non-entertainment appliances and virtually any device that is amenable to remote control. The universal remote control system in accordance with the present invention is user programmable to enable any
15 number of appliances to be programmed by the user. In order to facilitate portability and eliminate the inconvenience associated with power cords/cables, the universal control system in accordance with one embodiment of the invention may be battery operated. During periods when no voice commands are being issued the system enters a sleep or sound activation mode. An important aspect of the invention relates to the ability of the
20 system to switch from a sleep mode to an active mode solely by voice commands, to provide true hands-free remote operation.

 A block diagram of the system in accordance with the present invention is illustrated in FIG. 1 and generally identified with the reference numeral 10. As will be discussed in more detail below, the system 10 enables hands-free operation of one or
25 more appliances in a wireless manner.

 Referring to FIG. 1, the system 10 includes a microphone 20, an audio switching circuit 30, a sound activation circuit 40, a speech recognition circuit 50, and a transmitter, for example, an infrared signal controlling circuit 70 and one or more infrared light-emitting diodes 80. The system 10 may also contain an infrared receiver
30 71, a read/write memory device 72 for storage of received IR signal data one or more indicators 52, a keypad 51 and a speaker 53. A power supply circuit 90 is also included. The power supply 90 may be configured for DC operation to enable portability of the system 10 or alternatively AC operation.

5 An output signal from the microphone **20** is electrically connected to an
automatic audio switching circuit **30**. The microphone **20** may be one or more directional
microphones, which have higher sensitivity to sound generated in predetermined regions
in relation to the microphone's position than in other predetermined regions. A suitable
microphone is a model number M118HC directional microphone, available from Lucent
10 Technologies and described in detail in; "DM 1000 Component Directional
Microphone", pages 1 and 2, available from Lucent Technologies, hereby incorporated
by reference. Sound arriving at the microphone is converted into an electric audio output
signal by the microphone **20** and is directed to the audio switching circuit **30**. Depending
on the state of the audio switching circuit **30**, the microphone audio signal output is
15 directed to the speech recognition circuit **50** if the speech recognition circuit **50** is not in
a sound activation mode. Conversely, if the speech recognition circuit **50** is in sound
activation mode, the audio switching circuit **30** routes the microphone audio signal output
to a sound activation circuit **40**.

 In the sound activation mode, the output signal of the microphone **20** is
20 electrically connected to the sound activation circuit **40** which includes an amplification
circuit (shown in detail in FIG. 2c), that amplifies the signal and a trigger circuit **43**
(shown in FIG. 2c) that receives the amplified signal from the output of the amplification
circuit. An output of the trigger circuit **43** is electrically connected to an input/output pin
of the speech recognition circuit **50**. If the amplified signal is of sufficient amplitude to
25 activate the trigger circuit **43**, the output of the trigger circuit causes a logic state change
on the input/output pin of the speech recognition circuit **50**, causing the invention to
change modes from a sleep or sound activation mode to an awake or speech recognition
mode.

 The mode change may be done in software and/or hardware to cause the
30 logic state of a mode output pin **65** (shown in FIG. 2a) of the speech recognition circuit
50, connected to an input control of the audio switching circuit, to cause the audio
switching circuit **30** to route the microphone output signal to the speech recognition
circuit **50**. Once the logic state is changed to an awake or speech recognition mode, voice
commands may then be received and recognized by the speech recognition circuit **50**.

5 The speech recognition circuit 50 may include output pins that are electrically connected to an infrared signal controlling circuit 70. Upon recognition of a voice command associated with an instruction to the transmitter, for example, an infrared signal controlling circuit 70, the speech recognition circuit 50 sends one or more signals using the output pins to the infrared signal controlling circuit 70.

10 The system 10 as illustrated and described herein translates the voice commands to infrared signals for controlling the appliance by way of an infrared link. In particular, as will be discussed in more detail below, the output from the speech recognition circuit 50 is directed to a wireless transmitter, formed from an infrared signal controlling unit 70 and one or more infrared light emitting diodes 80 capable of transmitting infrared light in one or more wavelengths. As such, the present invention utilizes conventional infrared remote control microcontroller-based technologies, including the conventional universal appliance code libraries that are familiar to those skilled in the art. Alternatively, the system may utilize other wireless links, other than infrared or in addition thereto, such as RF, ultrasonic and optical links. In addition, certain aspects of the invention including the mode changing from a sleep to an awake mode are adapted to be used with appliances that are either wired and wirelessly coupled to the system. For example, the appliances may be coupled to the system 10 over a power distribution network. In all such applications, the principles of the present invention enable truly hands free control of the appliances.

25 Referring back to FIG. 1, for applications utilizing infrared signals to control the appliance, the infrared signal controlling circuit 70 is electrically connected to one or more infrared light emitting diodes 80. The infrared signal controlling circuit 70 receives and interprets signals from the speech recognition circuit 50 and if the signals communicate instructions to transmit infrared signals to a controlled appliance, the infrared signal controlling circuit 70 identifies the appropriate remote control code and sends a remote control signal representing the code to the infrared light emitting diode(s) 80, which transmits the signal to the controlled appliance.

30 An infrared receiver 71, a read/write memory 72, and an indicator 52d may be electrically connected to the infrared signal controlling circuit 80. The infrared

5 receiver 72 detects and receives the infrared remote control signals transmitted by other remote control transmitters in a learn mode. The infrared signal controlling circuit 70 receives these signals as digital output from the infrared receiver 72. The infrared signal controlling circuit 70 decodes and stores the digital signals as codes in the read/write memory 72 for later transmission. The indicator 52d may be used to provide a visual
10 indicator to the user during said infrared signal receiving and transmitting operations.

A keypad 51, indicators 52a, 52b and 52c, and a speaker 53 may be electrically connected to the speech recognition circuit 50. The keypad 51 buttons may be utilized by the user to send signals to the input pins of the speech recognition circuit 50 during a product setup process and to provide a power switch for the invention. The
15 indicators 52 may be utilized to provide the user with visual status of the system during setup and operation. The speaker 53 is driven by the speech recognition circuit 50 pulse width modulation output and is primarily used to provide synthesized speech prompts to the user during product setup processes.

Software executed by the speech recognition circuit 50 monitors
20 conditions with a sound activation time-out counter and an error recognition counter. Upon the attainment of predetermined conditions discussed below, the speech recognition circuit 50 software enters a low power consuming sleep or sound activation mode.

A power supply circuit 90 electrically connects a power source (not shown) to circuitry distributing electric power to the electronic elements of the present
25 invention. The power source may be either AC or DC or a combination thereof. For example, commercially available alkaline batteries or rechargeable battery packs are suitable for a DC power supply.

Reference is made to FIG. 17 which shows the power supply circuit 90
30 in greater detail than that shown in FIG. 1. As previously discussed, one of the buttons present on the keypad 51 may be connected to a momentary switch, which, when depressed and held for a sufficient duration of time, establishes an electrical connection between a power source 91 and an input control pin of a digitally controlled CMOS single-pole, single-throw (SPST) analog switch 93. An example of a commercially available SPST switch for such purposes is a model number ADG701, available from

5 Analog Devices, Inc. and described in a data sheet entitled; CMOS Low Voltage 2 Ω
SPST Switches, Rev a, pages 1-8 available from Analog Devices, Inc., hereby
incorporated by reference. The input control pin responds to this electrical connection
with the power source 91 in a manner equivalent to receiving a logic high digital input,
resulting in a closed electrical connection between switch 93 source and drain pins and
10 allowing a connection to be established between the power source 91 and a power
distribution plane 94. When the speech recognition circuit IC 55 becomes electrically
connected with the power source 91 as described above, the software stored within its
ROM 61 executes a program to set a predetermined output pin 68 to a logic high state.
The output pin 68 is electrically connected to the input control pin of the switch 93.
15 Thus, the response of the speech recognition circuit IC 55 to receiving electric energy
during a power up sequence is to cause switch 93 to establish a closed electrical
connection between its source and drain pins. This electrical connection within switch
93 allows the power source 91 to be electrically connected to the power distribution plane
94 which distributes electric energy throughout the printed circuit board assembly 16 for
20 use by components requiring electric energy for operation.

The software contained within the ROM 61 of the speech recognition
circuit 50 may respond to the recognition of a speech command such as "*Power*" when
the appropriate recognition vocabulary set is active and under the conditions described
below by executing a command to change the logic state of said output pin 68 to a logic
25 low condition. This logic low is then received by the input control pin of switch 93,
which responds by creating an open connection between switch 93 source and drain pins,
and thus disconnecting power distribution plane 94 from the power source 91. Thus, the
present invention may be powered down via voice command. If the power switch 93 is
open as shown in FIG. 17, the circuit elements reliant on this connection to receive
30 energy do not receive electric energy. Also shown in FIG. 17 is a protection diode 2, for
example, a commercially available 1N4001, located in series with the power source 91
and other electrical connections to prevent damage to other printed circuit board
assembly 16 components in the event batteries are inserted with incorrect polarity
orientation.

5 FIG. 2a illustrates the speech recognition circuit 50 in greater detail . The
electronic elements of the speech recognition circuit 50 that process the microphone
audio signal output received from the audio switching circuit 30 may be in the form of
a microcontroller- based integrated circuit, IC chip 55. Such microcontroller-based ICs
specifically designed for speech applications in consumer electronic products are well
10 described in the prior art and are commercially available. An example of a suitable IC
is a type RSC-300/364 speech recognition microcontroller as manufactured by Sensory,
Inc. of Sunnyvale, California and as described in a data sheet entitled; RSC-300/364
Recognition Synthesis Control, published by Sensory, Inc. copyright 1999, and Data
Book RSC-300/364; pages 1-50, published by Sensory Inc, Sunnyvale, California,
15 copyright August 1999, hereby incorporated by reference. Alternately, other
microcontrollers can be used as well as digital signal processors. In particular, the IC 55
contains as a minimum a preamplifier 56, an analog to digital converter (A/D) 57, a
speech processing unit 58, an automatic gain control (AGC) 59, a microcontroller 60, a
read-only memory (ROM) 61, a random access memory (RAM) 62, a pulse width
20 modulation (PWM) output 67 or a digital to analog converter (not shown), a mode output
65 pin, a clock 63, an external memory interface 66, and two general purpose
input/output (I/O) ports 68. Also included in the speech recognition circuit 50 are a clock
source 64, a read/write memory device for storage of speech reference pattern data 54,
and, optionally, additional read/write memory device(s) 69 or ROM devices (not shown)
25 connected to the external memory interface 66. The description of the operation of the
speech recognition circuit 55 is provided in general terms for the specific speech
recognition IC mentioned above and is specific only in areas where the present invention
departs from prior art disclosures or is beneficial to the explanation of aspects of the
present invention. It should also be noted that, as an alternate to the speech recognition
30 IC 55, a conventional microprocessor or a digital signal processor capable of executing
speech recognition software algorithms may be used. Any of the speech recognition
circuit elements described above that are not included in said conventional processors
may be provided in circuitry external to said IC.

5 The present invention executes pattern generation algorithms and speech
recognition algorithms that are known to those skilled in the art. One speech recognition
algorithm for speaker independent recognition uses a pre-trained neural network
described in prior art, for example, as is provided by Sensory, Inc. as described below.
One process for speaker dependent speech recognition involves creating a reference
10 pattern for each voice command word or phrase during a user-controlled product setup
process. During this set-up process, a pattern is generated when a voice command is
spoken by the user. A pattern is a compact representation of the significant acoustic
information in a voice command word or phrase. A speaker dependent reference pattern
is created by averaging patterns generated as the voice command is spoken two or more
15 times and the reference pattern is stored in a read/write memory 54. After the setup
process is complete, speaker dependent speech recognition then involves comparing an
unknown pattern generated from a voice command spoken by the user to the speaker
dependent reference patterns within a specified recognition vocabulary set. This
comparison may involve distance measurements and calculations of the fit of the
20 unknown pattern to each of the reference patterns to determine the closest matching
reference pattern. However, the present invention may implement one or more generally
known algorithms, including but not limited to pattern matching that compares an
unknown pattern with reference patterns, neural networks, and/or hidden Markov models.

 One embodiment of the present invention makes both speaker independent
25 and speaker dependent speech recognition available to the user by providing factory-
programmed speaker independent commands that require no additional user voice
training and providing speaker dependent command training capability to allow the user
to create custom names for appliances, functions, and macro programs. Speaker
independent speech recognition is designed to recognize words spoken by a plurality of
30 users and is language dependent. Speaker independent command reference data are
generally derived from recordings of the specified spoken commands from several
hundred individuals with different speech characteristics and accents in conditions
similar to the environment of a product's intended use. Therefore, speaker independent
commands require no voice training from the user. Speaker dependent recognition

5 generally involves a user training a product to recognize specific words, and is therefore
not language dependent. The implementation of linked recognition sets as previously
described also allows the user to easily access and navigate among both speaker
dependent and speaker independent recognition vocabulary sets. Other embodiments of
the present invention may be of the form of a speaker independent only version or a
10 speaker dependent version where a user may follow a set-up sequence to train speaker
dependent words in place of the speaker independent structure of the embodiment
described herein.

When the speech recognition circuit 50 is not in a sound activation mode,
the audio switching circuit 30 provides an electric connection between the microphone
15 audio signal output and the preamplifier 56 in the speech recognition circuit 50. The
preamplifier 56 provides signal amplification to a level suitable for analog to digital
conversion. The analog to digital converter (A/D) 57, preferably having an accuracy of
at least 12 bits, is coupled to the output of the preamplifier 56 and converts the incoming
audio waveform into digital representations of the incoming signal. The digital output
20 of the analog to digital converter 57 is directed to the speech processing unit 58. The
speech processing unit 58 is controlled by the controller 60 and utilizes RAM 62 for
temporary storage of data, control information and result registers, and an arithmetic
logic unit (not shown) to produce band-pass-filtered representations of the input
waveform in several frequency bands. The output of the speech processing unit 58 is
25 received by the controller 60. Utilizing code stored in ROM 61 as discussed below, and
register space and data space provided by the RAM 62, the controller 60 analyzes the
filtered input waveforms to produce a pattern in real time that contains the significant
acoustic information in the input signal. The controller 60 then executes recognition
algorithm software to determine which voice command in the active recognition
30 vocabulary set is the best match and was most likely spoken by the user. The controller
60, utilizing control code stored in the ROM 61, determines the appropriate operation of
the system associated with the recognition result, such as generating appropriate outputs
at general purpose input/output ports 68. An automatic gain control (ACG) 59 is
controlled by the controller 60 and provides feedback to the preamplifier 56 for

5 adjustment of the level of amplification performed on the microphone audio signal output due to variations in the input signal.

The speech recognition circuit 50 may include one or more microphone gain resistors, such as user-adjustable thumbwheel potentiometer 35, as well as capacitors (not shown), as part of the preamplification circuitry. Some or all of these components may be integrated into preamplifier 56. Such preamplification circuitry is well known to those skilled to the electronic arts and, for example, is described in the previously referenced in Data Book RSC-300/364, pages 1-50, published by Sensory Inc., Sunnyvale, California, copyright August 1999.

15 The IC 55 contains at least one oscillator which functions as a clock 63, driven by a clock source 64 external to the IC 55. The IC 55 contains an external memory bus 66 which serves as an interface for addressing additional ROM or RAM located external to the IC if additional memory capacity is needed for control code or data. The pulse width modulation (PWM) output pins 67 are electrically connected to a speaker 53 and used primarily to provide synthesized speech prompts and/or audio sounds to direct the user during product set-up sequences. The digital to analog converter (not shown) is electrically connected to an audio amplifier (not shown), and may be used as an alternate to the pulse width modulation (PWM) output 67, electrically connected to the speaker 53 to provide synthesized speech prompts.

25 Executing software code stored in the ROM 61, the controller 60 utilizes register space in the RAM 62 to control the logic states of predetermined control register bits to determine if the clock 63 is enabled or disabled and if the controller 60 is in a low power consuming mode or not. The controller 60 may place the speech recognition circuit 50 into a low power consuming sound activation mode by changing the logic states of said control register bits, removing the clock source 64 from the oscillator 63 of IC 55. The controller 60 software also changes the logic state of a mode output 65 pin of the speech recognition circuit 50, as it enters the sound activation mode. An input control for the audio switching circuit 30 is electrically connected to said mode output 65 pin which changes logic states as the speech recognition circuit changes modes

5 between speech recognition mode and sound activation mode. The input control for the audio switching circuit 30 changes as the logic state of the mode output pin changes, causing the electric signal output from the microphone 20 to be electrically connected to the sound activation circuit 40. The audio switching circuit connections are shown in detail in FIG. 2c.

10 The speech recognition circuit 50 remains in this sound activation mode until the sound activation circuit 40 causes a bit transition at a predetermined input 68 pin. The bit transition changes the state of the previously set control register bits which removes the speech recognition circuit 50 from the low power consuming sleep or sound activation mode and enables the oscillator clock 63. Once the oscillator clock 63 is
15 started and initialized, the code stored in the ROM 61 instructs the controller 60 to place the speech recognition circuit 50 into speech recognition mode running a continuous listening pattern generation and recognition software routine. The software also instructs the controller to change the logic state of the mode output 65 pin.

20 Stopping and restarting the speech recognition circuit 50 as previously described does not cause a reset of the controller 60, nor cause loss of contents of internal registers and thus allows the input/outputs 68 to remain where last set. By removing the oscillator clock source, the power requirement for the speech recognition circuit is significantly reduced, but the ability to maintain its energy supply allows the speech recognition circuit to retain the contents of its internal register and previously set
25 input/output 68 conditions and resume operation in a relatively uninterrupted manner. Furthermore, the energized speech recognition circuit remains capable of detecting input events at the IC 55 input 68 pins even when placed in low power consuming sound activation mode, further supporting the hands-free activation capability of the sound activated circuit 40.

30 The present invention may also contain software code stored in the ROM 61 to provide a user with a means of navigating a vocabulary structure consisting of multiple, partitioned recognition vocabulary sets. At any one time, no more than a single recognition vocabulary set is made active by the speech recognition circuit. With the total recognition vocabulary partitioned into smaller recognition vocabulary sets,

5 improvements in recognition time and accuracy result because, in general, as a
recognition vocabulary increases in size, recognition time increases and accuracy
decreases. Recognition vocabulary sets are generally created such that the voice
commands, represented by the reference data within each said set, have either functional
similarities or otherwise share a relationship that is intuitive to the operator. A voice
10 command in one recognition vocabulary set may activate another recognition vocabulary
set. In this fashion, a user may verbally navigate among different types of function
selections and target appliance selections in an intuitive fashion, while limiting the
number of alternative words among which the speech recognition circuit must
discriminate during any given recognition process. Furthermore, since a pattern
15 generated by a voice command is compared only to the words in the active recognition
vocabulary set, the use of phonetically similar words is possible if such similar words are
placed in different recognition vocabulary sets.

To prevent confusion that may arise with respect to the active recognition
vocabulary set at any given time, the present invention monitors conditions with a time-
20 out counter and an error counter to automatically return to a general default mode if
certain conditions are met. In other words, when no match is found or a period elapses
in which no recognition attempts occur, the system returns to a known default state.

When a voice command submitted by the user is recognized by speech
recognition circuit 50 as a match with one of the active recognition vocabulary set
25 reference commands, the controller 60 executes the control code instruction associated
with the matching reference command. The control code instruction may direct the
controller 60 to (a) activate a new recognition vocabulary set; (b) utilize IC 55 output 68
pins to communicate instructions to the infrared signal controlling circuit 70; or (c)
disconnect predetermined elements of the present invention circuitry from the power
30 supply circuit for long term deactivation of the unit. A control code instruction directing
the controller 60 to activate a new recognition vocabulary set may also direct the
controller 60 to enter a new operating mode utilizing different pattern generating and/or
speech recognition software.

5 The present invention may be provided with a user selectable default recognition vocabulary set, which is appropriate for an intended appliance category, to which the software causes the controller 60 to return following the recognition of certain voice commands or as the result of other predetermined conditions such as the elapse of time-out periods or the detection of a specified number of speech recognition errors.
10 Recognition vocabulary sets contain reference command data representing the group of voice commands the invention is expecting to receive at any time, i.e. when a particular recognition vocabulary set is active.

 The software running while a default recognition vocabulary set is available for speech recognition may typically be executing a routine where the speech
15 recognition circuitry remains continuously available to generate patterns from detected voice commands unless otherwise processing a previous voice command for recognition or measuring the silence level to provide compensation for background noise. As indicated previously, when a voice command submitted by the user is recognized by speech recognition circuit 50 as a match with one of the default recognition vocabulary set reference commands, the controller 60 executes the control code instruction(s)
20 associated with the matching reference command. The control code instruction(s) may direct the controller 60 to activate a new recognition vocabulary set or utilize IC 55 output 68 pins to communicate instructions to the infrared signal controlling circuit 70. Control code instructions directing the controller 60 to activate a new recognition vocabulary set may also direct the controller 60 to enter a new operating mode utilizing
25 different pattern generating and/or speech recognition software.

 FIG. 2b illustrates the infrared signal controlling circuit 70 in greater detail. More specifically, the infrared signal controlling circuit 70 includes a controller 76, an interface 75 to the speech recognition circuit, one or more clock sources 73, and
30 one or more infrared driver circuits 74. Preferably the electronic elements of the controller are in the form of an microcontroller integrated circuit, IC chip 76 as shown in FIG. 2b. Such microcontroller-based ICs specifically designed for infrared remote control transmitter applications which support infrared signal learning are well described in the prior art and are commercially available. An example of a commercially available

5 controller for such purpose is a model number Z86L98, available from Zilog, Inc. and described in detailed in; Preliminary Product Specification DS5000 701-IRX 1298, Z86 L81/86/98 28-Pin Low-Voltage Infrared Microcontroller, pages 1-55, available from Zilog, Inc., Campbell California, hereby incorporated by reference. Other microcontrollers as well as digital signal processors are also suitable.

10 The controller IC 76 generally contains, a controller, a read-only memory (ROM), a random access memory (RAM), a clock, an external memory interface, a timer, a modulator, one or more input ports, one or more output ports, and an encoder. A plurality of stored infrared instruction codes and a plurality of program instructions are generally stored within a ROM memory. The RAM is used by controller IC 76 to store data for operations and control. The controller IC 76 oscillator derives its source from
15 clock source 73, such as a crystal or a ceramic resonator. The controller IC 76 is electrically connected to an infrared receiver 71 that receives externally transmitted infrared function codes (from a teaching transmitter, not shown) and supplies them to controller IC 76 where they are conventionally decoded by the decoder, shown internally to controller IC 76 in FIG. 2a. The external memory interface is used by the controller IC 76 to store and access learned infrared signal codes in the external read/write memory 72. An infrared driver, which is generally transistor-based, is electrically connected to controller IC 76 and electrically connected to infrared light-emitting diode 80. An indicator light-emitting diode 52d is also connected to controller IC 76 which provides
20 the user message prompts and other information, such as indicating operating stages and prompting desired user actions, for assisting in the programming of the present invention.

25 The general operation of this type of microcontrollers is well described in the prior art. Therefore, description of the operation of the infrared signal circuit controller herein is provided in general terms and is specific only in areas where the present invention departs from prior art disclosures or is beneficial to the explanation of
30 aspects of the present invention. For conventional microcontrollers designed for remote control transmitter applications, the universal library of appliance codes are generally stored within the ROM memory of the controller IC 76 or stored within a ROM memory external to controller IC 76 and accessible through an external memory interface. Codes

5 acquired through infrared code learning are typically stored in a read/write memory external to controller IC 76. The memory devices are typically organized into a plurality of pages with the various infrared function codes for a particular appliance model being generally assigned to a specific memory page.

10 As shown in FIG. 2b, an interface 75 provides electrical connections between the speech recognition circuit 50 and the controller IC 76. A plurality of output pins $PO_0, PO_1, \dots PO_{r-1}$ at the controller IC 76 are electrically connected as data inputs to each of a series of multiplexers ($MUX_0, MUX_1, \dots MUX_{n-1}$) within the interface 75, which in one embodiment may be a programmable logic device configured to operate a switching matrix, connecting controller IC 76 outputs to controller IC 76 inputs. A
15 suitable programmable logic device is a MACH 4 CPLD logic device, available from Lattice Semiconductor Corporation and described in detail in Publication 17466, Rev j, May 1999, entitled; MACH 4 CPLD FAMILY High Performance EE CMOS Programmable Logic, by Lattice Semiconductor Corporation, hereby incorporated by reference. The output 68 pins of the speech recognition IC 55 are electrically connected
20 as select inputs $SI_0, SI_1, \dots SI_{m-1}$ to each of the multiplexers contained within the interface 75. The output of each multiplexer is electrically connected exclusively to one input pin $PI_0, PI_1, \dots PI_{n-1}$ of controller IC 76.

In response to the speech recognition circuit 50 recognition of a voice command associated with an operation to send an instruction to the infrared signal
25 controlling circuit 70, the output 68 pins send a binary instruction to the select pin inputs of the interface 75 multiplexers shown in FIG. 2a. Depending on the binary instruction sent, each multiplexer may select zero or one of the data inputs to be electrically connected to the multiplexer output. The interface 75 further controls the output enable of each multiplexer such that the output is enabled only if one of the data inputs has been
30 selected for that multiplexer. This process produces an input at controller IC 76 input pins that is equivalent to that resulting from a button depress on a keypad of a conventional remote control transmitter which generates circuit connections. The controller IC 76 software interprets the instruction received at its input pin(s) and responds by (a) identifying a section of the ROM to be made available for subsequent

5 access if the instruction is associated with an appliance category selection; (b) by identifying a memory location within its internal ROM and retrieving the control code stored therein if the instruction is associated with a command stored within the universal library of codes stored in ROM or (c) retrieving a learned infrared code stored in read/write memory 72 if the instruction is associated with a learned infrared signal. If
10 the response to the received instruction is to transmit an infrared signal, the controller 76 utilizes its formatting program and its modulator to generate the precise carrier frequency, pulse width, pulse modulation, and overall timing format for a signal based upon the control code retrieved, and submits the signal to an infrared driver 74 which drives one or more infrared light emitting diodes 80. The infrared light emitting diode
15 80 converts the electrical signal received into an infrared signal which is transmitted to one or more target appliances.

FIG. 2c illustrates the audio switching circuit 30 and the sound activation circuit 40 in greater detail. FIG. 2c shows the present invention in the sound activation mode as indicated by the audio switching circuit 30 maintaining a switch closure and therefore electrical connection between the microphone 20 output and the sound activation circuit 40. The audio switching circuit 30 in the preferred embodiment of the present invention contains a commercially available digitally controlled, single-pole, double-throw (SPDT) analog switch, for example, a model number ADG 719 (CMOS Switch), available from Analog Devices and described in a data sheet entitled; CMOS Low Voltage 4 Ω SPDT Switch ADG 719, Rev a, pages 1-8, available from Analog
20 Devices, hereby incorporated by reference. The operation of the audio switching circuit 30 and the sound activation circuit 40 as shown in FIG. 2c is described in greater detail below.

30 Figures 2d through 2f show alternative embodiments of the sound activation circuit 40 shown in Fig. 2c. In particular, Fig. 2d shows a sound activation circuit 40 with a microphone load resistance value and a time constant value for a timing circuit that differ from the respective values shown in Fig. 2c. Different values affect the microphone 20 sensitivity while in sound activation mode and the time constant duration

5 of said timing circuit, respectively, in manners that are well known to those skilled in the electronic arts. The sound activation circuit 40 shown in Fig. 2d also includes fewer components than that shown in Fig. 2c. The general operation of the sound activation circuit 40 described below and shown in Fig. 2c also describes the sound activation circuit 40 shown in Fig. 2d.

10 Fig. 2e shows another alternative sound activation circuit 40 that combines an additional Schmitt trigger inverter 43f, a 2- input NAND gate 44, a resistor and a capacitor with the sound activation circuit 40 shown in Fig. 2d. In comparison to the sound activation circuits shown in Fig. 2c and Fig. 2d, the sound activation circuit 40 shown in Fig. 2e is less susceptible to activation by sounds that exceed a predetermined
15 activation amplitude threshold, but are not maintained at or above said threshold for at least a predetermined duration. Thus, in comparison to the circuits shown in Figures 2c and 2d, the sound activation circuit 40 shown in Fig. 2e is responsive to such sounds as spoken words that exceed an activation amplitude threshold for at least a predetermined duration, but is less responsive to incidental sounds that do not meet both amplitude and
20 duration criteria.

Assuming that the system is in sound activation mode, the output signal from microphone 20 is electrically connected by audio switching circuit 30 to the sound activation circuit 40 as shown in Fig. 2e. The sound activation circuit 40 contains one or more audio amplification stages that amplify the electric signal output from the
25 microphone 20. Fig. 2e shows an audio signal amplification stage based upon an NPN transistor 41a, followed by another audio signal amplification stage based upon an NPN transistor 41b.

The sound activation circuit 40 also contains trigger circuitry. The trigger circuitry shown in Fig. 2e utilizes four inverting Schmitt trigger circuits, shown as part
30 of IC 43 because the IC's are commercially available which integrate several such circuits into a single device package. The amplified output signal from the last audio amplification stage is electrically connected to an input of a first inverting trigger 43a. If the resulting amplified electric audio signal representing the sound received by microphone 20 reaches a predetermined amplitude threshold equal in magnitude to a

5 logic state change (bit transition) at the input of inverting trigger 43a, the inverting trigger 43a activates, outputting a logical low, and leading to a logical high output at inverting trigger 43b and inverting trigger 43f.

The logical high output of inverting trigger 43b leads to a logical high condition at a first input pin of a 2-input NAND gate 44. The logical high output of the inverting trigger 43f is electrically connected to a resistor/capacitor time delay circuit that is electrically connected to a second input pin of 2-input NAND gate 44. If the output of the inverting trigger 43b is held in a logical condition for a predetermined duration, the time delay circuit will allow the second input of 2-input NAND gate 44 to reach the equivalent of a logical high condition. If both input pins of 2-input NAND gate 44 are simultaneously held in logical high conditions, indicating that sound exceeding said activation amplitude threshold continues to be detected after the time delay, then the output of 2-input NAND gate 44 transitions from a logical high condition to a logical low condition. The output pin of 2-input NAND gate 44 is electrically connected to the input pin 68 of the speech recognition circuit 50. Although not shown in Fig. 2e, 2-input NAND gate 44 is electrically connected to a power source and is electrically connected to a common ground. The general operation of such signal amplification, triggering and time delay circuits are well known to those skilled in the electronics art.

The sound activation circuit 40 also contains a potentiometer which allows resistance modification within the amplification circuit. This potentiometer is accessible to the user in the form of a thumbwheel knob 45 which the user can adjust to change a resistance value within the amplification circuit which modifies the sensitivity of the sound activation circuit.

The logic state change at the output pin of 2-input NAND gate 44 causes a bit transition at the input 68 pin of speech recognition circuit controller 60. As described below this bit transition is detected by controller 60 which responds by removing the speech recognition circuit from the low power consuming sound activation mode and enabling the controller clock 63. This activates speech recognition circuit 50 for subsequent speech recognition processing as shown in step S503 in Fig. 5. The software also instructs controller 60 to change the logic state of mode output 65 pin.

5 The speech recognition circuit 50 then maintains mode output 65 pin in the logic state consistent with the speech recognition mode. As shown in Fig. 2e, an input control pin of audio switching circuit 30 is electrically connected to said mode output 65 pin, causing the state of audio switching circuit 30 to be controlled by said mode output pin. As described below the logic stage change at mode output 65 pin results in a logic state
10 change at the input control pin of audio switching circuit 30, causing said circuit to electrically connect microphone 20 output signal to speech recognition circuit 50, disconnecting it from sound activation circuit 40, as shown in a step S504 in Fig. 5. This connection is maintained until speech recognition circuit 50 determines that predetermined conditions have been met to return to the sound activation mode.

15 Fig. 2f shows yet another alternative sound activation circuit 40 that combines additional Schmitt trigger inverters 43d-43f, 3-input NAND gates 46a-46c, digitally controlled analog switches 47a and 47b, and multiple timing circuits including resistors, capacitors and diodes with the sound activation circuit 40 shown in Fig. 2d. In comparison to the sound activation circuits shown in Fig. 2c and Fig. 2d, the sound
20 activation circuit 40 shown in Fig. 2f is less susceptible to activation by sounds that exceed a predetermined activation amplitude threshold, but are not maintained at or above said threshold for at least a predetermined duration. This sound activation circuit 40 is also less susceptible to activation by certain sounds, including speech, that exceed a predetermined activation amplitude threshold and are maintained at or above said
25 threshold for a period of time that exceeds a predetermined duration. Thus, in comparison to the circuits shown in Figures 2c and 2d, the sound activation circuit 40 shown in Fig. 2f is responsive to such sounds as spoken words that exceed an activation amplitude threshold for at least a predetermined first duration, but is less responsive to incidental sounds that do not meet both amplitude and duration criteria. Furthermore, in
30 comparison with Fig. 2e, the sound activation circuit 40 shown in Fig. 2f is less responsive to sounds that continue to exceed a predetermined activation amplitude threshold for a predetermined second duration, thus allowing for further restriction of the durations of sounds that may activate the system from a sound activation mode.

5 Assuming that the system is in sound activation mode, the output signal from
microphone **20** is electrically connected by the audio switching circuit **30** to the sound
activation circuit **40** as shown in Fig. 2f. The sound activation circuit **40** contains one or
more audio amplification stages that amplify the electric signal output from microphone
20. Fig. 2f shows an audio signal amplification stage based upon an NPN transistor **41a**,
10 followed by another audio signal amplification stage based upon an NPN transistor **41b**.

The sound activation circuit **40** also contains trigger circuitry. The trigger
circuitry shown in Fig. 2f utilizes six inverting Schmitt trigger circuits, shown as part of
IC **43** because IC are commercially available which integrate several such circuits into
a single device package. The amplified output signal from the last audio amplification
15 stage is electrically connected to an input of a first inverting trigger **43a**. If the resulting
amplified electric audio signal representing the sound received by microphone **20** reaches
a predetermined amplitude threshold equal in magnitude to a logic state change (bit
transition) at the input of inverting trigger **43a**, inverting trigger **43a** activates, outputting
a logical low. A logical low at the output of inverting trigger **43a** leads to a logical high
20 output at inverting trigger **43b** and a logical low condition at a first input of a 3-input
NAND gate **46c**, preventing the output of 3-input NAND gate **46c** from transitioning to
a logical low condition while the input of inverting trigger **43b** is held in a logical low
condition.

A logical high output of the inverting trigger **43b** leads to a logical low condition
25 at the output of inverting trigger **43c** and a logical high condition at a first input of a 3-
input NAND gate **46b**. As shown in Fig. 2f, the output of 3-input NAND gate **46b** is
electrically connected to a timing circuit including a diode, resistor and capacitor that is
electrically connected to an input of an inverting trigger **43f**. A logical high condition
at the first input of the 3-input NAND gate **46b** leads to a logical low at the output of 3-
30 input NAND gate **46b** unless a second input of 3-input NAND gate **46b** is held in a
logical low condition by a timing circuit described below that is electrically connected
to the second input of 3-input NAND gate **46b**.

A logical low condition at the output of 3-input NAND gate **46b** leads to a logical
low condition at the input of inverting trigger **43f**, remaining in this condition for at least

5 a duration determined by a time constant value of the associated timing circuit electrically connected to the input of inverting trigger 43f. A logical low condition present at the input of inverting trigger 43f leads to a logical low at the output of inverting trigger 43e. A logical low at the output of inverting trigger 43e leads to a logical high output at inverting trigger 43d and a logical low condition at a second input of 3-input NAND gate 46c, preventing the output of 3-input NAND gate 46c from transitioning to a logical low condition while the input of inverting trigger 43f is held in a logical low condition. A logical low at the output of inverting trigger 43e also leads to a logical low condition at a second input of 3-input NAND gate 46b, returning the output of 3-input NAND gate 46b to a logical high condition and maintaining this condition for at least a duration determined by a time constant value of the associated timing circuit electrically connected to the second input of 3-input NAND gate 46b. Also electrically connected to the second input of 3-input NAND gate 46b is a control input pin of a digitally controlled analog switch 47b as shown in Fig. 2f. A logical low condition at the second input of 3-input NAND gate 46b causes the switch 47b to open and remain open for a duration determined by the duration of the presence of a logical low condition at the output of inverting trigger 43e plus a time constant value of the associated timing circuit electrically connected to the second input of 3-input NAND gate 46b. The open position of switch 47b disconnects an electrical connection between a third input of 3-input NAND gate 46c and a circuit that remains in a logically low condition.

25 As shown in Fig. 2f, the output of inverting trigger 43d is electrically connected to a timing circuit including a diode, resistor and capacitor that is electrically connected to a control input pin of a digitally controlled analog switch 47a. A logical high condition at the output of inverting trigger 43d causes the switch 47a to close and remain closed for a duration determined by the duration of the presence of a logical high condition at the output of inverting trigger 43d plus a time constant value of the associated timing circuit electrically connected to the control input pin of switch 47a. The closure of switch 47a establishes an electrical connection between the output of 3-input NAND gate 46a and a third input to 3-input NAND gate 46c.

5 As indicated previously, a logical high output of inverting trigger 43b leads to a
logical low condition at the output of inverting trigger 43c. The output of inverting
trigger 43c is electrically connected to a timing circuit including a diode, resistor and
capacitor that is electrically connected to a first input of a 3-input NAND gate 46a. A
10 logical low condition at the output of inverting trigger 43c leads to a logical high
condition at the output of 3-input NAND gate 46a which is held in said logical high
condition for a duration determined by the duration of the presence of the logical low
signal received from the output of inverting trigger 43c plus a time constant value of the
associated timing circuit electrically connected to the first input of a 3-input NAND gate
15 46a. A logical high condition at the output of 3-input NAND gate 46a leads to a logical
high condition at the third input to 3-input NAND gate 46c while an electrical connection
is maintained by switch 47a and switch 47b remains open.

 Thus, as shown in Fig. 2f and described above, the three inputs to 3-input NAND
gate 46c may be simultaneously held in logical high condition if sound exceeding a
predetermined threshold is initially detected, continues to be detected after a
20 predetermined period of time, and ceases to be detected within a following predetermined
period of time. If said sound is detected and continues to be present after a
predetermined time delay, then the second and third input pins of 3-input NAND gate 46c
are held in a logical high condition. If the sound ceases before a timing circuit returns
the third input pin of 3-input NAND gate 46c to a logical low condition, then the first
25 input pin of 3-input NAND gate 46c will return to a logical high condition and the output
of 3-input NAND gate 46c will transition from a logical high condition to a logical low
condition. The output pin of 3-input NAND gate 46c is electrically connected to the
input pin 68 of the speech recognition circuit 50. Although not shown in Fig. 2f, 3-input
NAND gates 46a-46c are electrically connected to a power source and are electrically
30 connected to a common ground. The general operation of such signal amplification,
triggering and time delay circuits are well known to those skilled in the electronics art.

 Sound activation circuit 40 also contains a potentiometer which allows resistance
modification within the amplification circuit. This potentiometer is accessible to the user
in the form of a thumbwheel knob 45 which the user can adjust to change a resistance

5 value within the amplification circuit which modifies the sensitivity of the sound activation circuit.

The logic state change at the output pin of 3-input NAND gate 46c causes a bit transition at input 68 pin of speech recognition circuit controller 60. As described below, this bit transition is detected by controller 60 which responds by removing the speech
10 recognition circuit from the low power consuming sound activation mode and enabling the controller clock 63. This activates the speech recognition circuit 50 for subsequent speech recognition processing as shown in a step S503 in Fig. 5. The software also instructs the controller 60 to change the logic state of mode output 65 pin.

The speech recognition circuit 50 then maintains mode output 65 pin in the logic
15 state consistent with the speech recognition mode. As indicated previously and shown in Fig. 2f, an input control pin of audio switching circuit 30 is electrically connected to said mode output 65 pin, causing the state of audio switching circuit 30 to be controlled by said mode output pin. The logic state change at mode output 65 pin results in a logic state change at the input control pin of audio switching circuit 30, causing said circuit to
20 electrically connected microphone 20 output signal to speech recognition circuit 50, disconnecting it from sound activation circuit 40, as shown in step S504 in Fig. 5. This connection is maintained until speech recognition circuit 50 determines that predetermined conditions have been met to return to the sound activation mode.

Alternate schemes may also be employed to electrically connect
25 microphone 20 output to the speech recognition circuit 50 and the sound activation circuit 40. One alternate embodiment is shown in FIG. 18a which employs a commercially available digitally controlled (digitally enabled input control), single-pole, single-throw (SPST) analog switch, instead of the SPDT switch employed within the embodiment described above, within the audio switching circuit 30. As shown in FIG. 18a, an
30 electrical connection is always maintained between the microphone 20 output and the speech recognition circuit 50, but the switch is used to either electrically connect or disconnect the sound activation circuit 40 to the microphone 20 output depending on the state of the mode pin 65 of the speech recognition circuit 50. The speech recognition circuit 50 controls the mode pin 65 logic state as described in further detail below for the

5 embodiment discussed above such that the sound activation circuit 40 is electrically connected to the microphone 20 output only when the invention is placed into sound activation mode.

10 Another alternate embodiment is shown in FIG. 18b which employs two microphones 20a and 20b, the output of each is dedicated to the speech recognition circuit 50 or the sound activation circuit 40, respectively. Thus, the microphone outputs remain exclusively electrically connected to the speech recognition circuit 50 or the sound activation circuit 40. For this scheme, no switch is used, but an additional microphone is introduced, and the sound activation circuit 40 is allowed to harmlessly trigger during the speech recognition mode.

15 Another alternate embodiment is shown in FIG. 18c, which is a combination of the two alternate schemes presented above. This scheme employs two microphones 20a and 20b, the output of each is dedicated to the speech recognition circuit 50 or the sound activation circuit 40, respectively. As shown in FIG. 18c, an electrical connection is always maintained between the microphone 20a output and the speech recognition circuit 50, but an SPST switch as described above is used to either electrically connect or disconnect the sound activation circuit 40 to the microphone 20b output depending on the state of the mode pin 65 of the speech recognition circuit 50. The speech recognition circuit 50 controls the mode pin 65 logic state in the same manner as described later in further detail for the preferred embodiment such that the sound activation circuit 40 is electrically connected to the microphone 20 output only when the invention is placed into sound activation mode.

PHYSICAL UNIT

30 FIGS. 3 and 4a-4c illustrate an exemplary embodiment of a housing for the present invention. Referring first to FIG. 3, shown is speech recognizing transmitter 10 with a housing which includes a main housing portion 11, a microphone base 12 which holds a microphone 20 and that may be rotated independently from said main enclosure section 11, as described below and a removable battery access panel (not shown) on the bottom of the unit. Two ports 96, 98 in the form of openings are provided

5 in the top of the microphone base 12, through which sound is received by the microphone.

An opening in the main enclosure section 11 is provided for sound generated from a speaker 53. The opening may be formed from many small openings in the indicated area which may take the form of slits or cross-hatched pattern openings
10 through which sound generated by the speaker 53 may pass through the main enclosure section 11.

The indicators 52a, 52b, 52c and 52d are light-emitting diodes operating in visible light wavelengths that are used to communicate operating status to the user. Openings may also be provided in the main enclosure 11 for each of said indicators.

15 A keypad 51 may be provided to enable the user access to buttons used primarily to communicate with the system during product setup processes. Openings are provided in the main enclosure 11 for each button of said keypad.

A user-adjustable thumbwheel potentiometer 35 may also be provided to allow the microphone sensitivity adjustment for electric audio signals directed to a
20 speech recognition circuit. A user-adjustable thumbwheel potentiometer 45 may be provided to allow adjustment of the amplification level of electric audio signals directed to a sound activation circuit. Openings may be provided in the main enclosure 11 for each of said thumbwheel potentiometers.

25 Four vibration-absorbing, adhesive-backed feet 19 made of rubber or similar compounds that are conducive to vibration absorption may be mounted to the bottom of main enclosure section 11.

An infrared receiver 71 or other wireless signal detecting device may be mounted within the front portion of the main enclosure section 11 with an opening through which infrared light is received and detected.

30 FIG. 4a is a side elevational view of the physical structure of one embodiment of the present invention. In addition to those components shown in FIG. 3., FIG. 4a shows infrared light-emitting diode 80 and a battery holding compartment 18. Openings are provided in the main enclosure section 11 for each of the indicators and for mating of the removable battery access panel 17 (FIG. 4b) to the main enclosure section

5 11. Electronic components are either mounted upon or are electrically connected by wiring to a printed circuit board assembly 16 shown with hidden lines.

FIGS. 4b and 4c show the rotatable IR transmitter and rotatable microphone feature in more detail. In particular, referring first to the rotatable microphone feature, the housing 11 may be formed from a front housing portion 82 and rear housing portion 84. The front and rear housing portions 82 and 84 are formed within continuous edges 86 and 88, respectively, to enable the front 82 and rear housing portion 84 to be joined together with a suitable adhesive, such as an epoxy, or by way of ultrasonic welding or otherwise formed to be coupled together. Each of the front 82 and rear 84 housing portions includes a semi-circular opening 85, 87 formed at the top of the housing 11. Semicircular annular notches 95 and 97 are formed adjacent to each of the semicircular openings 85 and 87. As will be discussed in more detail below, these semicircular annular notches 95 and 97 are for receiving a microphone base 12 and enabling it to rotate. In particular, the microphone base 12, for example, as discussed above, includes a outer rim portion 99 formed as a disk. The outer rim portion 99 is adapted to be received in a semi-circular annular notches 95 and 97 in order to enable the microphone base 12 to be rotatably mounted with respect to the housing 11.

Electrical conductors 21 are used to connect the microphone 20 to the circuitry described above. In order to protect the electrical connection between the electrical conductors 21 and the microphone from being damaged as a result of rotation of the microphone base 12, sufficient slack is provided in the conductors 21.

As discussed above, the microphone 20 may be a directional microphone. As such, the microphone 20 is provided with a pair of sound ports 22 and 23. Rectangular openings 96 98 are provided in the microphone base 12 to allow sound to reach the microphone ports 22 and 23.

30 A radially extending rib 100 may be provided on the outer rim portion 99. An axially extending rib 102 may be formed in one of the semicircular annular notches 95, 97 to form a stop. In particular, the axial rib 102 is adapted to engage the radial rib 100 on the outer rim portion 99 of the microphone base 12 to limit rotation of the microphone base 12.

5 Another important feature of the invention relates to the fact that the infrared light emitting diode 80 may be rotatably mounted relative to the rear housing portion 84. In particular, an opening 104 may be provided in the rear housing portion 84. A pair of spaced apart plates 106 and 108 may be formed adjacent to the opening 104 and configured to extend into the rear housing portion 84 as generally shown in FIG. 4b.
10 A pair of protuberances 110 may be formed on the upper and lower plate 106 and 108 to form a pivot axis.

The infrared light emitted diodes 80 may be carried by an irregularly shaped housing 112 having a top side 114 and a bottom side 116. The housing 112 is open on one end and contains apertures 118 and 120 in the top 114 and bottom 116 sides.
15 The apertures 118 and 120 are configured to receive the protuberances 110 and the top 106 and bottom plates 108 disposed inward in the rear housing portion 84 to enable the housing portion 112 to rotate relative to the rear housing portion 84. An extending protuberance 81 enables a user to rotate the housing 112 to adjust the physical orientation of the light emitting diode 80.

20 The housing portion 112 is adapted to carry the infrared light emitting diodes 80. Electrical conductors 89 are used to provide an electrical connection between the infrared light emitting diode 80 and the balance of the circuitry. The conductors 89 are provided with sufficient slack to avoid effecting the electrical connections to the electrical conductors when the housing 112 is rotated.

25 As mentioned above, the system may be AC or DC. In DC embodiments as shown in FIG. 14b, a battery access hatch 17 may be provided on the bottom of the housing 11.

SOFTWARE

30 FIG. 5 is a flowchart form of two default modes of the present invention. A sound activation mode is the default mode when the invention is operating in a low power consuming manner in a step S501. Otherwise, a continuous listening speech recognition mode is the default mode in a step S505 unless a user is performing product setup processes. In normal use, the speech recognition circuit 50 remains electrically

5 connected to the power supply circuitry **90** and receives electric power while in both of these modes. It should be noted that means is also provided to electrically disconnect the electric power source from the section of the power supply circuit that distributes electric power to other electronic elements within the present invention if it is desirable to prevent unintentional activation or if the invention is not to be used for an extended period of time. The command to disconnect power from said electronic elements is not included within a default recognition vocabulary set to prevent unintentional deactivation of the invention and to prevent confusion with using the invention to power on and off controlled appliances. The command is placed in a recognition vocabulary set that must be accessed by a command in another recognition vocabulary set to ensure recognition of said command is intentional.

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When the power supply electric source is electrically connected to the power supply circuit **90** section that distributes electric power to other electronic elements, the operation of the invention depends on whether or not the invention is in sound activation mode as shown in a step **S501**. The user can visually determine this state because no indicators **52a**, **52b**, **52c** or **52d** are illuminated during the sound activation mode. If the system is not in the sound activation mode, then it is either in the default speech recognition mode listening for voice commands as shown in a step **S505** or temporarily executing a speech recognition routine involving another recognition vocabulary set. Again, it should be noted that an exception applies if the user is performing a product setup process, during which time the invention may also enter modes where it is waiting for the user to depress a button.

30
If it is temporarily executing a speech recognition routine involving another recognition vocabulary set, the invention will automatically return to the default speech recognition mode after the user has completed submitting voice commands within the recognition vocabulary set active at that time. The conditions under which other speech recognition routines cease and the default speech recognition mode becomes active are described later.

While in the sound activation mode as shown in a step **S502**, the microphone **20**, the audio switching circuit **30**, the sound activation circuit **40** and the

5 speech recognition circuit IC 55, as a minimum, receive electric energy from the power supply circuit 90. The microphone 20, the audio switching circuit 30, the sound activation circuit 40 and the speech recognition circuit IC 55, as a minimum, have low power consuming characteristics while in the sound activation mode. When the microphone 20 receives an acoustic signal from an area surrounding the present invention, the microphone 20 converts the acoustic signal into an electric signal. 10 Depending on the state of the audio switching circuit 30, the electric signal output from the microphone 20 is electrically connected to either the sound activation circuit 40 if the system is in sound activation mode or the speech recognition circuit 50 if the system is in speech recognition mode. The audio switching circuit 30 is set to one of these two possible states. As shown in FIG. 2c, an input control for the audio switching circuit 30 15 is electrically connected to a speech recognition circuit 50 mode output 65 pin which changes logic states as the speech recognition circuit changes modes between sound activation mode and speech recognition mode. The input control for the audio switching circuit 30 automatically detects the logic state of said mode output pin and changes the electrical connections for the electric signal output from the microphone 20 accordingly. 20

Assuming that the system is in sound activation mode, the output signal from the microphone 20 is electrically connected by the audio switching circuit 30 to the sound activation circuit 40 as shown in FIG. 2c. The sound activation circuit 40 contains one or more audio amplification stages that amplify the electric signal output from the microphone 20. FIG. 2c shows an audio signal amplification stage based upon an NPN transistor 41a, followed by another audio signal amplification stage based upon an NPN transistor 41b. The sound activation circuit 40 also contains a trigger circuit. The trigger circuit shown in FIG. 2c utilizes a series of three inverting Schmitt trigger circuits, shown collectively as IC 43 because IC are commercially available which integrate several such 25 circuits into a single device package. The amplified output signal from the last audio amplification stage is electrically connected to an input of a first trigger circuit. If the resulting amplified electric audio signal representing the sound received by the microphone 20 reaches a predetermined amplitude threshold equal in magnitude to a logic state change (bit transition) at the input of the trigger circuit, the trigger circuit 30

5 activates, indicating the sound has been detected as shown in a step S502. The first inverting trigger circuit then outputs a logical low, leading to a logical high output at the second inverting trigger followed by a logical low output at the third inverting trigger in IC 43. It is the output of the third inverting trigger that is electrically connected to the input pin 68 of the speech recognition circuit 50. The general operation of such signal
10 amplification and triggering circuits are well know to those skilled in the electronics arts.

The sound activation circuit 40 also contains a potentiometer which allows resistance modification within the amplification circuit. This potentiometer is accessible to the user in the form of a thumbwheel knob 45 which the user can adjust to change a resistance value within the amplification circuit which modifies the sensitivity of the
15 sound activation circuit.

As indicated above, the logic state change of the output pin on the trigger circuit causes a bit transition at the input 68 pin of the speech recognition circuit controller 60. This bit transition is detected by the controller 60 which responds by removing the speech recognition circuit from the low power consuming sound activation
20 mode and enabling the controller clock 63. This activates the speech recognition circuit 50 for speech recognition processing as shown in a step S503. The software also instructs the controller 60 to change the logic state of the mode output 65 pin.

The speech recognition circuit 50 then maintains the mode output 65 pin in the logic state consistent with the speech recognition mode. As indicated previously and shown in FIG. 2c, an input control pin of the audio switching circuit 30 is electrically
25 connected to the mode output 65 pin, causing the state of the audio switching circuit 30 to be controlled by the mode output pin. The logic state change at mode output 65 pin results in a logic state change at the input control pin of the audio switching circuit 30, causing the circuit to electrically connect the microphone 20 output signal to the speech
30 recognition circuit 50, disconnecting it from the sound activation circuit 40, as shown in a step S504. This connection is maintained until the speech recognition circuit 50 determines that predetermined conditions have been met to return to the sound activation mode.

5 After the controller clock 63 is initialized and stabilized, and the audio
switching circuit 30 has connected the microphone 20 signal output to the speech
recognition circuit 50, the controller 60 utilizes the ROM 61 to activate the speech
recognition mode software as shown in a step S505. A sound activation mode time-out
counter and a recognition error counter are set to zero as shown in a step S506. The
10 sound activation time-out counter tracks elapsed time between attempts made by the
speech recognition circuit 50 to recognize sounds and if a predetermined time value
TMAX elapses between recognition attempts, the speech recognition circuit software
initiates a routine to enter sound activation mode and changes the logic states of the
previously described control register bits. The recognition error counter tracks the
15 number attempts made by the speech recognition circuit 50 to recognize sounds for which
no match is identified. The use of the recognition error counter is further described later.
Each time a match is identified during speech recognition processing, the sound
activation time-out counter value and the recognition error counter value are reset to zero
value.

20 A green light-emitting diode 52a is activated and remains illuminated in
a step S507 while the speech recognition mode is available to execute a pattern
generation algorithm to provide a visual indicator to the operator that the invention is
ready to receive a voice command. It should be noted that this indicator will briefly
deactivate during a silence level detection period, pattern generation or during speech
25 recognition processing to inform the user that the speech recognition circuit 50 is
temporarily unavailable to receive a voice command, but the green light-emitting diode
52a re-illuminates after the silence level detection period is completed or recognition
processing routine returns a result.

30 When the speech recognition circuit 50 is activated from a sound
activation mode, the default speech recognition mode software executes a continuous
listening routine. The green light-emitting diode 52a illuminates while the speech
recognition circuit is waiting to detect sounds for which to create patterns and submit for
recognition processing as shown in step S508. During this mode, the speech recognition
circuitry executes a software routine that cycles among states where it monitors

5 environmental sound level until a suitable silence level is detected, generates a pattern
for a detected sound, compares the duration of the acquired pattern representing the
detected sound to a defined duration for the active recognition vocabulary set commands,
and when the duration of the detected sound pattern is consistent with said active
recognition vocabulary set duration, executes a recognition algorithm to determine if a
10 match can be identified for the acquired unknown pattern and one of the commands in
the active recognition vocabulary set. Acquired patterns that are not consistent in
duration with recognition vocabulary set commands (too long or too short) are ignored,
and the speech recognition circuit software returns to execute the silence level detection
routine. The silence level detection routine listens (remains in a detection mode) until
15 the noise level drops below a predetermined threshold, meaning a certain silence level
is achieved. During this silence level detection routine, result codes are returned and
compared to a noise threshold value until a result code is returned indicating the noise
level has dropped below the predetermined threshold. Pattern generation can then be
performed if a sound is detected. This cycle is shown as steps S508 through S517. Such
20 continuous listening software routines are well known to those skilled in the art.

The default mode speech recognition circuit software cycles between a
silence level detection routine and a listening (ready for pattern generation) routine
shown in steps S508, S509 and S510 while waiting for the detection of a sound. The
sound activation time-out counter value is periodically compared to the predetermined
25 value TMAX in a step S509. If the time-out period elapses before a sound is detected,
the speech recognition circuit 50 executes software code to enter the sound activation
mode and disable the clock 63 from the clock source 64 as shown in FIG. 6. If the time-
out period has not elapsed, the speech recognition circuit 50 continues to cycle between
a sound level detection routine and a listening (ready for pattern generation) routine,
30 returning to steps S508, S509 and S510.

If sound is detected in a step S510, the green light-emitting diode 52a
ceases to illuminate and a pattern is generated to represent the acoustically significant
elements of the sound in a step S511. The duration of the acquired unknown pattern for
the detected sound is compared to determine if its duration is consistent with the duration

5 a visual indicator to the operator that no match was identified in a step S516. The
recognition error counter value is then compared to value EMAX in a step S517. If the
recognition error counter value is equal to value EMAX, the speech recognition circuit
50 executes software stored in its ROM 61 to enter the sound activation mode and disable
the clock 63 from the clock source 64 and as shown in FIG. 6. If the recognition error
10 counter value is not equal to value EMAX, the green light-emitting diode 52a is activated
and remains illuminated and the speech recognition circuit 50 executes software which
cycles between the silence level detection routine and the listening (ready for pattern
generation) routine in steps S508, S509 and S510.

15 If a match for the acquired pattern is identified in a step S514, the speech
recognition circuit 50 software identifies the operation associated with the matching
recognition vocabulary set command in a step S518 and determines if the operation is to
send an instruction to the speech recognition circuit controller 60 to activate a new
recognition set vocabulary or to output a signal to the infrared controlling circuit 70 using
the speech recognition circuit input/output 68 pins. The signal to the infrared controlling
20 circuit 70 communicates either a appliance category selection command in a step S520
or a command to transmit one or more infrared signals for specified functions to the
currently controlled appliance in a step S521.

25 Following the submission of a signal to the infrared signal controlling
circuit 70, the speech recognition circuit controller 60 executes software stored in its
ROM 61 to reset the values TMAX and EMAX to zero in a step S506, activates the green
light-emitting diode 52a in a step S107 and returns to a continuous listening routine
which cycles between the silence level detection routine and the listening (ready for
pattern generation) routine in steps S508, S509 and S510. FIG. 7 shows the steps
followed when the speech recognition circuit controller 60 receives a signal instructing
30 it to activate a new recognition set.

The present invention uses conventional silence level detection, continuous listening, pattern generation, and speech recognition algorithms to perform the aforementioned software routines. These algorithms are well documented in the prior art and are familiar to those skilled in the electronics arts. For example, exemplary

5 speech recognition algorithms are available from Sensory, Inc., Sunnyvale, California, under their brand name Sensory Speech 5.0 Technology. Other speech recognition algorithms which contain some of the features in the present invention include Voice Direct™, TSSP and Voice Activation™ software, all available from Sensory, Inc.. Other speech recognition algorithms are also suitable.

10 As indicated in steps S509 and S517 in FIG. 5, the speech recognition circuit software periodically monitors the status of two counter values that are independently controlled by the software. If either of these two values, the sound activation time-out counter value or the recognition error counter value, has reached its maximum allowed value TMAX or EMAX, respectively, the speech recognition circuit
15 50 changes the mode of the system from speech recognition mode to sound activation mode. Otherwise, as indicated in steps S506 and S515 shown in FIG. 5, these counters are also reset to zero.

FIG. 6 shows in a step S620 the sound activation mode is entered only from a default recognition mode. If the active recognition vocabulary set is not a default
20 recognition vocabulary set operating in a default recognition mode, then upon attainment of a maximum allowed counter value for a time-out counter or a recognition error counter, the software will return to a default recognition mode before the sound activation mode is entered as shown by a step S620 in FIG. 6 referring to a step S505 in FIG. 5.

Reference is made to FIG. 6. Step S621 shows that when operating in a
25 default recognition mode, and upon the attainment of the value TMAX for the sound activation time-out counter value or the value EMAX for the recognition error counter value, the speech recognition circuit 50 inactivates or disables the electronic elements that are not needed during sound activation mode, such as indicators 52a, 52b, 52c and 52d to reduce power consumption during the sound activation mode. In a step S622, the
30 system enters a sound activation mode as described previously by changing the states of control register bits that disable the clock oscillator 63 from its clock source 64 and place the speech recognition circuit in a low power consuming mode and setting the mode output 65 pin to the logic state defined for sound activation mode.

5 As shown in step S623, an input control for the audio switching circuit 30 is electrically connected to said mode output 65 pin which changes logic states as the speech recognition circuit changes modes between speech recognition mode and sound activation mode. The input control for the audio switching circuit 30 detects the logic state of the mode output pin and electrically connects the electric signal output from the microphone 20 to the sound activation circuit 40.

10 As shown in steps S624, S625 and S626, the speech recognition circuit remains in this sound activation mode, listening for sound. While in the sound activation mode, the microphone 20, the audio switching circuit 30, the sound activation circuit 40 and the speech recognition circuit IC 55, as a minimum, receive electric energy from the power supply circuit 90. The microphone 20, the audio switching circuit 30, the sound activation circuit 40 and the speech recognition circuit IC 55, as a minimum, have low power consuming characteristics at least while in the sound activation mode. When the microphone 20 receives an acoustic signal from an area surrounding the present invention, the microphone 20 converts the acoustic signal into an electric signal. The state of the audio switching circuit 30 is set to electrically connect the electric signal output from the microphone 20 to the sound activation circuit 40. The sound activation circuit 40 contains one or more audio amplification stages, shown in FIG. 2c, that amplify the electric signal output from the microphone 20. The sound activation circuit 40 also contains a trigger circuit 43 shown in FIG. 2c. The amplified output signal from the last audio amplification stage is electrically connected to an input of the trigger circuit. If the resulting amplified electric audio signal representing the sound received by the microphone 20 reaches a predetermined amplitude threshold equal in magnitude to a logic state change (bit transition) at the input of the trigger circuit, the sound activation circuit activates, indicating the sound has been detected at a step S625 in FIG. 6 and referring to a step S502 in FIG. 5. The sound activation circuit is shown in detail in FIG. 2c.

 As indicated in a step S518 shown in FIG. 5, when a match is identified during the pattern recognition process and the operation associated with the recognized command is an instruction to activate a different recognition vocabulary set, the software

5 will execute the instruction to enter the appropriate recognition mode for the indicated recognition vocabulary set in step S628 shown in FIG. 7. Recognition modes are commercially available that are capable of executing software that involves different recognition routines, such as continuous listening, pattern queuing and response prompting recognition as described below.

10 The continuous listening recognition mode was described previously in the explanation of FIG. 5 steps. A continuous listening routine may also be executed for a non-default recognition vocabulary set. For brevity, an additional description of this mode is not provided. Instead, the system returns to step S505 in FIG. 5, after which the same basic process follows. The primary exception being that when the maximum allowed time-out or recognition error counter value is attained, the speech recognition circuit 50 will not enter sound activation mode, but will instead enter the default continuous listening recognition mode as indicated in a step S620 in FIG. 6.

15 A response prompting recognition mode is shown in FIG. 8. When the speech recognition circuit software activates a recognition vocabulary set and executes a response prompting routine as shown in a step S630, the user is expected to select a voice command from the active recognition vocabulary set and respond when prompted by an illuminated green light emitting diode 52b. A green light emitting diode 52a remains illuminated in this mode when the speech recognition circuit 50 is available to generate patterns to indicate to the user that the active recognition mode is not the default recognition mode. As defined previously for the continuous listening recognition mode, a time-out counter and a recognition error counter are set to zero when the response prompting recognition mode is activated. However, the maximum allowed values for both of these counters are typically less than those for continuous listening recognition mode.

20 Following the prompting of the user by the illumination of a green light emitting diode 52b in a step S632, the software enters a pattern generating mode in a step S633, waiting for a voice command to be detected. If a maximum allowed time-out value TMAX1 is attained before a voice command is detected, the software will terminate the response prompting routine and return to the default continuous listening recognition

5 mode as shown in a step S634. Until time TMAX1 has expired, the speech recognition circuit remains available to generate a pattern when a voice command is detected as shown in steps S635, S633 and S634. If a voice command is detected in a step S635, a pattern is generated in a step S636 and submitted for pattern recognition processing in a step S637.

10 During step 637 the acquired unknown pattern is analyzed by the speech recognition circuit controller 60, utilizing a recognition algorithm stored in its ROM 61, to determine if it can be classified as a match with any of the reference commands within the active recognition vocabulary set and if the likelihood of correctly recognizing the unknown pattern exceeds a predetermined threshold. The result of this comparison is identified in a step S638.

15 If a match for the acquired pattern is not identified, the value of the recognition error counter is incremented by one in a step S638 and the red light-emitting diode 52c illuminates briefly to provide a visual indicator to the operator that no match was identified in a step S640. The recognition error counter value is then compared to a maximum allowed recognition error counter value EMAX1 in a step S641. If the recognition error counter value is equal to value EMAX1, the speech recognition circuit 50 executes software stored in its ROM 61 to terminate the response prompting routine and return to a default continuous listening recognition mode as shown in a step S641 and a step S505 in FIG. 5. If the recognition error counter value is not equal to value
20 EMAX1, the green light-emitting diode 52b is activated and remains illuminated and the speech recognition circuit 50 executes software to enter a pattern generating mode, returning to a step S633 and waiting for a voice command to be detected. As previously indicated, until time TMAX1 has expired, the speech recognition circuit remains available to generate a pattern when a voice command is detected as shown in steps S635,
25 S633 and S634.

30 If a match for the acquired pattern is identified in a step S638, the speech recognition circuit 50 software identifies the operation associated with the matching recognition vocabulary set command in a step S642 and determines if the operation is to send an instruction to the speech recognition circuit controller 60 to activate a new

5 recognition vocabulary set or not. If a new recognition vocabulary set is to be activated, the software executes the instruction to enter the appropriate recognition mode for the indicated recognition vocabulary set in a step S628 shown in FIG. 7.

If the operation associated with the recognized command is to send an instruction to the speech recognition circuit controller 60 to activate a macro sequence
10 of commands, then software begins to execute the macro program as indicated in a step S700 in FIG. 11, which is described later.

As shown in a step S644, if the operation associated with the recognized command is to send an instruction to the speech recognition circuit controller 60 to
15 output a signal to the infrared controlling circuit 70, the software uses the speech recognition circuit input/output 68 pins. The signal to the infrared controlling circuit communicates either a appliance category selection command in a step S645 or a command to transmit an infrared signal for a specified function to the currently controlled appliance in a step S646.

Following the submission of a signal to the infrared signal controlling
20 circuit 70, the speech recognition circuit controller 60 executes software stored in its ROM 61 to determine whether to remain in the active recognition vocabulary set to receive additional voice commands or to terminate the response prompting routine and return to a default continuous listening recognition mode as shown in a step S647 and a step S505 in FIG. 5. If remaining in the active recognition vocabulary set, the software
25 resets the values TMAX1 and EMAX1 to zero in a step S631, activates the response prompting green light-emitting diode 52b in a step S632 and enters a pattern generating mode in a step S633, waiting for a voice command to be detected until either TMAX1 or EMAX1 counter values are attained, at which time the software will terminate the response prompting routine and return to a default continuous listening recognition mode
30 as shown in steps S634 or S641, followed by a step S505 in FIG. 5.

A pattern queuing recognition mode is shown in FIG. 9. Generally, pattern queuing involves the user providing a voice command after each prompt within a series of prompts. The number of prompts in the series is predetermined. A pattern is generated for each voice command as it is received, and the pattern is queued into

5 memory. After patterns have been generated and queued into memory for all received
 voice commands, the voice commands are submitted one by one for recognition.
 Following recognition of each pattern, the operation instruction associated with the
 command in the active recognition vocabulary set identified as a match with the unknown
 pattern is queued into memory. When all patterns within the series have been recognized,
 10 and all associated operation instructions have been queued into memory, the controller
 60 performs each of the operation instructions in a defined order.

For example, the system utilizes a pattern queuing routine to allow a user
 to submit a string of consecutive voice commands, which may be separated by brief
 pauses, selected from a vocabulary recognition set which includes the names of digits
 15 zero through nine. In this example, a user submits the word "channel" during the
 continuous listening default routine. When the word "channel" is recognized, the
 software activates the recognition vocabulary set including digit names and initiates a
 pattern queuing routine, prompting the user to submit one, two or three digit names to
 identify a desired channel number for an appliance.

20 When the speech recognition circuit software activates a recognition
 vocabulary set and executes a pattern queuing routine as shown in a step S660, the user
 is expected to select a voice command from the active recognition vocabulary set and
 respond when prompted by an illuminated green light emitting diode 52b. The green
 light emitting diode 52a remains illuminated in this mode when the speech recognition
 25 circuit 50 is available to generate patterns to indicate to the user that the active
 recognition mode is not the default recognition mode. As defined previously for the
 continuous listening recognition mode, a time-out counter is set to zero when the pattern
 queuing recognition mode is activated as shown in a step S661. However, the maximum
 allowed value TMAX2 for this counter is typically less than that for continuous listening
 30 recognition mode. Also at this time, a pattern counter and a queue counter are set to zero
 in a step S662.

The pattern counter value is incremented each time after a pattern is
 generated until a maximum pattern counter value MAXP is attained. In this manner each
 pattern counter number value is representative of a single generated pattern and the

5 maximum number attained by said counter is equal to the number of patterns generated. The value MAXP represents the maximum number of patterns the routine will generate before terminating the pattern generation process and beginning a speech recognition process. The minimum value for the pattern counter before the routine will generate speech recognition processing is one. If no patterns are generated within the time
10 allowed, then the software returns to the default continuous listening mode.

The queue counter is utilized in a similar manner to the pattern counter, except that it is used to track operation instructions identified during a speech recognition process. As a match is identified for an unknown pattern during the pattern recognition process, the operation instruction of the associated recognition vocabulary set command
15 determined to be the best match is queued into memory until all generated patterns are processed through the speech recognition process. In this manner each queue counter number value is representative of an operation instruction now associated with a single generated pattern and is useful in retaining sequential order during the storage and retrieval of said instruction from memory. The maximum value attained by said queue
20 counter is equal to the number of patterns generated. Unknown patterns for which no match is identified during the speech recognition process are ignored, in which cases the queue counter is not incremented.

Following the production of a visual prompt by the green light emitting diode 52b in a step S663, the speech recognition circuit 50 software begins a listening
25 routine (ready to generate a pattern) awaiting a voice command in a step S664. As shown in steps S664, S665 and S670, the speech recognition circuit 50 system remains in this routine until either a voice command is detected in a step S665 or the time-out counter value reaches the value TMAX2 in step S670. As shown in a step S666 a pattern is generated by the speech recognition circuit 50 when a voice command is detected in a
30 step S665. The generated unknown pattern is queued into RAM 62 in a step S667.

As shown in a step S668, the value of the pattern counter is then compared with the value MAXP. If the pattern counter value is less than the value of MAXP, then the pattern counter value is incremented by one and the green light emitting diode 52b provides a visual prompt in a step S663 for the user to submit another voice command.

5 This process continues to cycle through these steps S663 through S669 until either the pattern counter reaches the value MAXP in step S668, indicating the maximum number of patterns allowable have been generated, or until a time-out occurs as described previously. If a time-out does occur at a step S670, the value of the pattern counter is compared to the value zero in a step S671. If the pattern counter value is equal to zero, 10 then the system returns to the default continuous listening mode as shown in a step S505 in FIG. 5. If the pattern counter value is not equal to zero, then patterns have been generated.

Generated patterns are then submitted by the system for processing by the pattern recognition algorithm in a step S672, one pattern at a time, in reverse order from the pattern generation order. Suitable pattern recognition algorithms have been described 15 above.

If a match for an acquired pattern is identified in a step S673, the speech recognition circuit 50 software identifies the operation associated with the matching recognition vocabulary set command and queues this operation instruction into RAM 62 in a step S674. The queue counter is then incremented by the value one in a step S675. 20 The pattern counter is then decremented by the value one in a step S676. The pattern counter value is then compared to the value zero in a step S677 to determine if there are any unknown patterns queued in RAM 62 which have not been submitted for speech recognition processing. If the pattern counter value is not equal to zero, then the software submits the next unknown pattern for speech recognition processing in a step S678 and returns to step S672 to perform pattern recognition. The software continues to cycle through steps S672 through step S678 until the pattern counter value is equal to value zero in step S677. If a match for an acquired pattern is not identified in a step S673, the pattern counter value is decremented by one in a step S676 before proceeding to step 25 S677.

When the pattern counter value is equal to value zero in step S677 in FIG. 9, the software compares the queue counter value to the value zero in a step S680 in FIG. 10 to determine if there are any operation instructions queued in the RAM 62. If the value of the queue counter is not equal to the value zero, the software retrieves from 30

5 RAM 62 the operation instruction associated with the current value of the queue counter
in a step S681. The speech recognition circuit 50 executes the operation instruction in
a step S682 by sending a signal through the input/outputs 68 pins to the infrared signal
controlling circuit 70. The processing of said signal received by the infrared signal
controlling circuit is described later. The speech recognition circuit 50 software then
10 decrements the queue counter value by the value one in a step S683 and returns to step
S680 to determine if all operation instructions have been retrieved from RAM 62. The
software continues to cycle through steps S680 through step S683 until the queue counter
value is equal to value zero in step S680 at which time the system returns to the default
continuous listening mode as shown in a step S505 in FIG. 5.

15 As shown in a step S682, the operation instruction associated with the
recognized command is processed by the speech recognition circuit controller 60 to
determine an output signal to the infrared controlling circuit 70, which is sent via the
speech recognition circuit input/output 68 pins.

The routine S690 identifies the processing steps performed within the
20 infrared signal controlling circuit 70. The signal from the speech recognition circuit
output 68 pins is received by inputs of the infrared signal controlling circuit 70 and
processed to determine the associated remote control function in a step S691. The output
from the speech recognition circuit output 68 pins provides a signal that is the
informational equivalent to that of a signal generated when a button is depressed on a
25 keypad of a conventional remote control transmitter. Thus the input to the controller of
the infrared signal controlling circuit 70 can be uniquely associated with a function
similarly to the input received from a conventional keypad generated circuit connection.
The controller of the infrared signal controlling circuit 70 interprets the signal received
at its input pin(s) by identifying a memory location in a step S692 and retrieving the
30 control code stored therein. This controller generates a signal based upon the control
code in a step S693 and submits the signal to an infrared driver 74, which drives one or
more infrared light emitting diodes 80 in a step S694. The infrared light emitting diode
80 converts the electrical signal into an infrared signal which is transmitted to one or
more target appliances in a step S695.

5 In one embodiment of the invention, as discussed above, an interface is provided as part of the infrared signal controlling circuit 70. The interface simulates the function of a switch matrix, connecting one or more inputs of the controller of the infrared signal controlling circuit 70 to one or more of its outputs as typically results when a keypad button is depressed. When the speech recognition circuit 50 sends a
10 signal to this interface, the interface allows electrical connections to be established, similar to a keypad button depression, between inputs and outputs of the controller of the infrared signal controlling circuit 70. One embodiment of the interface includes a programmable logic device as discussed above and is shown in FIG. 2b, described above. The interface provides an advantage since it is programmable and thus can be easily
15 modified for use with a variety of controllers for infrared signal controlling circuits 70.

 As indicated in a step S643 in FIG. 8, the recognition of a single voice command may generate a series of control signals to one or more target appliances. Such a sequence of control signals is hereafter referred to as a macro. Each macro must be created by the user during a product setup process described below. Macros may contain
20 operation instructions for appliance category selection, infrared signal codes and/or time delays. Macros are stored in the read/write memory 54 controlled by the speech recognition circuit 50 and may be associated with a user trained speaker dependent command.

 As indicated in a step S700, once a macro name is recognized, the speech
25 recognition circuit 50 software retrieves the first instruction stored in the read/write 54 memory location associated with the recognized command. If the instruction retrieved is determined to be a time delay in a step S701, the software executes a time delay in a step S702 and returns to step S700 to retrieve the next instruction from memory. If the instruction is not a time delay, the speech recognition circuit 50 software sends a signal
30 utilizing the speech recognition circuit input/output 68 pins to the infrared signal controlling circuit 70 in step S703. As indicated in a step S704, after a signal is sent to the infrared signal controlling circuit 70, the software returns to the read/write 54 memory location associated with the recognized command to determine if another instruction is to be retrieved and processed. If so, the system retrieves the instruction,

5 returning to step S700. The system continues to cycle through steps S700 through step S704 until an end marker is reached by the software in the memory location in a step S704, at which time the system returns to the default continuous listening mode as shown in step S505 in FIG. 5.

10 As previously indicated, the output from the speech recognition circuit input/output 68 pins provides sufficient information to the infrared signal controlling circuit 70 to generate a signal that is equivalent to that generated when a button is depressed on a keypad of a conventional remote control transmitter. The routine S710 identifies the processing steps performed within the infrared signal controlling circuit 70. The signal from the speech recognition circuit input/output 68 pins is received by inputs of the infrared signal controlling circuit 70. If the signal contains an instruction to select an appliance category in a step S711, the infrared signal controlling circuit 70 responds in a step S712 by making the memory locations associated with said appliance category active for subsequent access. If the signal contains an instruction to identify, generate and submit an infrared signal to a target appliance, then the infrared signal controlling circuit 70 performs these processes as indicated in steps S713 through S717. The controller of the infrared signal controlling circuit 70 interprets the signal received at its input pins in a step S713 and identifies a memory location in a step S714, retrieving the control code stored therein. This controller generates a signal based upon the control code in a step S715 and submits the signal to an infrared driver 74, which drives an infrared light emitting diode 80 in a step S716. The infrared light emitting diode 80 converts the electrical signal into an infrared signal which is transmitted to one or more target appliances in a step S717.

30 **Automatic Mute Control Sequencing:**

A mute operation sequencing feature may be selected, activated, and operated by a user in a completely hands-free manner. For example, a voice command such as "mute" may be added to a "Control" recognition vocabulary set, and each time "mute" is

5 recognized by the system while the "Control" recognition vocabulary set is active, the
software will sequence through different values of a muting mode variable MMV. Each
value of MMV represents a submode with respect to an automated mute command
sequencing feature. In a first mode OFF, the automated mute command sequencing
feature is disabled and the system operates as described previously. In a second mode,
10 automatic muting mode AMM, a muting signal is generally issued to a controlled
appliance when the unit is activated from sound activation mode and enters speech
recognition mode to aid subsequent speech recognition by reducing background noise
generated by a controlled appliance. A mute canceling signal may later be automatically
issued to the controlled appliance following the recognition of one or more
15 predetermined spoken commands or, for example, when certain conditions are met such
as attainment of a predetermined time-out counter value and/or attainment of a
predetermined recognition counter value. In a third mode, recognition error muting mode
REM, a muting signal is automatically issued to a controlled appliance upon the detection
of one or more types of recognition errors. The recognition errors causing such action
20 may be limited to only specific error types such as that generated when the continuous
listening algorithm detects that environmental noise is loud enough to potentially
diminish the accuracy of subsequent speech recognition. A mute canceling signal may
be generated similarly to that of the AMM mode described above. Once a muting mode
is selected, the software will remain in that mode until intentionally changed by the user.

25 In addition to the variable MMV, the software may also utilize one or more variables
to track the muted/non-muted status MS of the controlled appliance at any particular
time. Values for the variable MS may represent a "no muting activated" status NMA that
indicates the controlled appliance is not muted, an "automated muting activated" status
AMA that indicates an automated mute signal has been sent to the controlled appliance
30 and the appliance is currently muted, and a "command muting activated" status CMA
that indicates that the user has issued a voice command such as "Sound" to intentionally
mute the controlled appliance.

If the software is executing the default continuous listening recognition mode while

5 MMV is set to mode AMM or mode REM, and MS indicates that a NMA status exists,
the successful recognition of predetermined voice commands associated with vocabulary
recognition set "sub-menus" may also cause a muting signal to be issued, causing the
controlled appliance to remain muted during the recognition processing of commands
selected from said sub-menus and spoken by the user. Upon returning to the default
10 continuous listening recognition mode, a mute canceling signal is automatically sent to
the controlled device.

Reference is made to FIGURES 5 through 11 to further describe the automated mute
sequencing feature. If the MMV is set to OFF mode the software performs as described
in the previous explanations associated with these figures. If the MMV is set to mode
15 AMM or mode REM, the software follows the processes shown in FIGURES 5 through
11 and described in the previous explanations associated with these figures as well as the
additional activities associated with the automated mute sequencing feature described
below.

Referring to FIG. 5, if the MMV is set to mode AMM, then in addition to the
20 activities previously described for a step S505, the software also checks the status of MS.
If MS is set to CMA status, then a voice command such as "Sound" has previously been
recognized by the speech recognition software, which indicates a user desires that the
controlled appliance remain muted. Thus, if MS is set to CMA status, no subsequent
automatic muting signals will be issued until the user sets MS to a status other than
25 CMA, which may be accomplished, for example, by the next recognition of the voice
command "Sound." If MS is set to AMA status, then a muting signal is automatically
sent to the controlled appliance, with the infrared signal generated in the manner
described in previous explanations. The software executes a default continuous listening
recognition mode as shown in steps S506 through S517 and described previously. As
30 also previously described, the software periodically monitors the status of independent
time-out and recognition error counters to determine when to return to sound activation
mode. If a predetermined time value TMM elapses before a spoken command is
detected, as shown in a step S509, then a mute canceling signal is sent to the controlled

5 appliance and the software follows steps S620 through S626 shown in FIG. 6 to return
to sound activation mode. Similarly, if a predetermined maximum number of recognition
errors EMM is attained as shown in a step S517, then a mute canceling signal is sent to
the controlled appliance and the software follows steps S620 through S626 shown in FIG.
6.

10 If a match for a spoken command is identified in a step S514 shown in FIG. 5, then
as previously described for a step S518, the software determines if the operation
associated with the recognized command is an instruction to activate a different
recognition vocabulary set or an instruction to output a signal to the infrared controlling
circuit 70. If an instruction is to be sent to the infrared controlling circuit 70, then a mute
15 canceling signal is automatically sent to the controlled appliance prior to said instruction
being sent, unless the instruction is associated with a recognized command such as
“Sound,” which indicates the user desires the controlled device remain muted. In this
case, recognition of the command “Sound” would cause variable MS to be set to CMA
status as described above. If the software determines that the operation associated with
20 the recognized command is an instruction to activate a different recognition vocabulary
set, the software then proceeds to a step S628 shown in FIG. 7 to determine the
appropriate recognition mode and then proceeds appropriately to FIGURE 5, 8 or 9 as
described in the previous explanations associated with these figures.

The software continues to follow the steps shown in FIGURES 5 through 11 until
25 returning to the default continuous listening recognition mode as shown in a step S620
of FIG. 6, steps S634, S641 and S647 of FIG. 8; step S671 of FIG. 9; step S680 of FIG.
10; or step S704 of FIG. 11. Upon returning to the default continuous listening
recognition mode, a mute canceling signal is sent to the controlled appliance.

An alternative mute canceling sequence may be employed for some recognition
30 modes. For example, during pattern queuing recognition mode, it may be advantageous
to issue a mute canceling signal prior to the software’s return to the default continuous
listening recognition mode. In this case, the mute canceling signal may be issued at a
step S677 of FIG. 9 when the software has determined that all queued patterns have been

5 recognized. This approach reduces the time the controlled appliance remains muted and
prevents certain command functions, such as a volume increase function, from causing
the MS variable to lose synchronization with the controlled appliance's mute status.
Appliances in a muted condition are commonly removed from said muted condition upon
receipt of certain signals such as a volume increasing signal. For example, if the software
10 is operating in a pattern queuing recognition mode with an active vocabulary recognition
set containing volume control commands and has recognized the consecutive commands
"Up," "Up," "Up," the software may issue the mute canceling signal and then issue the
volume control commands to increase the volume of the controlled appliance by three
level adjustments.

15 When the software returns to the default continuous listening recognition mode from
another recognition mode and variable MS indicates a NMA status, subsequent
recognition of voice commands associated with sub-menu recognition vocabulary sets
may cause an automatic muting signal to be generated and sent to a controlled appliance.
Similarly to the above description, this capability allows recognition processing of
20 subsequent spoken commands selected from the associated recognition vocabulary set
to be performed in a noise-reduced environment, thus improving recognition accuracy.
For example, upon recognition of a command "Change" contained within the default
mode recognition vocabulary set, the software automatically issues a muting signal to the
controlled appliance prior to entering the recognition mode associated with the "Change"
25 recognition vocabulary set. Upon entering the recognition mode associated with the
"Change" sub-menu, the user may then issue voice commands such as "Up," "Down" or
"Back" that cause sequential channel changing while the controlled appliance remains
muted. When the software returns to the default continuous listening recognition mode,
a mute canceling signal may then be issued, automatically returning the controlled
30 appliance to a non-muted condition.

The recognition error detection automatic muting mode REM operates in the same
fashion as the mode AMM except that a muting command is not automatically issued as
the system transitions from sound activation mode to speech recognition. Instead, when

5 the software is executing the default continuous listening recognition mode and a
7 recognition error is detected, a muting signal is automatically sent to the controlled
9 appliance. As indicated above, the recognition errors causing such action may be limited
10 to only specific types such as that generated when the continuous listening algorithm
detects that environmental noise is loud enough to potentially diminish the accuracy of
subsequent speech recognition. A mute canceling signal may be generated using the
same means as described above.

It should also be noted that the above-described automated mute control
sequencing features may be combined in various forms to generate additional alternative
modes to those described above.

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PRODUCT SETUP

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As indicated in a step S201 in FIG. 12a, one of the buttons present on keypad 51 controls the state of a power switch. If the power switch is open as shown in a step S202, the power source is not electrically connected to sections of the power supply circuit 90 which have electrical connections to certain circuit elements and therefore, these circuit elements do not receive electric energy. When this power switch is closed, the power source is electrically connected to sections of the power supply circuit 90 which have electrical connections to certain circuit elements and therefore, these circuit elements do receive electric energy. Step S203 shows that when the power supply button is momentarily depressed and the power switch is placed into a closed state, the speech recognition controller 60 executes a reset, sets a time-out counter to value zero and starts the time-out counter, which increments as time elapses. As shown in a step S205, controller 60 enters a waiting state where it monitors input 68 pins to determine if inputs are received from depressed buttons located on keypad 51.

20

If no inputs are detected, i.e. no buttons are depressed, before the time-out counter reaches its maximum value SMAX as shown in step S214, the controller 60 executes code stored in ROM 61 to enter an appliance category selection routine shown in step S220 in FIG. 12b, which is described later.

25

If the user desires to enter an appliance code to select a specific appliance manufacturer's control codes from the universal appliance code library as shown in a step S206, the user presses the code button as shown in step S207. FIG. 13a through FIG 13c show the sequence of steps involved in programming such appliance codes.

30

If the user desires to use the system infrared signals from another remote control transmitter as shown in a step S208, the user presses the learn signal button as shown in step S209. FIG. 14a and FIG 14b show the sequence of steps involved in learning infrared codes.

If the user desires to teach the system custom speaker dependent names to be later associated with devices, functions or macros as shown in a step S210, the user presses the name command button as shown in step S211. FIG. 15 shows the sequence of steps involved in user voice training for custom names.

5 If the user desires to create a macro program as shown in a step S212, the
user presses the macro button as shown in step S213. FIG. 16a and FIG. 16b show the
sequence of steps involved in creating macro programs.

 A reset as shown in step S203 may also be initiated when the invention
is powered up and operating by depressing the setup button as shown in step S204. This
10 reset follows the same sequence as that resulting from an initial power up as shown in
steps S203 through in FIG. 12a and FIG. 12b.

 If no inputs are detected, i.e. no buttons are depressed, before the time-out
counter reaches its maximum value SMAX as shown in step S214 in FIG. 12a, the
controller 60 executes code stored in ROM 61 to enter an appliance category selection
15 routine shown in step S220 in FIG. 12b.

 A response prompting recognition mode for appliance category selection
is shown in FIG. 12b. The speech recognition circuit 50 software executes a response
prompting routine as shown in a step S221 and activates the appliance category name
recognition vocabulary set as shown in step S222. As defined previously for speech
20 recognition modes, a time-out counter is set to zero and started in a step S223 when the
response prompting recognition mode is activated. The user is then expected to select
a voice command from the appliance category name recognition set and respond when
prompted by an illuminated green light emitting diode 52a as shown in a step S224. For
example, the appliance category name recognition set may be comprised of such voice
25 command options as "television," "video," "satellite," and "cable" among which the user
may select.

 Following the prompting of the user by the illumination of a green light
emitting diode 52a in a step S224, the system enters a pattern generating mode in a step
S225, waiting for a voice command to be detected. If a maximum allowed time-out value
30 TMAXD is attained before a voice command is detected, the software will terminate the
response prompting routine and enter the default continuous listening recognition mode
as shown in a step S226. Until time TMAXD has expired, the speech recognition circuit
remains available to generate a pattern when a voice command is detected as shown in
steps S225, S226 and S227. If a voice command is detected in a step S227, a pattern is

5 generated in a step S228 and submitted for pattern recognition processing in a step S229.

During step S229 the acquired unknown pattern is analyzed by the speech recognition circuit controller 60, utilizing a recognition algorithm stored in its ROM 61, to determined if it can be classified as a match with any of the reference commands within the active recognition vocabulary set and if the likelihood of correctly recognizing the unknown pattern exceeds a predetermined threshold. The result of this comparison is identified in a step S230.

If a match for the acquired pattern is not identified, the red light-emitting diode 52c illuminates briefly to provide a visual indicator to the operator that no match was identified and the value of the recognition time-out counter is reset to the value zero and restarted as shown in a step S223. The green light-emitting diode 52a is then activated and remains illuminated as shown in step S224 and the speech recognition circuit 50 executes software to enter a pattern generating mode, returning to a step S225 and waiting for a voice command to be detected. As previously indicated, until time TMAXD has expired, the speech recognition circuit remains available to generate a pattern when a voice command is detected as shown in steps S225, S226 and S227.

If a match for the acquired pattern is identified in a step S230, the speech recognition circuit 50 software identifies the instruction associated with the matching recognition vocabulary set command, and issues a prompt, which may be a speech synthesis prompt, an audio sound or light-emitting diode indication, in a step S231 to identify the appliance category name recognized. The speech recognition circuit 50 then outputs a signal to the infrared controlling circuit 70, using output 68 pins to communicate the appliance category selection command in a step S232. The infrared controlling circuit 70 receives the signal and responds as shown in step S233 by making the memory section associated with the appliance category selected available for access.

Following the submission of a signal to the infrared signal controlling circuit 70, the speech recognition circuit controller 60 executes software stored in its ROM 61 to return to a default continuous listening recognition mode as shown in a step S234 and a step S505 in FIG. 5. If the appliance category name identified in step S231 is incorrect, step S234 also shows that the user may elect to press the setup button,

5 returning to step S204 in FIG. 12a and begin the process again.

While the present invention discloses the combined use of buttons and speech recognition during some of the product setup processes, it is also noted that the functions performed by depressing such buttons as the code button, learn signal button, name command button and macro buttons may also be performed through the use of speech
10 recognition means disclosed herein. For example the linked recognition vocabulary set structure disclosed may be used to accommodate hands-free setup of the product in addition to the hands-free activation and operation features. For example, a command such as "Setup" may be added to a "Control" recognition vocabulary set sub-menu described later in this disclosure. Upon recognition of the "Setup" command, a
15 recognition vocabulary set specific to product setup commands may be activated and contain such command options as "Code," "Learn Signal," "Name Command," and "Macro." A response prompting recognition mode may be used to activate this recognition vocabulary in the same manner described previously.

Recognition of these commands automatically initiate the appropriate setup
20 processes, providing an equivalent result to that of depressing the respective setup buttons. For a setup process that involves additional selections such as the macro program creation described below, additional commands such as "new command," "done," and "delay" may be provided within the recognition vocabulary sets made available during the setup processes.

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APPLIANCE CODE SELECTION

If the controller 60 detects an input corresponding to a depress of the code button shown in step S207 in FIG. 12a, a signal is sent to the infrared signal controlling circuit 70, using output 68 pins to instruct the infrared signal controlling circuit to enter
30 a programming mode. As shown in step S240 in FIG. 13a, the controller of the infrared controlling circuit executes a programming routine from software stored within its ROM, which includes setting to value zero and starting a programming time-out counter in a step S241. The programming routine prepares the controller of the infrared signal

5 controlling circuit 70 for subsequent receipt of a series of instructions. A first instruction identifies the intended appliance category, which is then followed by a series of instructions, where each instruction represents an identifier digit of an appliance code. The appliance code is comprised of a predetermined number of said identifier digits and uniquely identifies a specific control code set of the remote control command codes for
10 a particular appliance. When the controller of the infrared signal controlling circuit 70 receives instructions identifying all the identifier digits of an appliance code, it is capable of identifying the memory location within the universal appliance code library stored within its ROM where the remote control command codes for the intended appliance type are stored. The control codes are then made available for subsequent signal transmission and resulting control of the intended appliance. As indicated previously, universal
15 remote controls employing such universal appliance code libraries are well documented in prior art. The controller of the infrared controlling circuit 70 illuminates red light-emitting diode 52d during the programming mode period.

The speech recognizing circuit controller 60 executes code stored in ROM
20 61 to enter a response prompting recognition mode for appliance category selection shown in step S242. The speech recognition circuit 50 software executes a response prompting routine and activates the appliance category name recognition vocabulary set as shown in step S243. As defined previously for speech recognition modes, a time-out counter is set to zero and started in a step S244 when the response prompting recognition
25 mode is activated. The user is then expected to select a voice command from the appliance category name recognition set and respond when prompted by an illuminated green light emitting diode 52a as shown in a step S245. As indicated previously, the appliance category name recognition set may be comprised of such voice command options as "television," "video," "satellite," and "cable" among which the user may
30 select.

Following the prompting of the user by the illumination of a green light emitting diode 52a in a step S245, the software enters a pattern generating mode in a step S246, waiting for a voice command to be detected. If a maximum allowed time-out value TMAXD is attained before a voice command is detected, the software will terminate the

5 response prompting routine, and the programming time-out counter is allowed to expire as shown in step S292. Until time TMAXD has expired, the speech recognition circuit remains available to generate a pattern when a voice command is detected as shown in steps S246, S247 and S248. If a voice command is detected in a step S248, a pattern is generated in a step S249 and submitted for pattern recognition processing in a step S250.

10 During step S250 the acquired unknown pattern is analyzed by the speech recognition circuit controller 60, utilizing a recognition algorithm stored in its ROM 61, to determine if it can be classified as a match with any of the reference commands within the active recognition vocabulary set and if the likelihood of correctly recognizing the unknown pattern exceeds a predetermined threshold. The result of this comparison is identified in a step S251.

15 If a match for the acquired pattern is not identified, the red light-emitting diode 52c illuminates briefly to provide a visual indicator to the operator that no match was identified and the value of the recognition time-out counter is reset to the value zero and restarted as shown in a step S244. The green light-emitting diode 52a is then activated and remains illuminated as shown in step S245 and the speech recognition circuit 50 executes software to enter a pattern generating mode, returning to a step S246 and waiting for a voice command to be detected. As previously indicated, until time TMAXD has expired, the speech recognition circuit remains available to generate a pattern when a voice command is detected as shown in steps S246, S247 and S248.

20 If a match for the acquired pattern is identified in a step S251, the speech recognition circuit 50 software identifies the instruction associated with the matching recognition vocabulary set command, and issues a prompt, which may be a speech synthesis prompt, an audio sound or light-emitting diode indication, in a step S252 to identify the appliance category name recognized. The speech recognition circuit 50 then outputs a signal to the infrared controlling circuit 70, using output 68 pins to communicate the appliance category selection command in a step S253. The infrared controlling circuit 70 receives the signal and responds by making the memory section associated with the appliance category selected available for access in a step S254. The

5 infrared controlling circuit **70** then sets equal to value zero and restarts the programming time-out counter in a step **S256**.

Following the submission of a signal to the infrared signal controlling circuit **70**, the speech recognition circuit controller **60** executes software stored in its ROM **61** to enter a pattern queuing recognition mode as shown in a step **S257** and to
10 activate the digits recognition set as shown in step **S258**. If the appliance category name identified in step **S252** is incorrect, step **S255** shows that the programming time-out counter is allowed to expire as shown in step **S292**, before returning to step **S204** in FIG. 12a and beginning the process again.

As shown in steps **S257** and **S258** in FIG. 13a, the speech recognition
15 circuit software executes a pattern queuing routine and activates the digit name recognition vocabulary set. For example, the digit name recognition set may be comprised of such voice command options as "zero," "one," "two," ... "nine" among which the user may select.

As defined previously, a time-out counter is set to value zero and started
20 when the pattern queuing recognition mode is activated as shown in a step **S260** in FIG. 13b. Also at this time, a pattern counter and a queue counter are set to value zero in a step **S261**. The user selects an appliance code from a listing of the universal library of code supplied with the system and issues a spoken command identifying the first digit of the code when prompted by an illuminated green light emitting diode **52b** as shown
25 in a step **S262**.

The pattern counter value is incremented each time after a pattern is generated until a maximum pattern counter value **MAXC** is attained. In this manner each pattern counter number value is representative of a single generated pattern and the maximum number attained by said counter is equal to the number of patterns generated.
30 The value **MAXC** represents the maximum number of patterns the routine will generate before terminating the pattern generation process and beginning a speech recognition process. The minimum value for the pattern counter before the routine will generate speech recognition processing is one. If no patterns are generated within the time

5 allowed, then the software returns to the default continuous listening mode as described later.

The queue counter is utilized in a similar manner to the pattern counter, except that it is used to track operation instructions identified during a speech recognition process. As a match is identified for an unknown pattern during the pattern recognition process, the operation instruction of the associated recognition vocabulary set command
10 determined to be the best match is queued into memory until all generated patterns are processed through the speech recognition process. In this manner each queue counter number value is representative of an operation instruction now associated with a single generated pattern and is useful in retaining sequential order during the storage and retrieval of said instruction from memory. The maximum value attained by said queue
15 counter is equal to the number of patterns generated. Unknown patterns for which no match is identified during the speech recognition process are ignored, in which cases the queue counter is not incremented.

Following the production of a visual prompt by the green light emitting diode 52b in a step S262, the speech recognition circuit 50 software begins a listening routine (enters a state where it remains ready to generate a pattern) awaiting a voice
20 command in a step S263. As shown in steps S263, S264 and S265, the speech recognition circuit 50 software remains within said routine until either a voice command is detected in a step S264 or the time-out counter value reaches the value TMAX2 in step S265. As shown in a step S266 a pattern is generated by the speech recognition circuit
25 50 when a voice command is detected in a step S264. Said generated unknown pattern is queued into RAM 62 in a step S267.

As shown in a step S268, the value of the pattern counter is then compared with the value MAXC. If the pattern counter value is less than the value of MAXC, then
30 the pattern counter value is incremented by one in a step S269 and the green light emitting diode 52b provides a visual prompt in a step S262 for the user to submit another voice command. This process continues to cycle through these steps S262 through S269 until either the pattern counter reaches the value MAXC in step S268, indicating the maximum number of patterns allowable have been generated, or until a time-out occurs

5 as described previously. If a time-out does occur at a step S265, the user allows the programming time-out counter to expire as shown in step S292 in FIG. 13c, before returning to step S204 in FIG. 12a and beginning the process again or allowing the invention to automatically enter the default recognition mode.

Generated patterns are then submitted by the software for processing by
10 the pattern recognition algorithm in a step S270, one pattern at a time, in reverse order from the pattern generation order.

If a match for an acquired pattern is identified in a step S271, the speech recognition circuit 50 software identifies the operation associated with the matching recognition vocabulary set command and queues this operation instruction into RAM 62
15 in a step S272. The queue counter is then incremented by the value one in a step S273. The pattern counter is then decremented by the value one in a step S274. The pattern counter value is then compared to the value zero in a step S275 to determine if there are any unknown patterns queued in RAM 62 which have not been submitted for speech recognition processing. If the pattern counter value is not equal to zero, then the software
20 submits the next unknown pattern for speech recognition processing in a step S276 and returns to step S270 to perform pattern recognition. The software continues to cycle through steps S270 through step S276 until the pattern counter value is equal to value zero in step S275. If a match for an acquired pattern is not identified in a step S271, the pattern counter value is decremented by one in a step S274 before proceeding to step
25 S275.

When the pattern counter value is equal to value zero in step S275 in FIG. 13b, the software compares the queue counter value to the value zero in a step S280 in FIG. 13c to determine if there are any operation instructions queued in the RAM 62. If the value of the queue counter is not equal to the value zero, the software retrieves from
30 RAM 62 the operation instruction associated with the current value of the queue counter in a step S282. The speech recognition circuit 50 executes said operation instruction in a step S283 by sending a signal through the outputs 68 pins to the infrared signal controlling circuit 70. The processing of said signal received by the infrared signal controlling circuit is described later. The speech recognition circuit 50 software then

5 decrements the queue counter value by the value one in a step S284 and returns to step
S280 to determine if all operation instructions have been retrieved from RAM 62. The
software continues to cycle through steps S280 through step S284 until the queue counter
value is equal to value zero in step S280 at which time the software issues a prompt,
which may be a speech synthesis prompt, an audio sound or light-emitting diode
10 indication, in a step S281 to identify the appliance code recognized, and then enters the
default continuous listening mode as shown in a step S505 in FIG. 5.

As shown in a step S283, the operation instruction associated with the
recognized command is processed by the speech recognition circuit controller 60 to
determine an output signal to the infrared controlling circuit 70, which is sent via the
15 speech recognition circuit output 68 pins.

S285 identifies the processing steps performed within the infrared signal
controlling circuit 70. The signal from the speech recognition circuit output 68 pins is
received by inputs of the infrared signal controlling circuit 70 and processed to determine
an identifier associated with a recognized digit name in a step S286. The output from the
20 speech recognition circuit output 68 pins is equivalent to a signal generated when a
button is depressed on a keypad of a conventional remote control transmitter. Thus the
input to the controller of the infrared signal controlling circuit 70 is essentially the same
as received from keypad generated circuit connections which are well documented in
prior art. The controller of the infrared signal controlling circuit 70 stores the identifier
associated with the signal received in a memory location in a step S287. Identifiers are
25 determined and stored for each instruction received from the speech recognition circuit
50 until all instructions are received as determined in a step S288. The set of identifiers
are then analyzed by the controller of the infrared controlling circuit 70 to determine if
a they collectively comprise a valid appliance code in a step S289. If a valid code exists,
30 the remote control functions associated with that code are assigned to the previously
identified appliance category in a step S293 and the programming mode is terminated in
a step S294.

If the code is not valid, the code is not accepted in a step S290 and any
previously established code remains active. Light-emitting diode 52d illuminates in a

5 step **S291** and the programming time-out counter is allowed to expire in a step **S292**. FIG. 13c also shows that, as the programming time-out counter is allowed to expire, the time-out counter for the speech recognition circuit 50 is also allowed to expire, after which the speech recognition circuit 60 executes software stored in its ROM 61 to return to a default continuous listening recognition mode.

10 Following the submission of the last signal to the infrared signal controlling circuit 70, the speech recognition circuit controller 60 executes software stored in its ROM 61 to return to a default continuous listening recognition mode as shown in a steps **S281** in FIG. 13c and a step **S505** in FIG. 5. If the appliance category name identified in step **S281** is incorrect, the user may elect to press the setup button, returning to step **S204** in FIG. 12a and begin the process again.

INFRARED SIGNAL LEARNING

If the controller 60 detects an input corresponding to a depress of the learn signal button shown in step **S209** in FIG. 12a, a signal is sent to the infrared signal controlling circuit 70, using output 68 pins to instruct the infrared signal controlling circuit to enter infrared signal learning program mode. As shown in step **S300** in FIG. 14a, the controller of the infrared controlling circuit executes a learning program routine from software stored within its ROM, which includes setting to value zero and starting a programming time-out counter in a step **S301**. The signal learning program routine prepares the controller of the infrared signal controlling circuit 70 for subsequent receipt of a series of instructions. A first instruction identifies the intended appliance category, which is then followed by instructions to enter infrared signal learning mode. As indicated previously, learning remote controls are well documented in prior art, for example as disclosed in U.S. Patent Nos. 4,905,279 and 5,959,751, hereby incorporated by reference. The controller of the infrared controlling circuit illuminates red light-emitting diode 52d in different manners to communicate the status of the signal learning process to the user during this programming mode.

The speech recognizing circuit controller 60 executes code stored in ROM 61 to enter a response prompting recognition mode for appliance category selection

5 shown in step S302. The speech recognition circuit 50 software executes a response prompting routine and activates the appliance category name recognition vocabulary set as shown in step S303. As defined previously for speech recognition modes, a time-out counter is set to zero and started in a step S304 when the response prompting recognition mode is activated. The user is then expected to select a voice command from the
10 appliance category name recognition set and respond when prompted by a speech synthesis prompt, an audio sound and/or the illumination of a green light emitting diode 52a as shown in a step S305. As indicated previously, the appliance category name recognition set may be comprised of such voice command options as “television,” “video,” “satellite,” and “cable” among which the user may select.

15 Following the prompting of the user, the software enters a pattern generating mode in a step S306, waiting for a voice command to be detected. If a maximum allowed time-out value TMAXD is attained before a voice command is detected, the software will terminate the response prompting routine and return to a default continuous listening recognition mode, and the programming time-out counter is allowed to expire as shown in step S292 as shown in FIG. 13c. Until time TMAXD
20 has expired, the speech recognition circuit remains available to generate a pattern when a voice command is detected as shown in steps S306, S307 and S308. If a voice command is detected in a step S308, a pattern is generated in a step S309 and submitted for pattern recognition processing in a step S310.

25 During step S310 the acquired unknown pattern is analyzed by the speech recognition circuit controller 60, utilizing a recognition algorithm stored in its ROM 61, to determine if it can be classified as a match with any of the reference commands within the active recognition vocabulary set and if the likelihood of correctly recognizing the unknown pattern exceeds a predetermined threshold. The result of this comparison
30 is identified in a step S311.

If a match for the acquired pattern is not identified, the red light-emitting diode 52c illuminates briefly to provide a visual indicator to the operator that no match was identified and the value of the recognition time-out counter is reset to the value zero and restarted as shown in a step S304. The green light-emitting diode 52a is then

5 activated and remains illuminated as shown in step S305 and the speech recognition circuit 50 executes software to enter a pattern generating mode, returning to a step S306 and waiting for a voice command to be detected. As previously indicated, until time TMAXD has expired, the speech recognition circuit remains available to generate a pattern when a voice command is detected as shown in steps S306, S307 and S308.

10 If a match for the acquired pattern is identified in a step S311, the speech recognition circuit 50 software identifies the instruction associated with the matching recognition vocabulary set command, and issues a prompt, which may be a speech synthesis prompt, an audio sound or light-emitting diode indication, in a step S312 to identify the appliance category name recognized. The speech recognition circuit 50 then
15 outputs a signal to the infrared controlling circuit 70, using output 68 pins to communicate the appliance category selection command in a step S313. The infrared controlling circuit 70 receives the signal and responds by making the memory section associated with the appliance category selected available for access in a step S314. The infrared controlling circuit 70 then sets equal to value zero and restarts the programming time-out counter in a step S317.

20 Following the submission of a signal to the infrared signal controlling circuit 70, the speech recognition circuit controller 60 executes software stored in its ROM 61 to enter a default recognition mode and to activate a default recognition set as shown in a step S320 in FIG. 14b. If the appliance category name identified in step S312 is incorrect, step S316 shows that the programming time-out counter is allowed to expire as shown in step S292 shown in FIG. 13c, before returning to step S204 in FIG. 12a and beginning the process again. FIG. 13c also shows that, as the programming time-out counter is allowed to expire, the time-out counter for the speech recognition circuit 50 is also allowed to expire, by reaching the value TMAXD, after which the speech
25 recognition circuit 60 executes software stored in its ROM 61 to return to a default continuous speech recognition mode.

30 As indicated above, once the appliance category is identified and communicated to the infrared signal controlling circuit 70, the speech recognition circuit controller 60 executes software stored in its ROM 61 to enter a default recognition mode

5 and to activate a default recognition vocabulary set as shown in a step S320 in FIG. 14b. This default recognition vocabulary set is made available to enable the user to navigate the recognition vocabulary structure via spoken commands to identify a command with which to associate the next infrared signal to be learned.

10 As described previously for speech recognition modes, a recognition time-out counter is set to zero and started in a step S321 when the default recognition mode is activated. The user is then expected to select a voice command from the default recognition vocabulary set and respond when a green light emitting diode 52a is illuminated as shown in a step S322. The default recognition vocabulary set may be comprised of such voice command options as "power," "channel," "change," "volume,"
15 "sound," "control" and "private" among which the user may select.

Following the prompting of the user by the illumination of a green light emitting diode 52a in a step S322, the software enters a mode where it is available for pattern generating in a step S323, waiting for a voice command to be detected. If a maximum allowed time-out value TMAXL is attained before a voice command is
20 detected, the software will terminate the speech recognition routine and return to a default continuous listening recognition mode, and the programming time-out counter is allowed to expire as shown in step S292 shown in FIG. 12c. Until time TMAXL has expired, the speech recognition circuit remains available to generate a pattern when a voice command is detected as shown in steps S323, S324 and S325. If a voice command is detected in
25 a step S325, a pattern is generated in a step S326.

As shown in a step S327, the acquired unknown pattern is analyzed by the speech recognition circuit controller 60, utilizing a recognition algorithm stored in its ROM 61, to determine if it can be classified as a match with any of the reference
30 commands within the default recognition vocabulary set and if the likelihood of correctly recognizing the unknown pattern exceeds a predetermined threshold. The result of this comparison is identified in a step S328.

If a match for the acquired pattern is not identified, the red light-emitting diode 52c illuminates briefly to provide a visual indicator to the operator that no match was identified and the value of the recognition time-out counter is reset to the value zero

5 and restarted as shown in a step S321. The green light-emitting diode 52a is then activated and remains illuminated as shown in step S322 and the speech recognition circuit 50 executes software to enter a pattern generating mode, returning to a step S323 and waiting for a voice command to be detected. As previously indicated, until time TMAXL has expired, the speech recognition circuit remains available to generate a
10 pattern when a voice command is detected as shown in steps S323, S324 and S325.

If a match for the acquired pattern is identified in a step S328, the speech recognition circuit 50 software identifies the operation associated with the matching recognition vocabulary set command in a step S329 and determines if the operation is to send an instruction to the speech recognition circuit controller 60 to activate a different
15 recognition set vocabulary or to output a signal to the infrared controlling circuit 70 using the speech recognition circuit output 68 pins. If the instruction is to activate a different recognition vocabulary set, step S330 shows that the routine returns to a step S320. The user may continue to navigate through different linked, recognition vocabulary sets until a voice command is recognized that is associated with a remote control function that is
20 associated with a read/write memory 72 location. If the operation involves sending a signal to the infrared signal controlling circuit as shown in a step S331, said signal communicates an instruction for a remote control function type that is associated with a memory location within read/write memory 72, controlled by the infrared signal controlling circuit 70. The controller of the infrared signal controlling circuit 70
25 identifies said memory location and targets this memory location for storage of an infrared code to be received as shown in a step S332.

The controller of the infrared signal controlling circuit 70 activates a red light-emitting diode 52d in a step S333 to prompt a user that it is ready to receive a transmitted infrared code and enables one or more of its input pins to detect and receive
30 signals generated by the infrared receiver 71, which is electrically connected to one or more of said input pins. For one embodiment of the invention, infrared receiver 71 is a commercially available photo IC capable of providing digital output to the controller of the infrared signal controlling circuit 70. Alternative schemes, utilizing other infrared light detecting devices with or without signal processing circuitry, may also be used as

5 the IR receiver 71. As shown in a step S334, the infrared signal is received from the IR receiver 71 of the present invention by the controller of the infrared signal controlling circuit 70 as digital data. The controller of the infrared signal controlling circuit 70 decodes and converts the received digital data into a control code format and stores the resulting control code into a memory location within read/write memory 72, controlled
10 by the infrared signal controlling circuit 70. The memory location is associated with the remote control function type associated with the recognized voice command spoken by the user.

The controller of the infrared signal controlling circuit 70 activates a red light-emitting diode 52d in a step S335 to inform the user if the infrared signal learning process was capable of successfully receiving, formatting and storing the infrared signal or not. This red light-emitting diode 52d provides prompts in different manners to distinguish between a successful learning process and a process during which an error was encountered. A successfully learned and stored infrared signal may be later transmitted by the invention while in an operation mode upon recognition of the voice command with which the learned infrared signal is associated.
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Following an attempt to learn an infrared signal, the controller of the infrared signal controlling circuit executes software stored within its ROM to reset to value zero and start the programming time-out counter, returning to a step S317 shown in FIG. 14a. Also, following the submission of a signal to the infrared signal controlling circuit 70, the speech recognition circuit controller 60 executes software stored in its ROM 61 to return to the default recognition mode and reset the value TMAXL to zero as shown in steps S331 and S320. As shown in a step S336, a user may elect to either return to the previous process steps to repeat a previously failing signal learning attempt or to attempt to learn additional infrared signals or the user may elect to allow the programming time-out counter of the infrared signal controlling circuit 70 to expire as shown in step S292 shown in FIG. 12c.
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After the time-out counters have reached their respective maximum values, the invention exits this setup programming mode and enters a default recognition mode, where it becomes available to receive spoken commands from the user and

5 respond by transmitting infrared control signals to appliances, including any infrared signals learned during a infrared signal learning setup process as described above.

VOICE TRAINING

10 If the controller 60 detects an input corresponding to a depress of the name command button shown in step S211 in FIG. 12a, a speaker dependent command voice training routine is initiated and executed by said controller as shown in a step S340 in FIG. 15. This training routine generates and stores into read/write memory 54 a user-specific reference pattern for each voice command to be included in a speaker dependent recognition vocabulary set. The speech recognition circuit controller 60 executes software stored in its ROM 61 to set to value zero and start a training program time-out counter as shown in a step S341.

15 Following the prompting of the user by a speech synthesis prompt, an audio sound and/or the illumination of a green light emitting diode 52a in a step S342, the software enters a mode where it is available for pattern generating in a step S343, waiting for a voice command to be detected. If a maximum allowed time-out value TMAXV is attained before a voice command is detected, the software will terminate the voice training as shown in step S345 and enter a default speech recognition operation mode which is described previously. Until time TMAXV has expired, the speech recognition circuit remains available to generate a pattern when a voice command is detected as shown in steps S343, S344, S345 and S346. If a voice command is detected in a step S344, a pattern is generated in a step S346.

20 One embodiment of the invention executes a speaker dependent reference pattern generation algorithm that is well known to those familiar with speech recognition art. The algorithm involves the generation of a pattern each time a voice command is spoken by a user. A pattern is a compact representation of the significant acoustic information in a voice command word or phrase. A reference pattern may be, for example, created by averaging patterns generated as the voice command is spoken two or more times. The reference pattern is then stored in a read/write memory 54. As shown in a step S347 and S348, the first pattern generated is stored into a read/write

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5 memory 54 location. The user is then prompted in a step S349 to repeat the voice command, returning to step S341 and continuing through step S346 to perform the pattern generation process for the repeated voice command.

Following the generation of the second pattern, the second pattern is then compared to the first pattern which is stored in read/write memory 54 to determine if the
10 two patterns match sufficiently to satisfy a predetermined matching criteria as shown in a step S350. If the matching criteria is not satisfied, the two patterns are determined to not match, and the first pattern generated is replaced by storing the second pattern generated into the previously identified read/write memory 54 location, and thus overwriting the first pattern. The user is then prompted in a step S349 to repeat the voice
15 command, returning to step S341 and continuing through step S346 to perform the pattern generation process for the repeated voice command. As shown by steps S341 through S350 this process cycle may be continued until two patterns are generated which are capable of meeting said matching criteria.

Once two patterns are generated which are capable of meeting said
20 matching criteria, a reference pattern is generated as shown in step S351. A pattern recognition routine is then executed to compare the resulting reference pattern to any other previously generated reference patterns within the intended recognition vocabulary set which are stored in read/write memory 54 to determine if the new reference pattern is sufficiently different than said previously generated reference patterns. This
25 comparison is performed to prevent the acceptance of similar voice commands, which may reduce the recognition accuracy rate. The comparison may calculate distance measurements of the fit of the newly generated reference pattern to the previously generated reference patterns within the intended recognition vocabulary set. The distance measurements between the newly generated reference pattern and the closest matching
30 previously generated reference pattern(s) may then be compared to a predetermined comparison criteria to determine the degree of similarity. If the newly generated reference pattern is too similar to an existing reference pattern, the newly generated reference pattern is rejected, and the user is prompted in a step S353 to select a different voice command name, returning to step S341.

5 If the newly generated reference pattern is not found to be too similar to
an existing reference pattern, the newly generated reference pattern is compressed and
stored into read/write memory 54 as shown in a step S354. In a step S355, the speech
recognition circuit controller 60 executes software stored in its ROM 61 to determine if
sufficient capacity remains in read/write memory 54 to allow additional voice commands
10 to be trained. If there is sufficient capacity in the memory 54, the system returns to step
S341, where the user is prompted to enter another voice command by a speech synthesis
prompt, an audio sound and/or the illumination of a green light emitting diode 52a. If
the user desires to exit this voice training mode, the user allows the training program
time-out counter to expire as shown in a step S356. If there is insufficient capacity in the
15 memory 54, the user is informed accordingly by a speech synthesis prompt, an audio
sound and/or the illumination of a red light emitting diode 52c and the training program
terminates.

 The contents of the read/write memory 54 may be erased by depressing
and simultaneously holding the name command button and the code button for a brief
20 period of time. Depressing and momentarily holding two predetermined
buttons on keypad 51 may cause the address pointer for the read/write memory 54 to be
set to zero, allowing any data previously stored within said memory to be overwritten
during subsequent write operations to said memory. This enables a user to effectively
“erase” this memory and store different data in a form of speech command reference
25 pattern data and macro program instruction data.

 The read/write memory 54 utilized in the preferred embodiment of the
present invention may be a commercially available I²C™ Serial EEPROM, for example
a model number 24LC64 available from MicroChip Technology Inc. and described in a
data sheet entitled; 24AA64/24LC64 64K I²C™ CMOS Serial EEPROM, document
30 number DS21189C published by MicroChip Technology Inc. copyright 1999, pages 1-
12, available from MicroChip Technology Inc., hereby incorporated by reference. When
the two said buttons are simultaneously depressed, two input pins 68 of IC 55 which are
electrically connected to said buttons are brought to a logical low state. The software
stored in ROM 61 of the speech recognition circuit 50 executes a program which detects

5 this condition and responds by setting the address pointer for the next available address
location for memory 54 to value zero and storing this value in the predetermined address
pointer location of said memory 54. The next attempt by the speech recognition circuit
software to store data to said memory 54 will retrieve the value of the address pointer for
10 the next available location from said predetermined location within memory 54, and
interpret the value zero as an instruction to begin storing data in the first address
configured to accept data.

MACRO PROGRAMMING

15 If the controller 60 detects an input corresponding to a depress of the
macro button shown in step S213 in FIG. 12a, a macro programming routine is initiated
and executed by said controller as shown in a step S360 in FIG. 16a. As indicated in a
step S361, the system executes an appliance category selection routine as described in
step S220 in FIG. 12b to identify the appliance category from which the macro will be
20 activated when the macro name is later recognized by the speech recognition circuit 50
as a voice command. If the appliance category name identified during the execution of
the appliance category selection routine is incorrect, step S362 shows that the user may
elect to press the setup button, returning to step S204 in FIG. 12a and begin the process
again.

25 If the appliance category name identified during the execution of the
appliance category selection routine is correct, the user allows the software routine to
continue. A step S362 shows that the software enters a speaker dependent recognition
mode in a step S363 and a speaker dependent recognition vocabulary set is activated in
a step S364. The speaker dependent recognition vocabulary set activated may contain
30 one or more macro names, and possibly other speaker dependent voice commands for
non-macro uses, previously trained by the user in accordance with the process steps
described in FIG. 15. The speech recognition circuit controller 60 executes software
stored in its ROM 61 to set to value zero and start a recognition time-out counter as
shown in a step S365.

5 Following the prompting of the user by a speech synthesis prompt, an audio sound and/or the illumination of a green light emitting diode 52a in a step S366, the software enters a mode where it is available for pattern generating in a step S367, waiting for a voice command to be detected. If a maximum allowed time-out value TMAXM is attained before a voice command is detected, the software will terminate the macro programming routine as shown in step S368 and the user may elect to press the setup button, returning to step S204 in FIG. 12a and begin the process again. Until time TMAXM has expired, the speech recognition circuit remains available to generate a pattern when a voice command is detected as shown in steps S367, S368, and S369. If a voice command is detected in a step S369, a pattern is generated in a step S370 and submitted for pattern recognition processing in a step S371.

10 During step S371 the acquired unknown pattern is analyzed by the speech recognition circuit controller 60, utilizing a recognition algorithm stored in its ROM 61, to determined if it can be classified as a match with any of the reference commands within the active recognition vocabulary set and if the likelihood of correctly recognizing the unknown pattern exceeds a predetermined threshold. The result of this comparison is identified in a step S372.

15 If a match for the acquired pattern is not identified a red light-emitting diode 52c illuminates briefly to provide a visual indicator to the operator that no match was identified in a step S373 and returns to step S365 to set to value zero and start a recognition time-out counter. The software then re-enters a mode where it is available for pattern generating, waiting for a voice command to be detected. As previously indicated, until time TMAXM has expired, the speech recognition circuit remains available to generate a pattern when a voice command is detected as shown in steps S367, S368 and S369.

20 If a match for the acquired pattern is identified in a step S372, the speech recognition circuit 50 software identifies a read/write memory 54 location associated with the matching recognition vocabulary set command in a step S374. Said memory 54 location is used to store the sequence of commands instructions to be associated with the macro name identified by the preceding voice command. As shown in a step S375, the

5 software executed by the speech recognition circuit controller 60 then activates the default recognition mode associated with the appliance device type previously selected.

As indicated previously, once the macro name is identified, the speech recognition circuit controller 60 executes software stored in its ROM 61 to enter a default recognition mode and to activate a default recognition vocabulary set as shown in a step S381 in FIG. 16b. This default recognition vocabulary set is made available to enable the user to navigate the recognition vocabulary structure via spoken commands to identify a voice command for which the associated instruction is to be stored within the read/write memory 54 location associated with said macro name voice command.

As described previously for speech recognition modes, a recognition time-out counter is set to zero and started in a step S382 when a recognition mode is activated. The user is then expected to select a voice command from the default recognition vocabulary set and respond when prompted by a speech synthesis prompt, an audio sound and/or the illumination of a green light emitting diode 52a as shown in a step S383. As also indicated previously, the default recognition vocabulary set may be comprised of such voice command options as "power," "channel," "change," "volume," "sound," "control" and "private" among which the user may select.

Following the prompting of the user by the illumination of a green light emitting diode 52a in a step S383, the software enters a mode where it is available for pattern generating in a step S384, waiting for a voice command to be detected. If a maximum allowed time-out value TMAXM is attained before a voice command is detected, the software will return to a known default continuous listening recognition mode and the user may continue generating the macro as shown in step S385. Until the time TMAXM has expired, the speech recognition circuit remains available in the active recognition mode to generate a pattern when a voice command is detected as shown in steps S384, S385 and S386. If a voice command is detected in a step S386, a pattern is generated in a step S387.

As shown in a step S388, the acquired unknown pattern is analyzed by the speech recognition circuit controller 60, utilizing a recognition algorithm stored in its ROM 61, to determine if it can be classified as a match with any of the reference

5 commands within the active recognition vocabulary set and if the likelihood of correctly recognizing the unknown pattern exceeds a predetermined threshold. The result of this comparison is identified in a step S389.

10 If a match for the acquired pattern is not identified, the red light-emitting diode 52c illuminates briefly to provide a visual indicator to the operator that no match was identified as shown in a step S390 and the value of the recognition time-out counter is reset to the value zero and restarted as shown in a step S382. The green light-emitting diode 52a is then activated and remains illuminated as shown in step S383 and the speech recognition circuit 50 executes software to enter a pattern generating mode, returning to a step S384 and waiting for a voice command to be detected. As previously described, 15 until the time-out counter value of the currently active recognition mode reaches its respective maximum value, the speech recognition circuit remains in the active recognition mode available to generate a pattern when a voice command is detected as shown in steps S384, S385 and S386.

20 If a match for the acquired pattern is identified in a step S389, the speech recognition circuit 50 software identifies the operation associated with the matching recognition vocabulary set command in a step S391 and determines if the operation is to send an instruction to the speech recognition circuit controller 60 to activate a different recognition set vocabulary or to output a signal to the infrared controlling circuit 70 using the speech recognition circuit output 68 pins. If the instruction is to activate a different 25 recognition vocabulary set, step S391 shows that the routine returns to a step S380 to enter the appropriate recognition mode and activate the recognition vocabulary set associated with the recognized voice command in step S381. The user may continue to navigate through different linked, recognition vocabulary sets until a voice command is recognized that is associated with an instruction to output a signal to the infrared 30 controlling circuit 70.

If a voice command is recognized that is associated with an instruction to output a signal to the infrared controlling circuit 70, the associated instruction is stored within the read/write memory 54 location associated with said macro name voice command as shown in a step S392. In the memory 54 location sequentially following

5 the memory location where the instruction is stored, an end marker instruction may be automatically stored by the speech recognition circuit 50 software as shown in step S393. The user must then determine if this is the last instruction to be added to the macro program or not. If another instruction is to be added, the user must determine if it is desirable to insert a time delay between the execution of the currently identified
10 instruction and a following macro instruction to be selected. As shown in a step S394, if the insertion of a time delay is desirable, the user may depress a keypad 51 designated as a time delay button one or more times, where each button depress increases the length of the time delay by a brief period (typically 0.5 seconds or less) by storing one or a series of time delay instructions within the read/write memory 54 location associated
15 with said macro name voice command as shown in a step S395. The time delay instructions are stored into said memory 54 location in a section sequentially following the section of the instruction previously identified via voice command.

If the user determines that another instruction is be added to the macro program, then the user depresses the macro button as shown in a step S396, the software
20 returns to a step S375 shown in FIG. 16a, and the software executed by the speech recognition circuit controller 60 then activates the default recognition mode associated with the appliance device type previously selected. As indicated previously, this default recognition vocabulary set is made available to enable the user to navigate the recognition vocabulary structure via spoken commands to identify another voice
25 command for which the associated instruction is also to be stored within the read/write memory 54 location associated with said macro name voice command.

Each additional instruction added to a macro is stored in the same memory 54 location as that of the previously stored end marker instruction, which was stored by the software after the previous macro instruction was stored, thus over-writing the end
30 markers. This process for adding instructions to said memory location 54 associated with said macro continues until the user determines the last instruction has been identified via voice command. At this time, the user depresses a keypad 51 button designated as a program completion button as shown in a step S397 to instruct the speech recognition circuit controller 60 to execute software stored in its ROM 61 terminate the macro

5 programming routine and enter the default recognition mode associated with the previously identified appliance category as shown in step S398.

The macro program resulting from this process is stored in a read/write memory 54 location comprised of multiple, sequential bytes of memory. Each byte may contain an instruction to output a signal to the infrared controlling circuit 70, an instruction to execute a time delay, or an instruction in the form of an end marker to
10 instruct the speech recognition circuit controller 60 software that the last macro instruction has been retrieved. When a macro name is spoken by a user and recognized by the speech recognition circuit controller 60 software, said software retrieves and sequentially executes each of the instructions stored within the read/write memory 54
15 location associated with said macro name in the same order which the instructions were stored.

Within this macro programming software routine, the use of keypad 51 buttons other than the macro button, such as the code button and signal learning button, may be used for such functions as time delay insertion and end marker insertion into the
20 macro sequence. This approach allows for a reduction of the required button count, and is particularly useful for such relatively infrequently used functions as those identified above.

Reference is made to FIG. 17 which shows the power supply circuit 90 in greater detail than that shown in FIG. 1. This circuit is described previously in the
25 section describing the process steps of FIG. 12a.

DESCRIPTION OF OPERATION

Once successfully setup, the present invention typically remains in a sound activation mode until sound pressure exceeding a defined threshold (sound
30 activation sensitivity setting) initiates a "wake up" event. Once the oscillator is started and stabilized, the system enters a continuous listening default recognition mode awaiting detection and recognition of one of the default menu words associated with a selected target appliance.

5 Control functions for the target appliance can then be activated via voice
commands. Once an appliance has been selected, its default menu remains the active
recognition vocabulary set until changed by the user. Voice commands may then be
selected from the available recognition vocabulary set. The vocabulary options made
available by the default menu vary depending upon the category of the appliance selected
10 (for example, a VCR may have different options available than a TV). Voice commands
may instruct the invention to initiate a control signal to the target appliance or activate
a function sub-menu in the form of a different recognition vocabulary set (which may
include access, for example, to different appliance control functions, macro functions,
speaker dependent commands or device selection commands).

15 The unit then remains in a continuous listening default recognition mode
for a defined period of time or until a defined number of consecutive unsuccessful
recognition attempts occur, whichever occurs first. If any default menu word is
recognized, the invention executes the appropriate command. If no default menu words
are recognized, the unit returns to sound activation mode. Upon returning to default
20 recognition mode from sound activation mode, the software remains in default
recognition mode until a defined period of time where no recognition (successful)
activity has elapsed after the last recognized command (a "user settling period") or until
a defined number of consecutive unsuccessful recognition attempts occur, whichever
occurs first.

25 When in a continuous listening default recognition mode, a green LED
52a remains illuminated to provide a visual cue to the user when the device is ready to
receive commands for recognition and a red LED 52c will illuminate when unavailable.
Following activation from sound activation mode, the invention returns to the default
menu of the most recently selected appliance.

30 **Default Menu Vocabulary for a Television:**

5 As an example, Table 1 below identifies seven words comprising a default menu recognition vocabulary set available for a television. Fig. 5 shows the process steps associated with the software executed during this mode.

If the speaker independent command "*Power*" is recognized, the invention transmits the IR signal for the Power command, turning the currently controlled
10 appliance on or off.

Recognition Vocabulary - Television

15	Power	Channel	Change	Volume	Sound	Control	Private
----	-------	---------	--------	--------	-------	---------	---------

Table 1

Table 2 below identifies words (digit names) comprising a channel number recognition vocabulary set. If the word "*Channel*" is recognized, a pattern queuing routine is initiated, as shown in FIG. 9, and makes the following speaker independent sub-menu available for recognition:

Recognition Vocabulary- Television

25	Power	Channel	Change	Volume	Sound	Control	Private
		Zero					
		One					
		Two					
30		Three					
		Four					
		Five					
		Six					
		Seven					
35		Eight					
		Nine					

5

Table 2

The green LED 52a then prompts a user to say a digit name. After detecting the first digit, the invention's green LED 52b then quickly prompts the user for another digit name. In one embodiment of the invention, the routine prompts the user for up to 3 digit names. If a second digit (or third) is not detected within a predetermined period of time, the invention performs the speech recognition process and transmits the IR signal(s) associated with any recognized channel number names and returns to the default recognition mode.

10

15

Table 3 below identifies words comprising a directional channel changing recognition vocabulary set. If the word "**Change**" is recognized, the invention enters a response prompting recognition mode as shown in FIG. 8 and the following speaker independent sub-menu is made available for recognition:

20

Recognition Vocabulary - Television

Power	Channel	Change	Volume	Sound	Control	Private
		Up				
		Down				
		Back				

25

Table 3

"**Up**" and "**Down**" are instructions to advance forward or in reverse order to the next sequentially available channel number, respectively. "**Back**" is an instruction to return to the channel number established prior to the current channel number.

30

If the words "**Up**," "**Down**" or "**Back**" are recognized, the invention transmits the associated IR signal associated with the indicated channel directional change and awaits, for a predetermined period of time, for another Up/Down/Back command before returning to the default menu recognition mode. This sequence continues until no Up/Down/Back commands are recognized within said predetermined

35

5 period of time of a previous command, at which time the software returns to the default menu recognition mode.

Table 4 identifies words comprising the volume changing recognition vocabulary set. If the word "*Volume*" is recognized, the invention enters a response prompting recognition mode as shown in FIG. 8 and the following speaker independent sub-menu is made available for recognition:

Recognition Vocabulary - Television

Power	Channel	Change	Volume	Sound	Control	Private
			Up			
			Down			

Table 4

20 "*Up*" and "*Down*" are instructions to increment or decrement the volume level, respectively. If the words "*Up*" or "*Down*" are recognized, the invention transmits the associated IR signal associated with the indicated volume level change and awaits, for a predetermined period of time, for another Up/Down command before returning to the default menu recognition mode. This sequence continues until no Up/Down commands are recognized within said predetermined period of time of a previous command, at which time the software returns to the default menu recognition mode.

25 Table 5 below identifies a word in the default recognition vocabulary for the muting function. If the word "*Sound*" is recognized, the invention transmits the IR signal for the muting command and returns to default recognition mode.

Recognition Vocabulary- Television

Power	Channel	Change	Volume	Sound	Control	Private
-------	---------	--------	--------	-------	---------	---------

Table 5

30 Table 6 below identifies the words comprising the device selection/control recognition vocabulary set. If the word "*Control*" is recognized, the invention enters a

5 response prompting recognition mode as shown in FIG. 8 and the following speaker independent sub-menu is made available for recognition:

10

Recognition Vocabulary - Television	
Power	Channel Change Volume Sound Control Private
	Television
	Video
15	Satellite
	Cable Box
	Switch
	Power ...

Table 6

20 If the words "*Television*," "*Video*," "*Satellite*" or "*Cable Box*" are recognized, the invention makes the specified appliance type available for subsequent control.

If the word "*Switch*" is recognized, the invention transmits an IR signal associated with the "TV/Video" switching function and returns to the default recognition mode.

25 If the word "*Power*" is recognized, the software returns to response prompting recognition mode, awaiting a repeat of this command to ensure the invention is not accidentally powered down. If a second word "*Power*" is recognized, the invention utilizes a speech recognition circuit 50 input/output 68 pin to activate a switch 93 to disconnect the power source from the power supply circuit 90. Manually depressing a

30 power button is required to re-activate the invention.

Table 7 below indicates how a speaker dependent vocabulary recognition set sub-menu may be accessed if speaker dependent vocabulary words have previously been trained. If the word "*Private*" is recognized, the software enters speaker dependent recognition mode and makes a recognition vocabulary set containing speaker dependent

35 function names, device names and macro names available for recognition. It should be noted that this recognition vocabulary set remains empty until the user has entered speaker dependent names via the voice training setup process shown in FIG. 15. The

5 recognition of any speaker dependent voice command causes the software to execute the instruction(s) associated with the recognized command, including the transmission of any associated IR signals, and remain in speaker dependent recognition mode awaiting another command from this recognition vocabulary set. If no words are detected for a predetermined period of time or if a predetermined number of consecutive recognition error occur, the software automatically returns to a continuous listening default recognition mode, awaiting speaker independent commands.

15 **Recognition Vocabulary - Television**

Power	Channel	Change	Volume	Sound	Control	Private	
							Custom Name 1
							Custom Name 2
							etc.
							Macro Name 1
							Macro Name 2
							etc.

20
25
Table 7

30 **Default Menu Vocabulary for Video:**

In addition to the default recognition vocabulary set commands available for a *“Television,”* the device selection of *“Video”* (VCR, DVD, etc.) may also make voice commands named *“Play,” “Stop,” “Pause,” “Record,” “Rewind”* and *“Fast Forward”* available. If any of these are recognized, the invention transmits the IR signal associated with the indicated function and returns to continuous listening default recognition mode. The voice command *“Record”*, however, is an exception. If the word *“Record”* is recognized, the software returns to recognition mode awaiting a repeat of this command to ensure there is no unintentional recording onto the media within the VCR or other such device.

5

Macros:

As described previously, a user has the option of creating one or more macros, where a single speaker dependent word command may produce a series of infrared signal transmissions to one or more target appliances. For example, the voice command "**HBO**" may generate infrared signals for digits "1," "2," and "3," causing the TV to change to channel number "123." FIG. 16a and FIG. 16b describe the macro programming process in detail.

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Obviously, many modifications and variations of the present invention are possible in light of the above teachings. Thus, it is to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically described above. For example, the circuitry and related software disclosed herein may be otherwise integrated and/or combined differently than represented by the embodiments of this invention. For example, one such alternate approach may involve providing direct electrical connections between predetermined speech recognition circuit IC output pins 68 and remote control controller IC 76 input pins. For this example, software executed by the speech recognition circuit 50 may emulate the signals output by the output pins of a conventional remote control controller when one of its keypad buttons are depressed, whereby the remote control controller output pins are generally electrically connected to remote control controller input pins. Other approaches may integrate the features of this invention differently than disclosed therein into one or more microcontrollers, processors, digital signal processors (DSP), application-specific integrated circuits (ASIC) and the like.

30

In addition, the hands-free voice-operated remote control transmitter software is not limited to executing a speaker independent, continuous listening default recognition mode. For example, a setup process may be provided where a user is prompted to train speaker dependent words in a manner which would generate a speaker dependent vocabulary structure similar to the speaker independent vocabulary structure disclosed for the present invention.

5 Furthermore, the software executed by the present invention may be adapted to guide a user through controlled appliance setup processes, for example programming a VCR with or without VCR-PLUS® capability to record a televised program, in a prompt -driven manner.

10 Moreover, sound-activation circuitry utilized by the present invention is not limited to use of inverting Schmitt trigger circuits. Similar circuitry capable of performing amplification and comparator operations, such as that based upon one or more operational amplifiers, may also be used. Furthermore, the mode of activation of the present invention is not limited to sound activation. Similar schemes, for example, such as those utilizing light detection circuitry or motion detection circuitry may also be
15 used.

5

CLAIMS

1. A voice actuated control system for controlling appliances comprising:

a microphone for receiving audio signals;

10 a speech recognition system for receiving audio signals; said speech recognition system having a low power sound activation mode for detecting the presence of audio signals and a speech recognition mode for decoding said audio signals and generating control signals for controlling one or more appliances, said speech recognition system including a circuit for switching between said sound activation mode and a speech recognition mode as a function of the amplitude of said
15 audio signals; and

an appliance control circuit which includes a transmitter, said appliance control unit for receiving said control signals from said speech recognition system and generating and transmitting an appliance control signal to a selected appliance.

20

2. The voice actuated system as recited in claim 1, wherein said transmitter is configured to wirelessly transmit appliance control signals to said selected appliance

3. The voice actuated system as recited in claim 2, wherein said transmitter is an infrared transmitter.

25

4. The voice actuated system as recited in claim 2, wherein said transmitter is an RF transmitter.

5. A voice actuated control system for controlling one or more appliances, the control system comprising:

30 a microphone for receiving audio signals and converting said audio signals to electrical signals;

5 an audio circuit for receiving said electrical signals from said
microphone and coupling said microphone to a sound activation circuit in one or
more modes including a sleep mode and a speech recognition mode;

10 a sound activation circuit coupled to said microphone in a sleep mode
configured to detect when electrical signals from said microphone exceed a
predetermined threshold and generate a wake-up signal to said speech recognition
circuit, causing circuit to switch to said speech recognition circuit, and;

15 a speech recognition circuit having one or more modes of operation
including a speech recognition mode for generating first control signals when the
electrical signals from said microphone represent one or more predetermined
command signals or alternatively generating a sleep signal to cause said audio circuit
to return to sleep mode after a predetermined time period when no command signals
are detected; and

20 an appliance control circuit for receiving said first control signals from
said speech recognition circuit and generating second control signals to cause the
appliance to perform the desired command.

6. The control system as recited in claim 5, wherein the appliance
control unit is configured to wirelessly transmit said second control signals to said
select appliance.

25 7. The control system as recited in claim 6, wherein said second
control signals are RF signals.

8. The control system as recited in claim 7, wherein said second
control signals are infrared signals.

9. A voice-activated control system for controlling one or more
selected appliances, the control system comprising:

30 a voice recognition system for receiving representative voice signals
and converting said representative voice signals to one or more command signals for

5 controlling one or more selected appliances, the voice recognition system including a plurality of linked speech recognition vocabulary sets.

10. The voice activated control system as recited in claim 9, wherein at least one of said linked speech vocabulary sets is speaker dependent.

10 11. The voice activated control system as recited in claim 9, wherein at least one of said linked speech vocabulary sets is speaker independent.

12. A voice recognition control system for controlling appliances, the control system comprising:

a microphone for receiving audio signals;

15 a speech recognition system for receiving audio signals from said microphone and converting said audio signals to control signals for controlling a selected appliance, the speech recognition system having a sound activation low power mode for detecting the presence of audio signals; a speech recognition mode for decoding said audio signals and generating control signals and generating control signals for controlling an appliance; and a mute mode for the selected appliance in
20 order to reduce background noise.

13. The voice recognition control system as recited in claim 12, wherein said voice recognition system is configured to enable said MUTE mode by way of a voice command.

25 14. The voice recognition system as recited in claim 12, wherein said MUTE mode include a plurality of submodes

15. The voice recognition system as recited in claim 14, wherein one of said submodes is an OFF mode.

30 16. The voice recognition system as recited in claim 14, wherein one of said submodes is an automatic muting mode for muting an appliance in order to reduce the background noise.

5 17. The voice recognition system as recited in claim 14, wherein one
of said submodes is a recognition error muting mode for automatically muting an
appliance upon detection of one or more types of recognition errors.

18. A voice activated control system for controlling one or more
selected appliances, the control system comprising;

10 a voice recognition system for receiving representative voice signals
and converting said representative voice signals to one or more command signals for
controlling one or more selected appliances, the voice recognition system including a
command signal receiver and memory for receiving and storing command signal data
to be associated with said representative voice signals.

15 19. The voice activated control system as recited in claim 18, wherein said
command signal receiver is configured as an infrared signal receiver.

20. The voice recognition system in claim 16, wherein said automatic muting
mode includes automatic mute canceling for an appliance.

20 21. A voice activated control system for controlling one or more selected
appliances, the control system comprising;

a voice recognition system for receiving representative voice signals and
converting said representative voice signals to one or more command signals for
controlling one or more selected appliances, the voice recognition system including a
pivotally adjustable directional microphone for positioning said microphone.

25 22. The voice activated control system as recited in claim 5, wherein said
predetermined threshold level of said sound activation circuit is user-adjustable.

5 **HANDS-FREE, VOICE-OPERATED REMOTE CONTROL TRANSMITTER**

Abstract

 A wireless, programmable, sound-activated and voice-operated remote control transmitter can be used to add hands-free speech control operation to a plurality of remotely controlled appliances manufactured by various manufacturers, each of which is normally controlled with one or more signals from an associated remote control transmitter. The present invention may be pre-programmed with a universal library of codes for controlling various appliance categories and appliances produced by various manufacturers within each category. The present invention may also be programmed using the controlled appliances' remote control transmitters and one or more operators' spoken commands. Once programming is complete, there is no need for the operator to manually operate the present invention, allowing true hands-free voice control of the remotely controlled products. The programmable transmitter structure includes means for independently aligning the output signal transmitter and voice input microphone with the remotely controlled appliance and the operator, respectively. Voice commands are organized into a plurality of linked recognition vocabulary sets, each representing a subset of the complete voice command vocabulary available. These subsets are structured in a fashion that is intuitive to the user because the structure is consistent with controlled appliance operation. The invention discloses a scheme by which a user can easily navigate via voice commands between recognition sets to attain access to the intended voice commands.

10

15

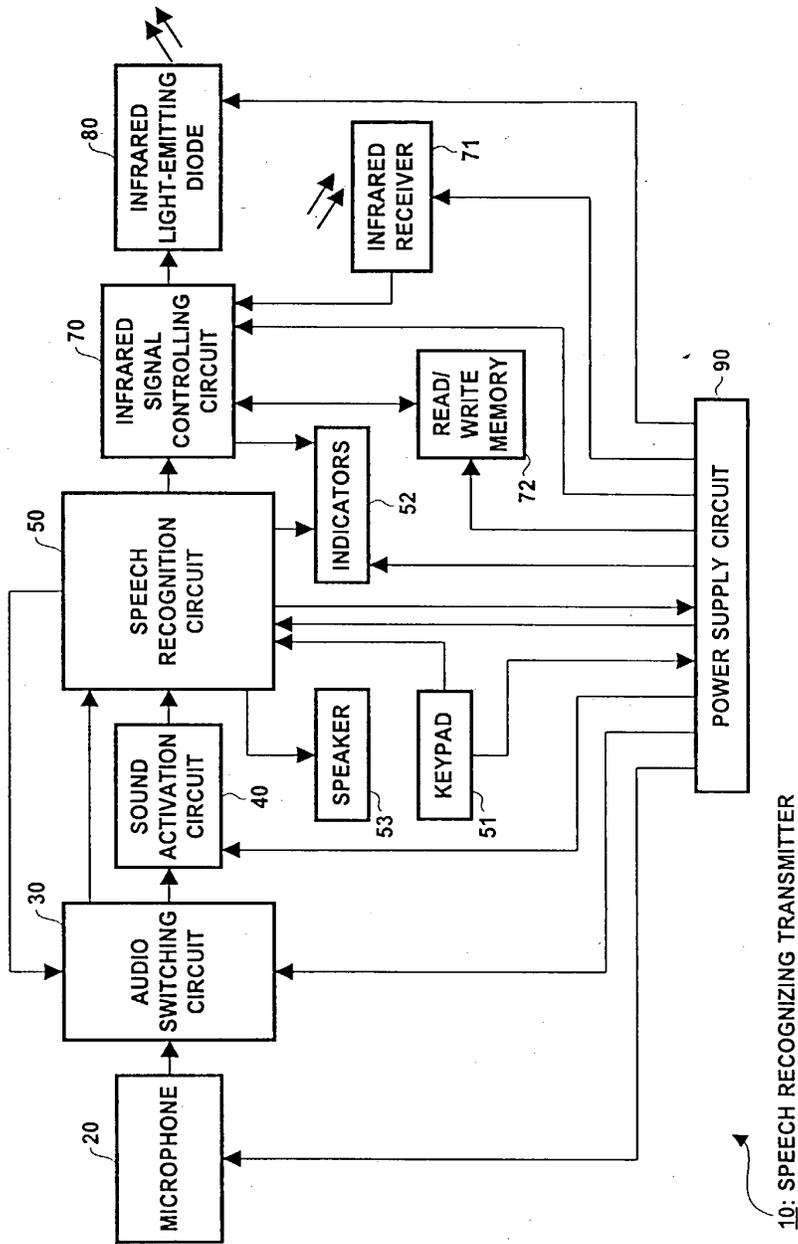
20

25

20728924

Doc #:CHI01 (211548-00001) 20728924v1.6/21/2002/Time:11:04

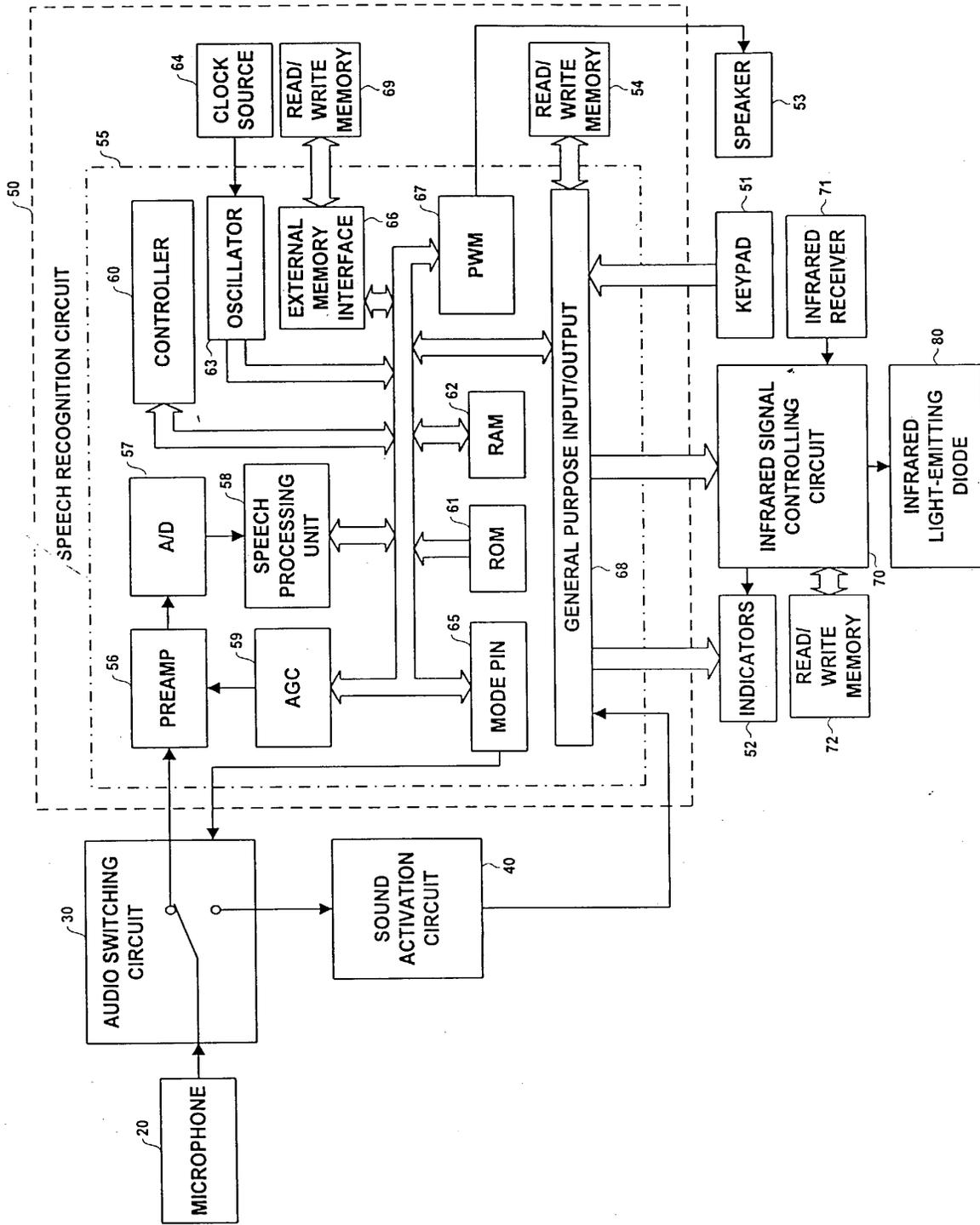
FIG. 1



10/168935, 01/27/03

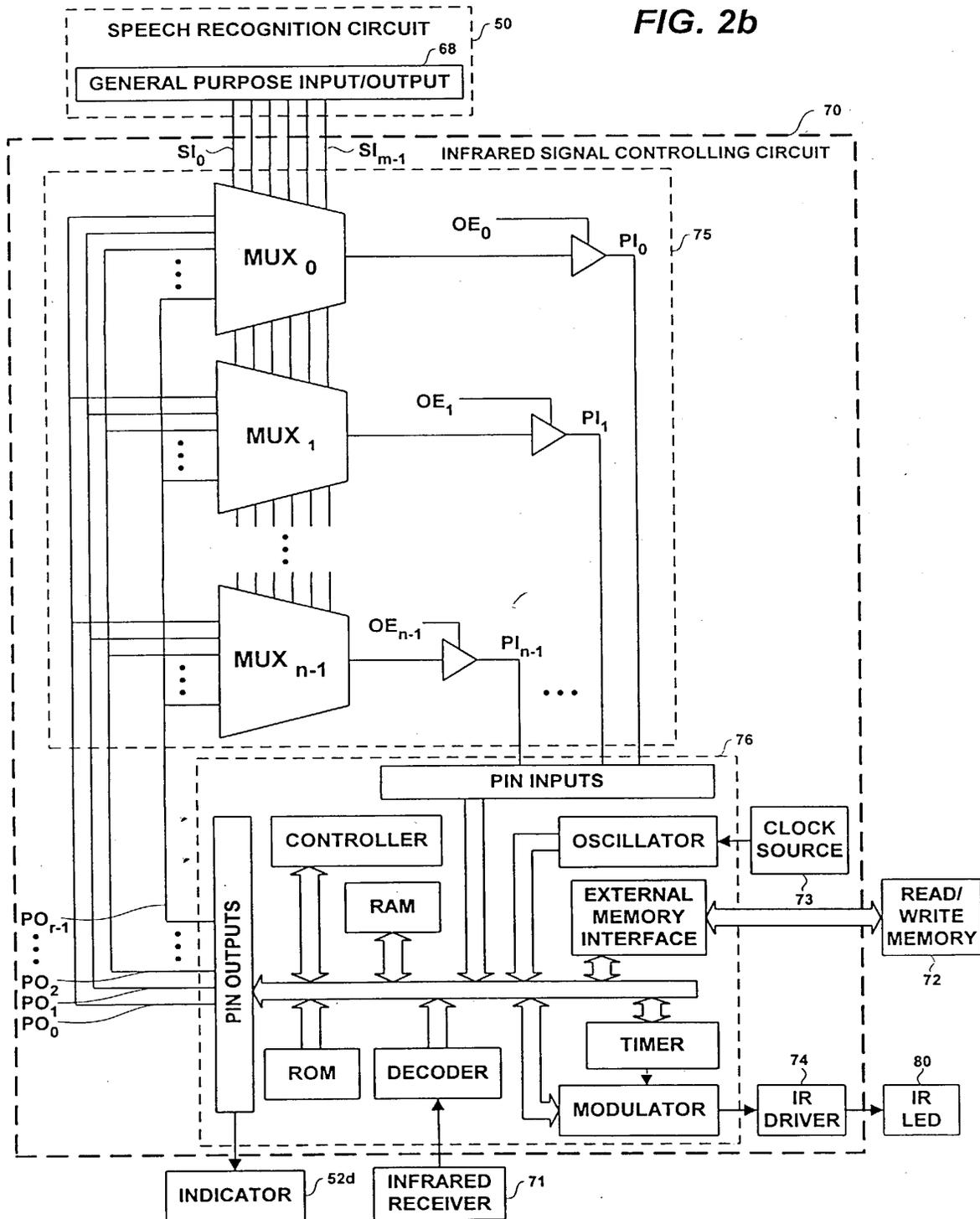
10: SPEECH RECOGNIZING TRANSMITTER

FIG. 2a



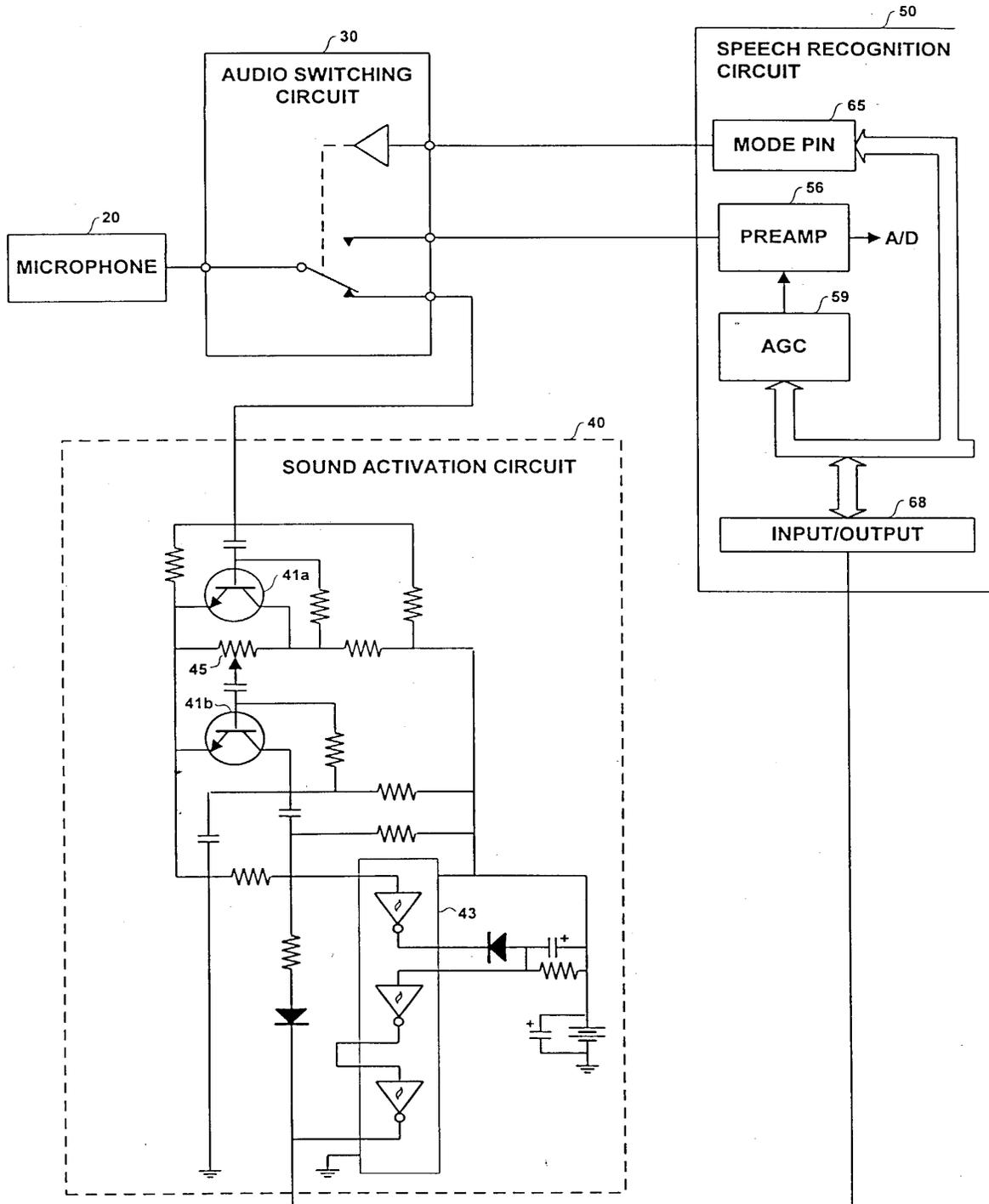
10/168935 . 012703

FIG. 2b



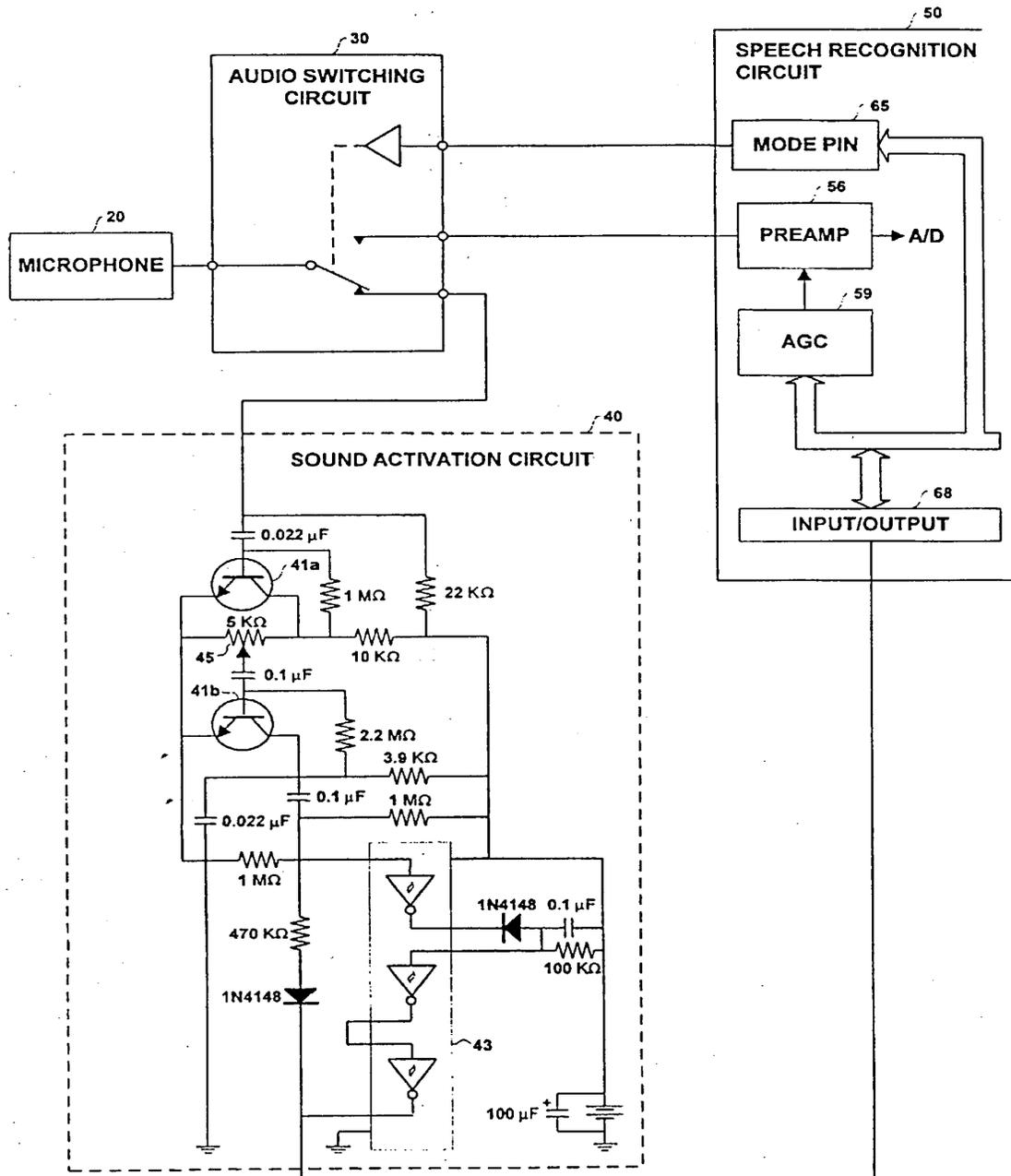
4/30

FIG. 2c



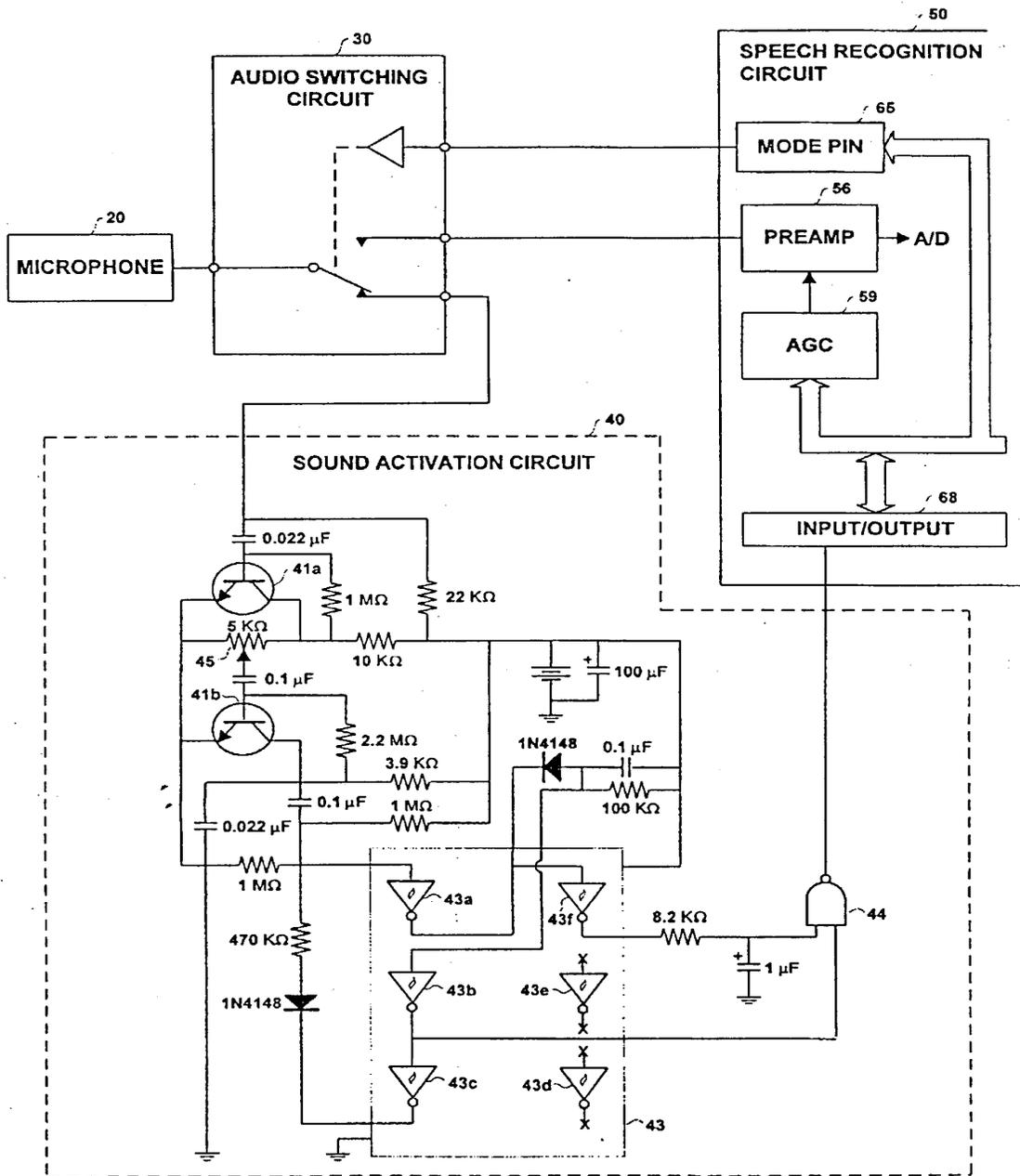
5/30

FIG. 2d



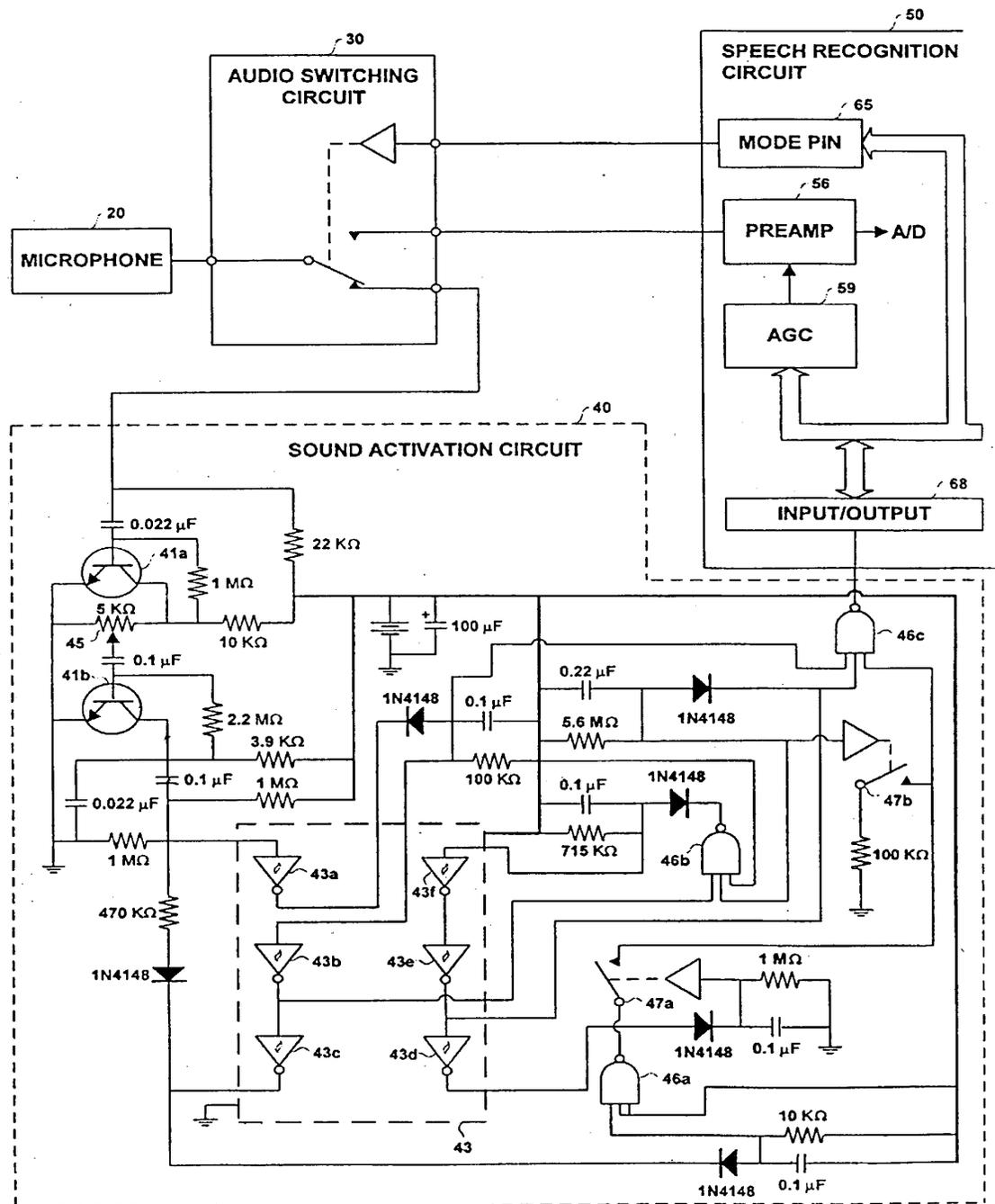
6/30

FIG. 2e



7/30

FIG. 2f



8/30

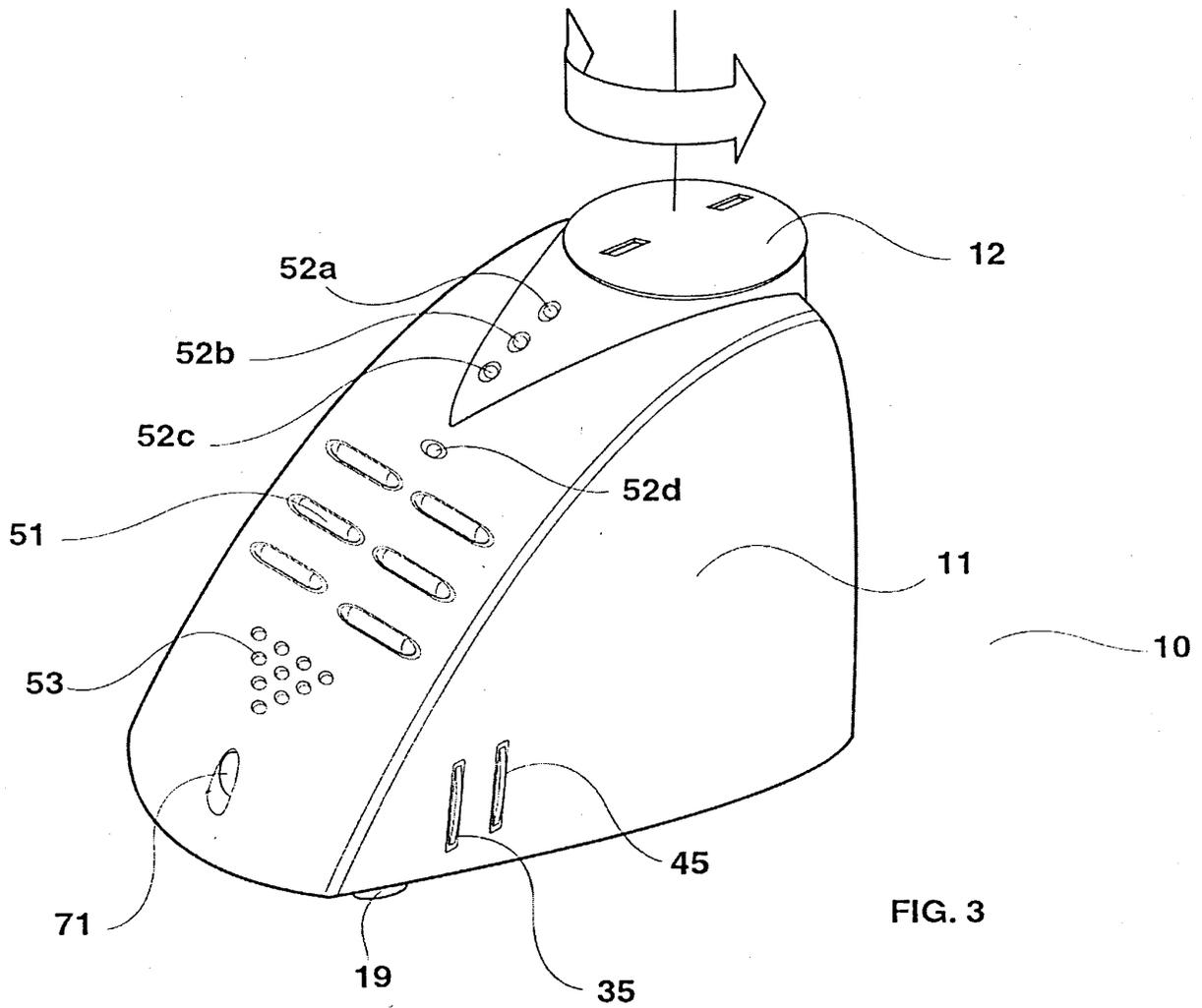
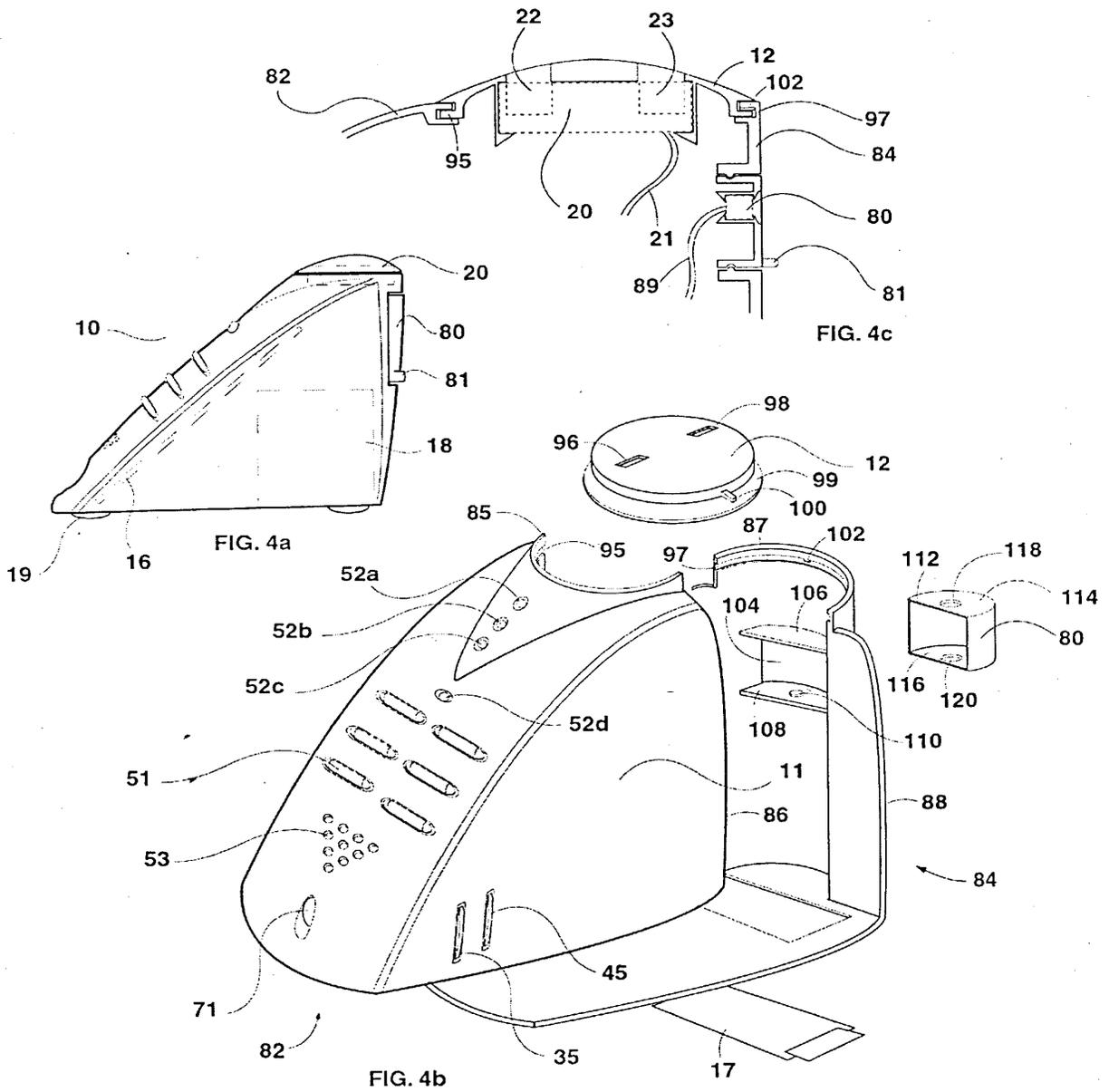


FIG. 3

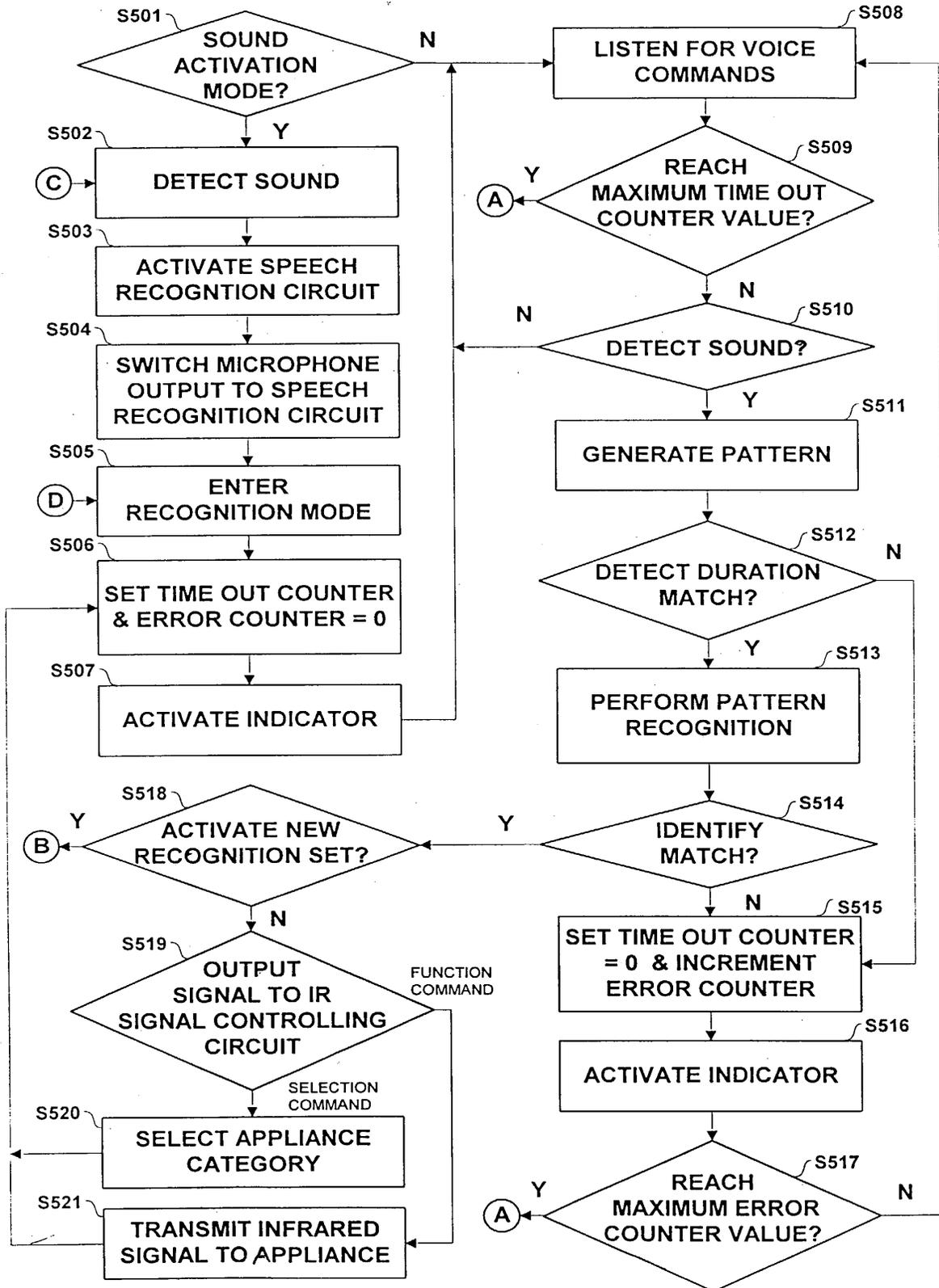
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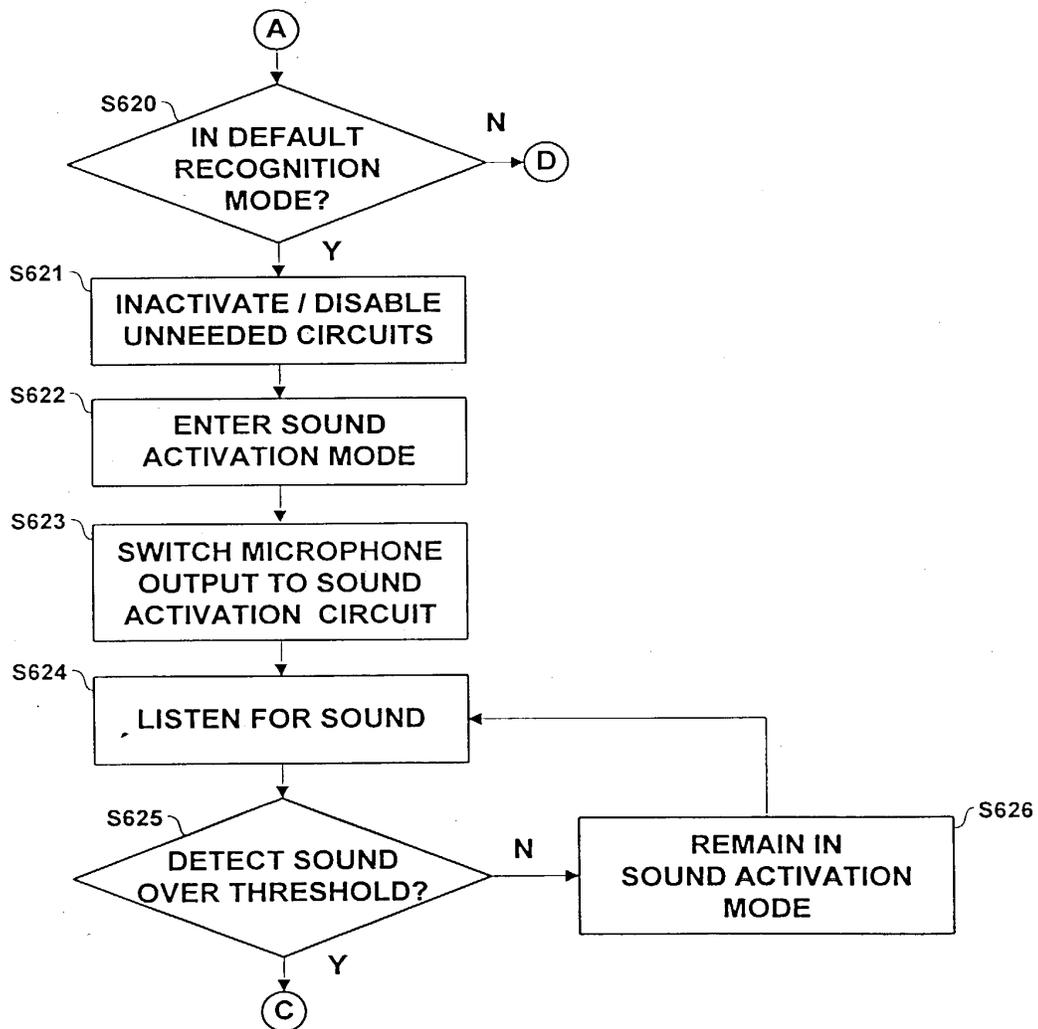
10/168935

FIG. 5



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FIG. 6



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FIG. 7

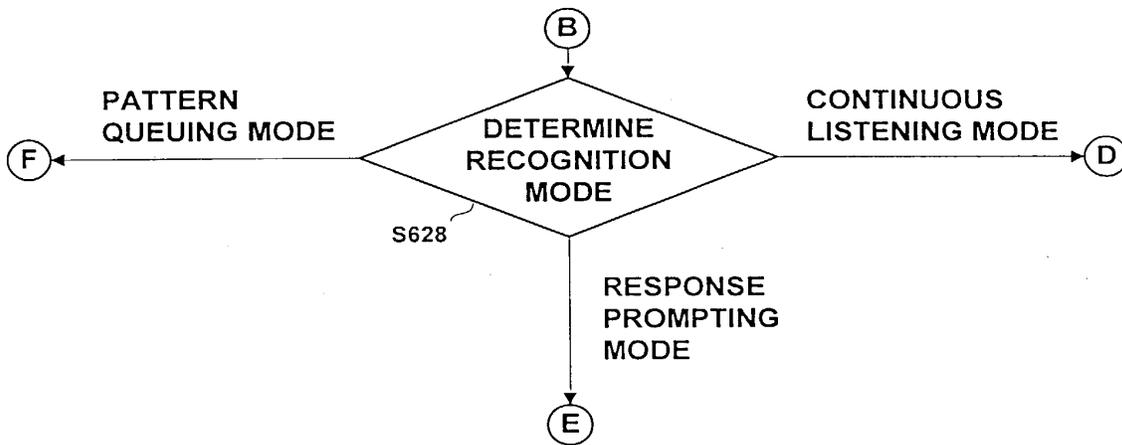
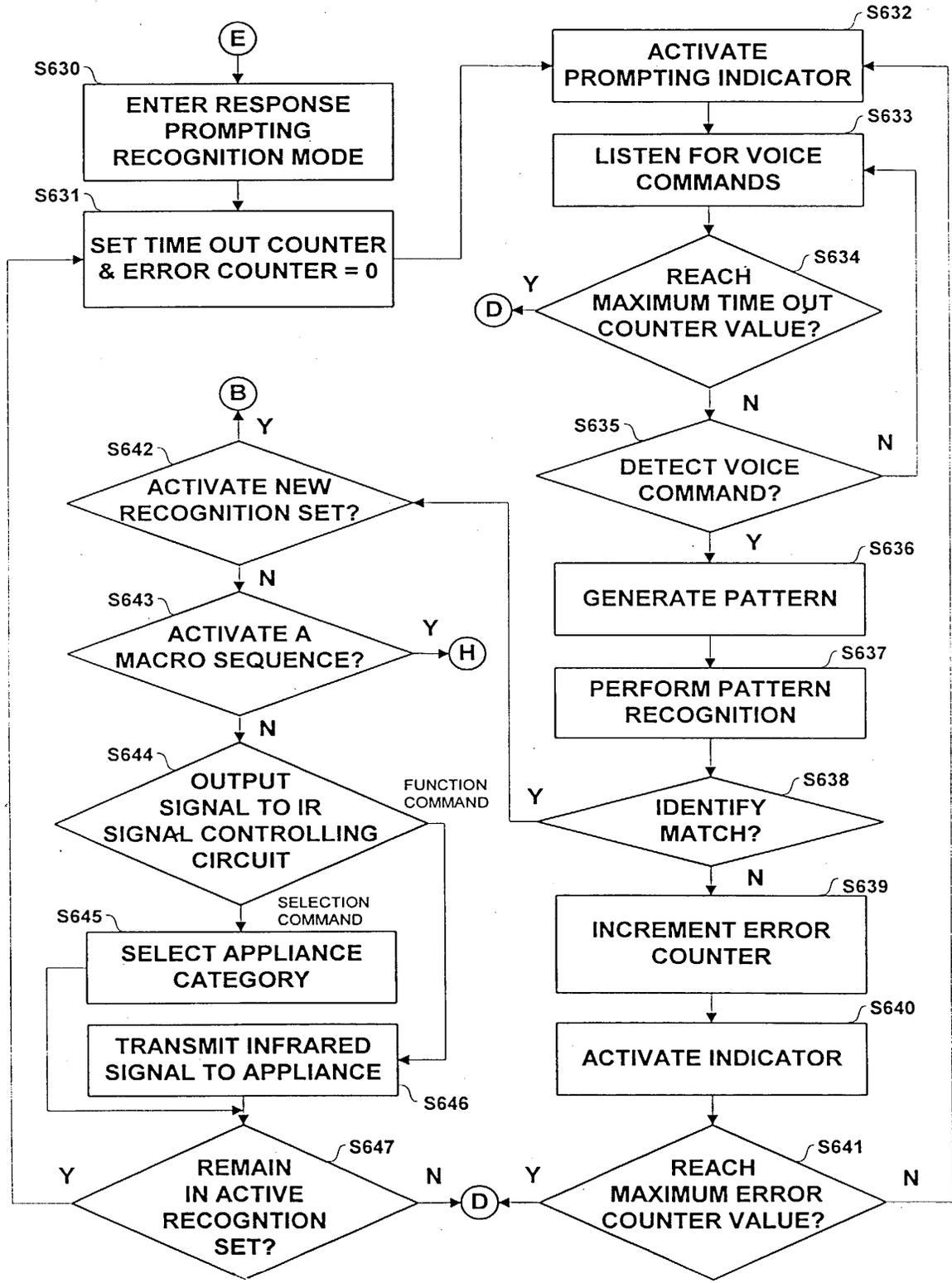


FIG. 8



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FIG. 9

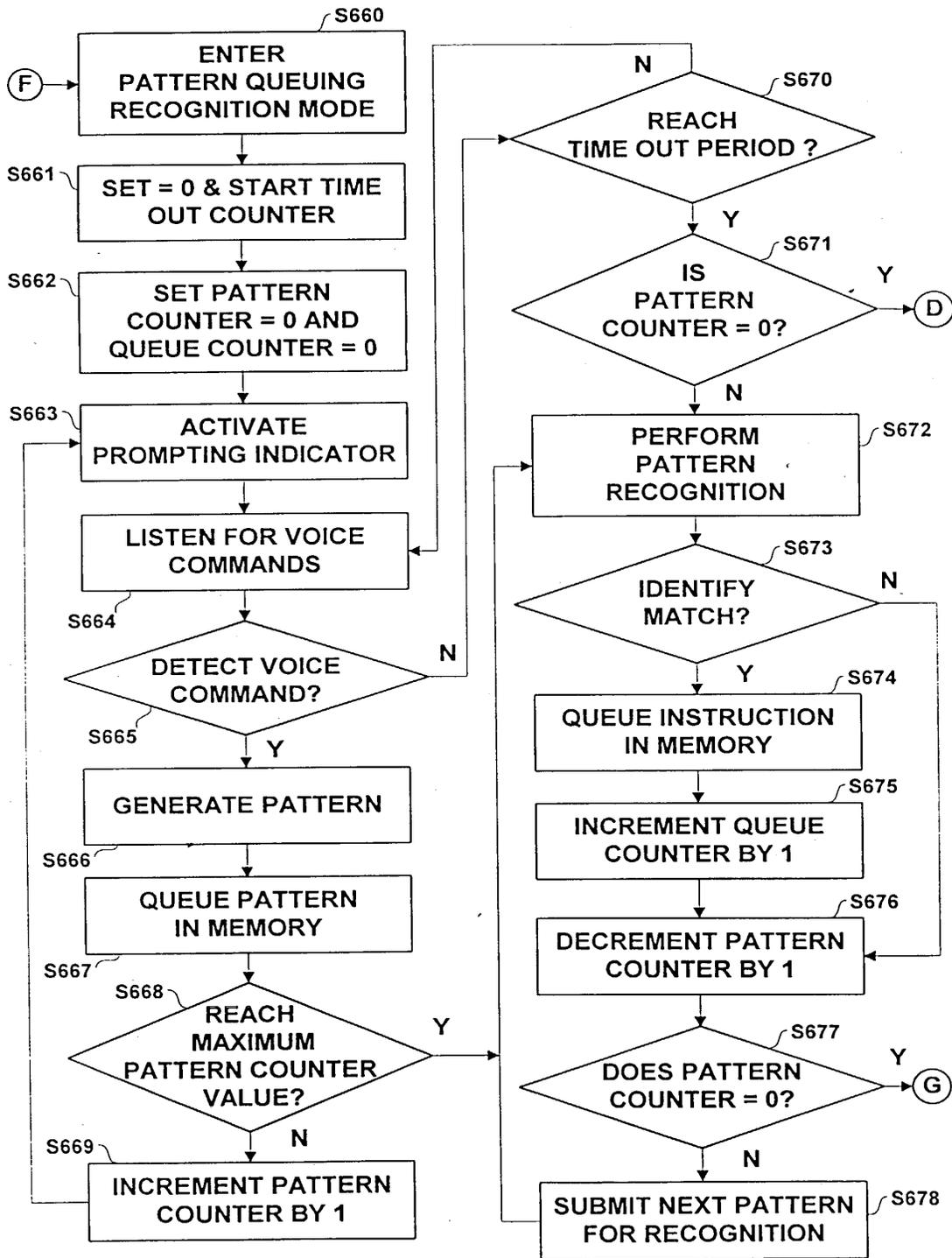


FIG. 10

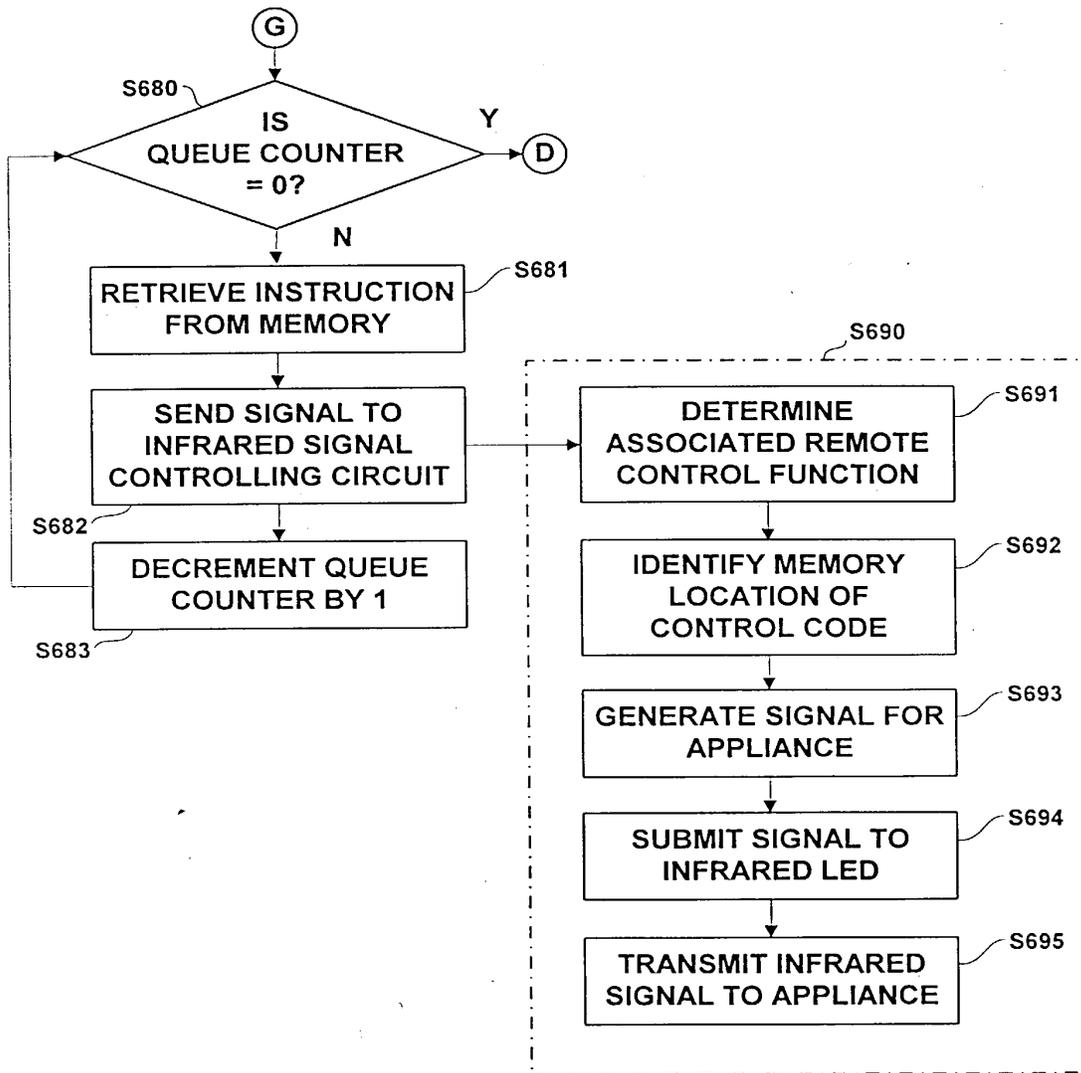
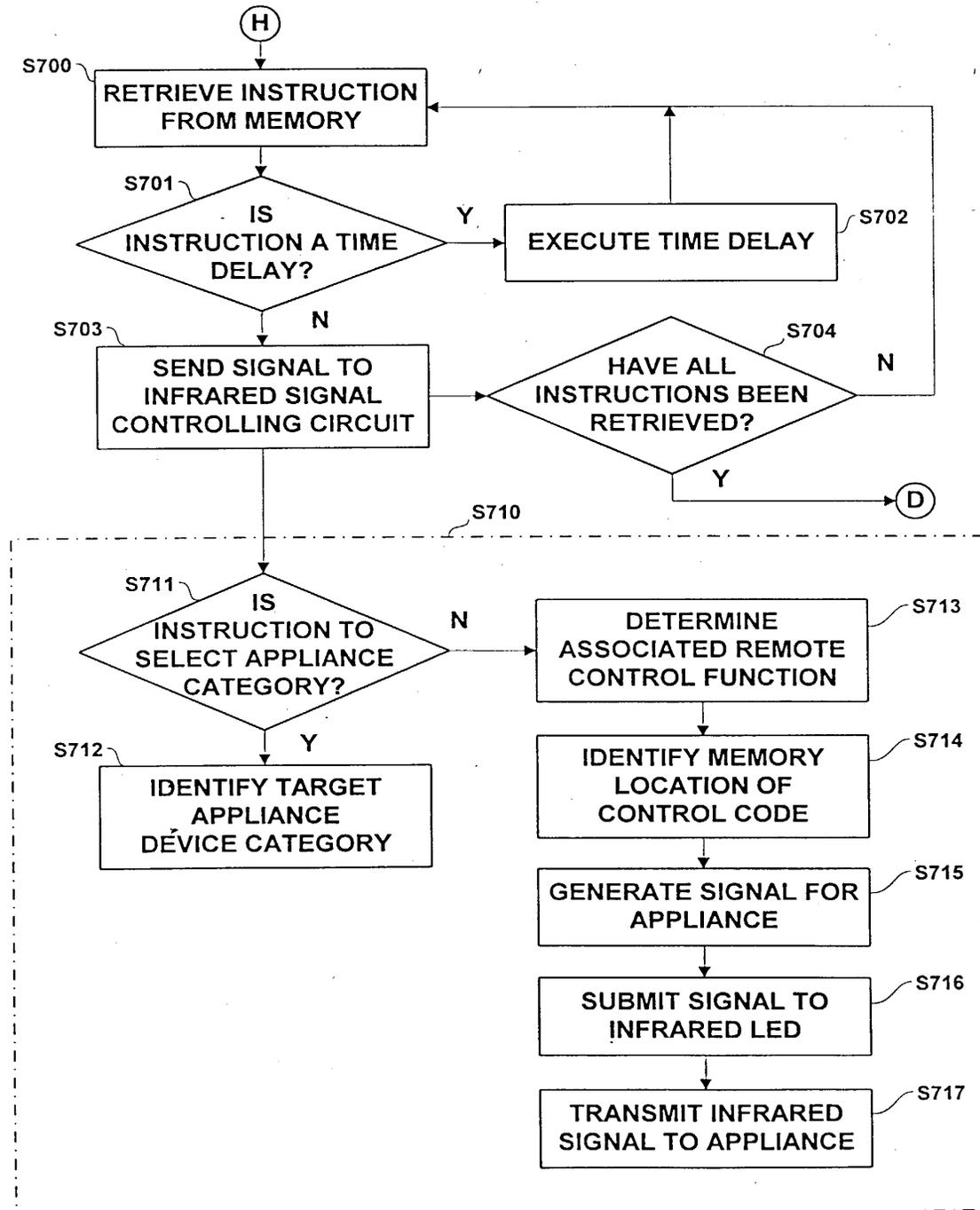


FIG. 11



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FIG. 12a

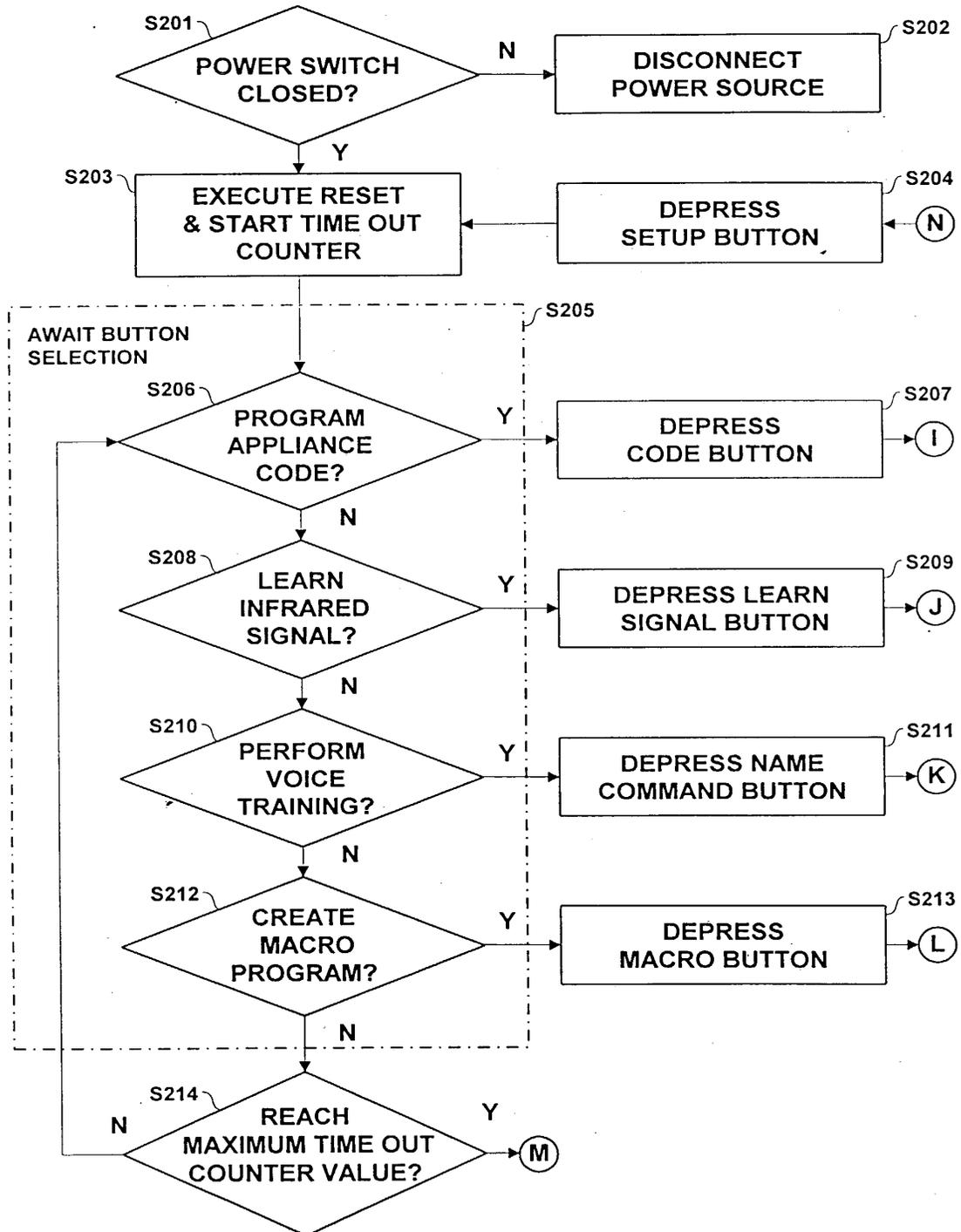


FIG. 12b

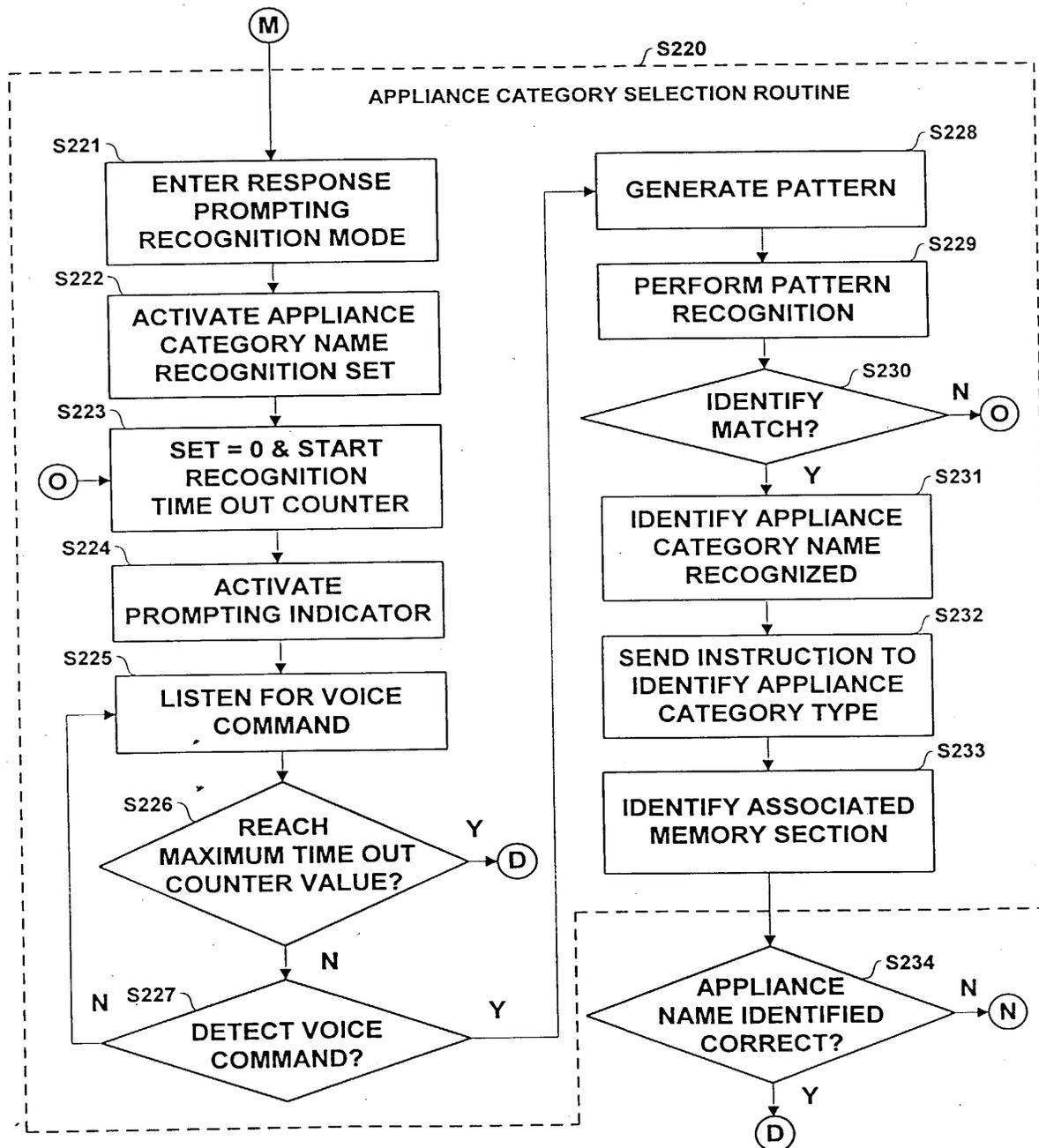


FIG. 13a

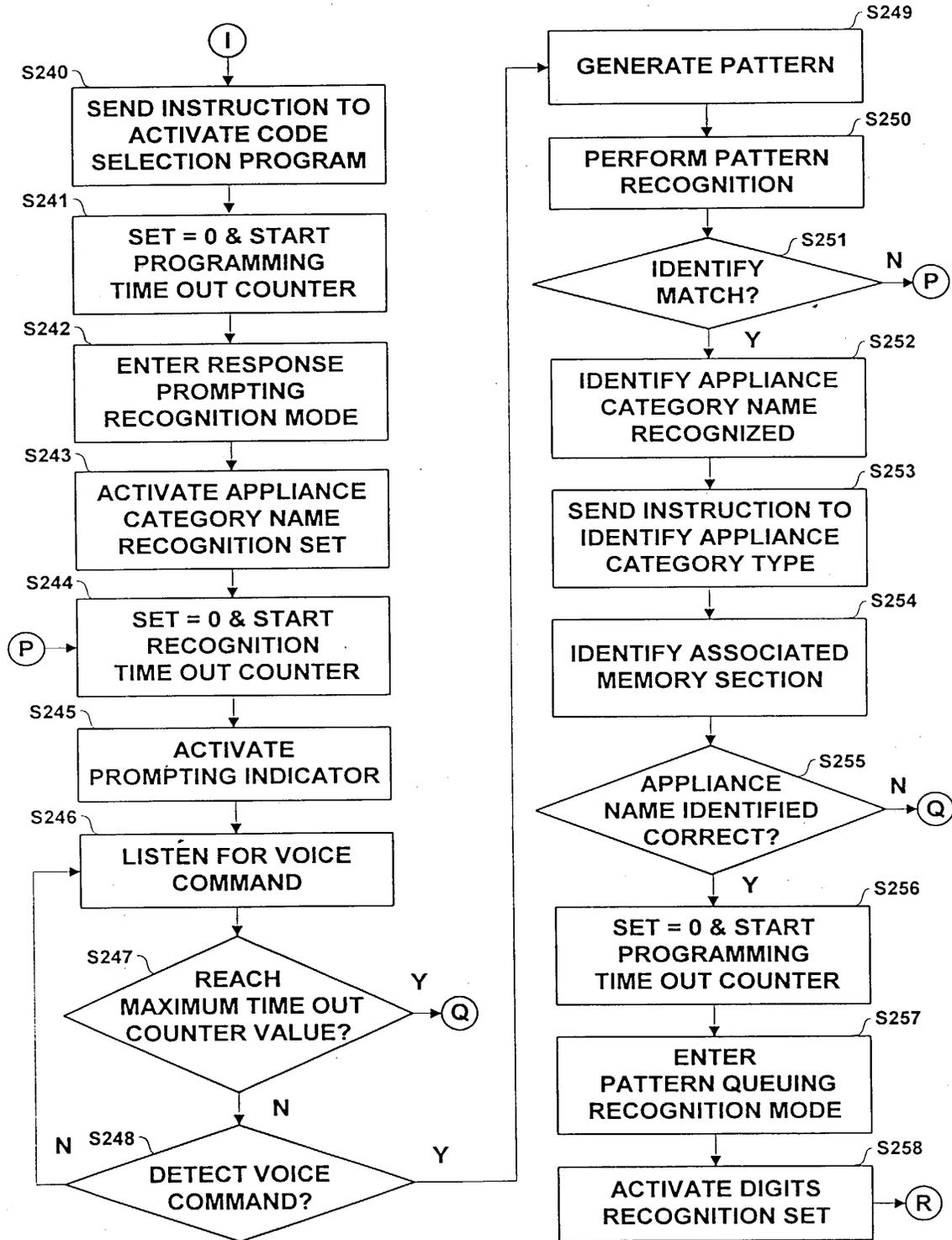


FIG. 13b

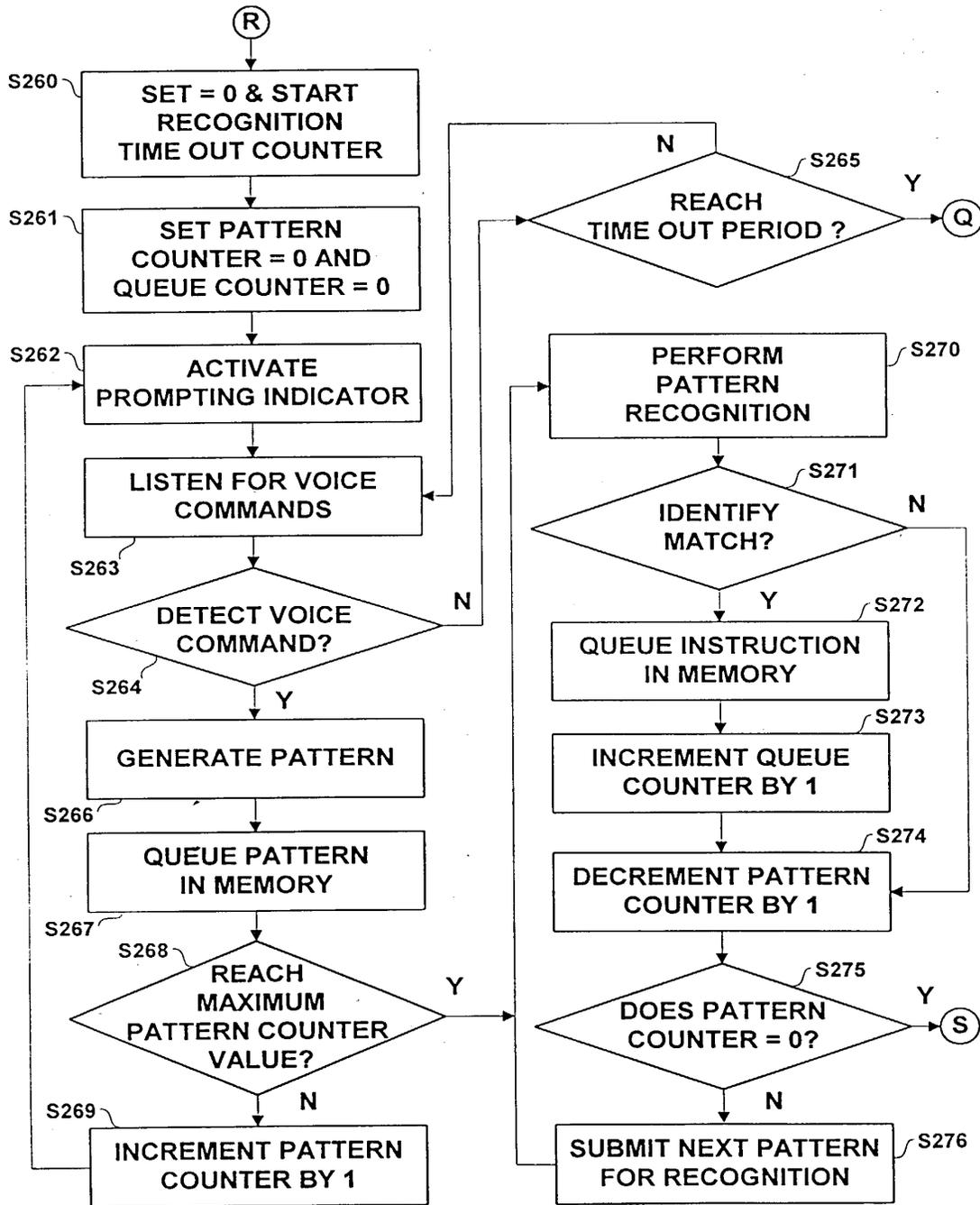


FIG. 13c

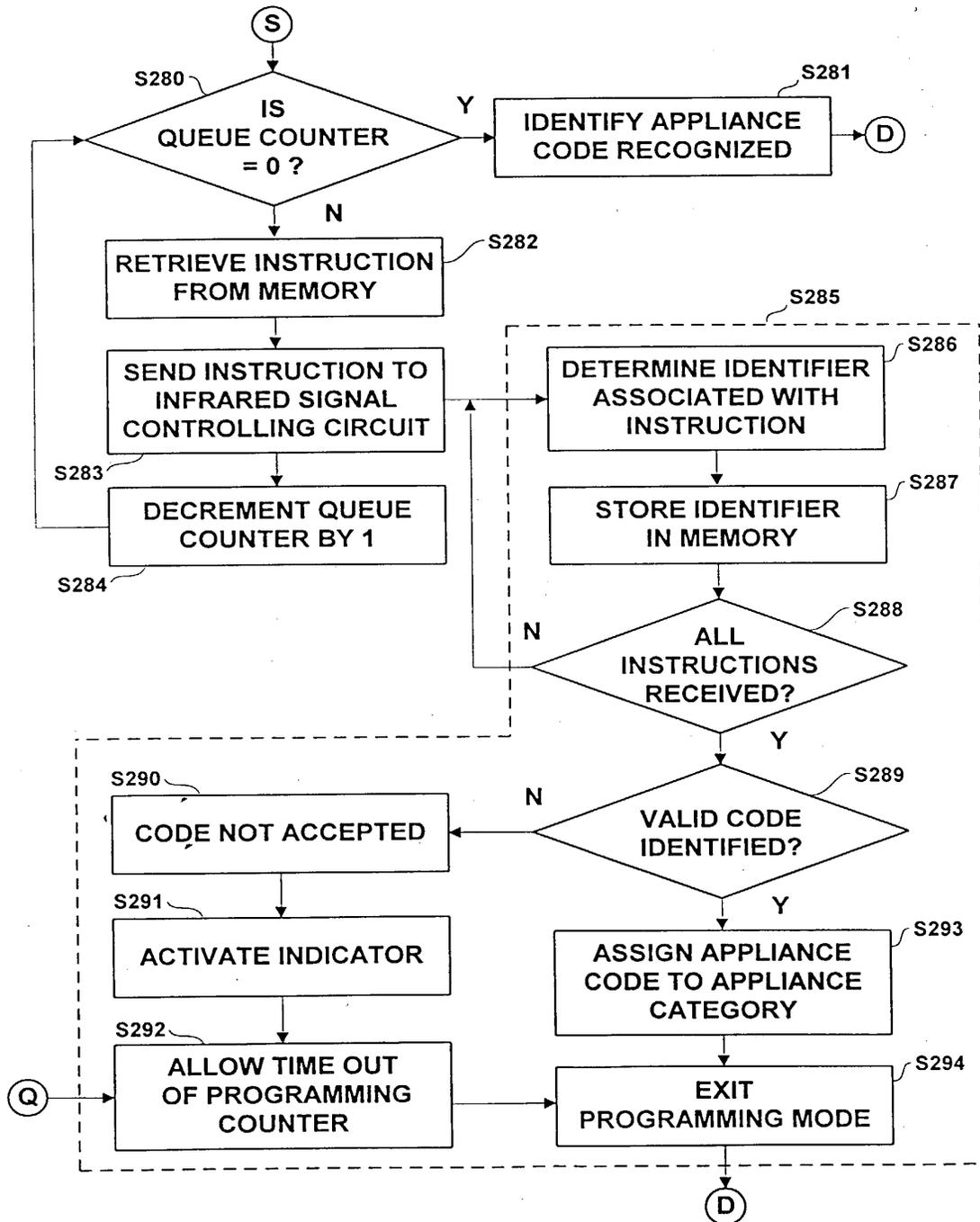


FIG. 14a

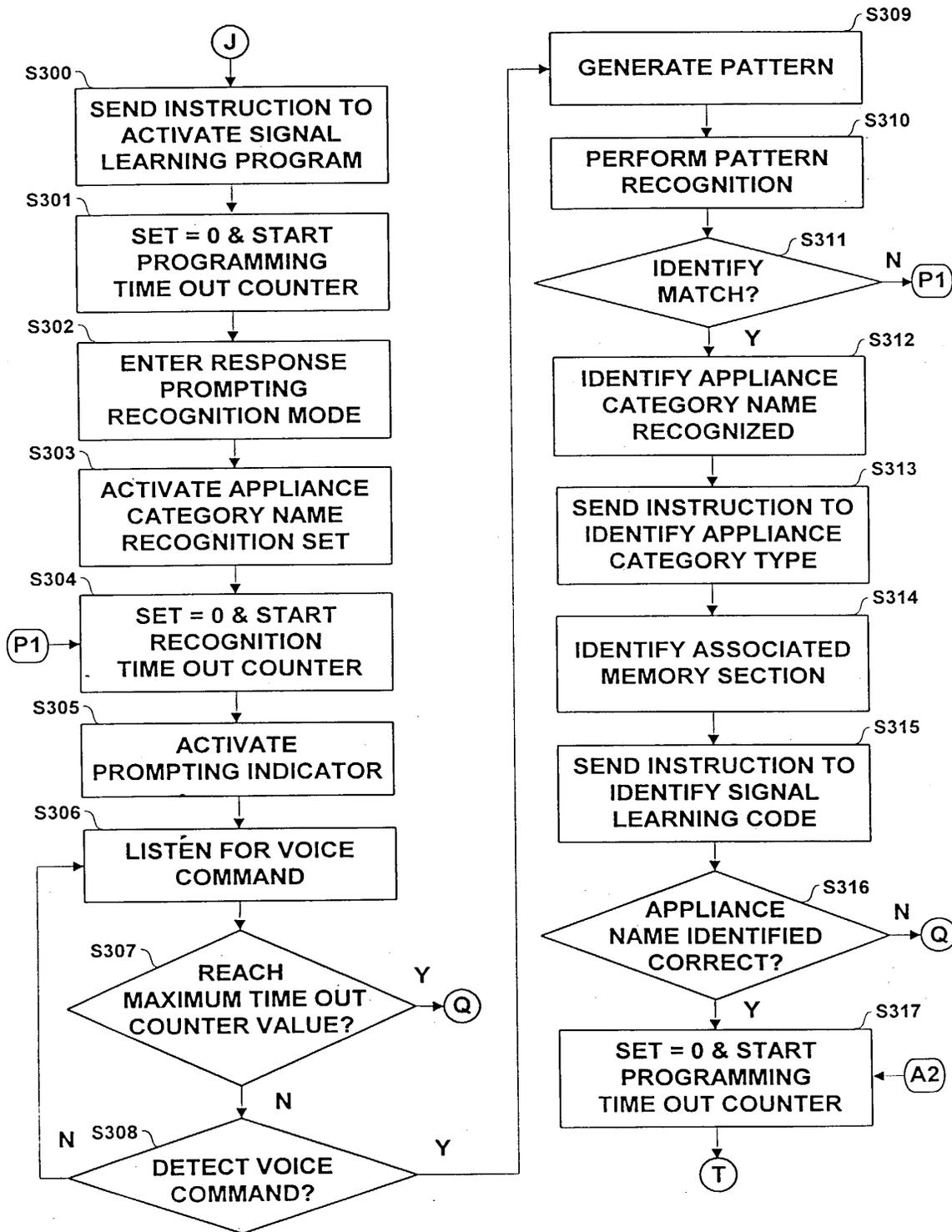


FIG. 14b

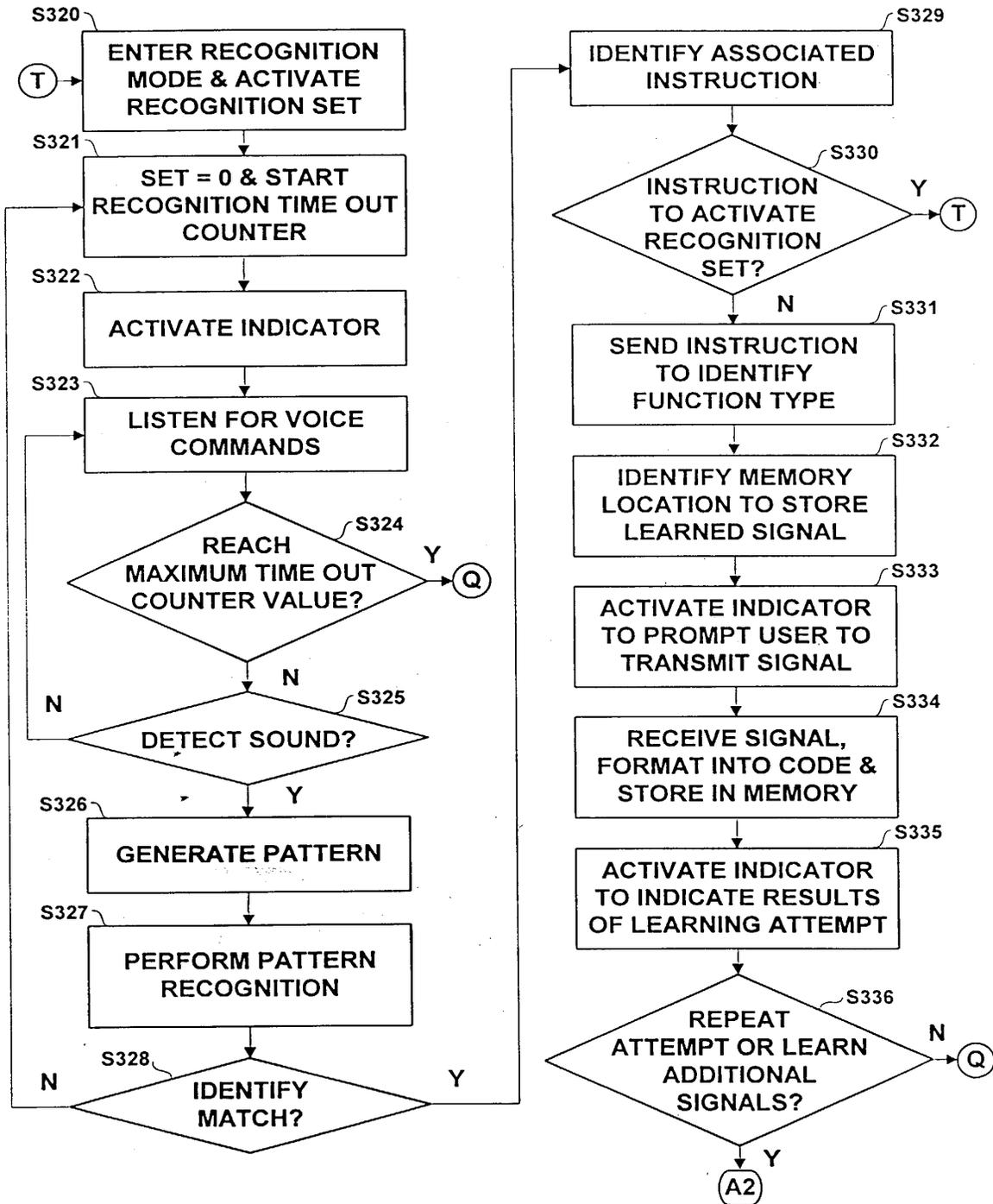


FIG. 15

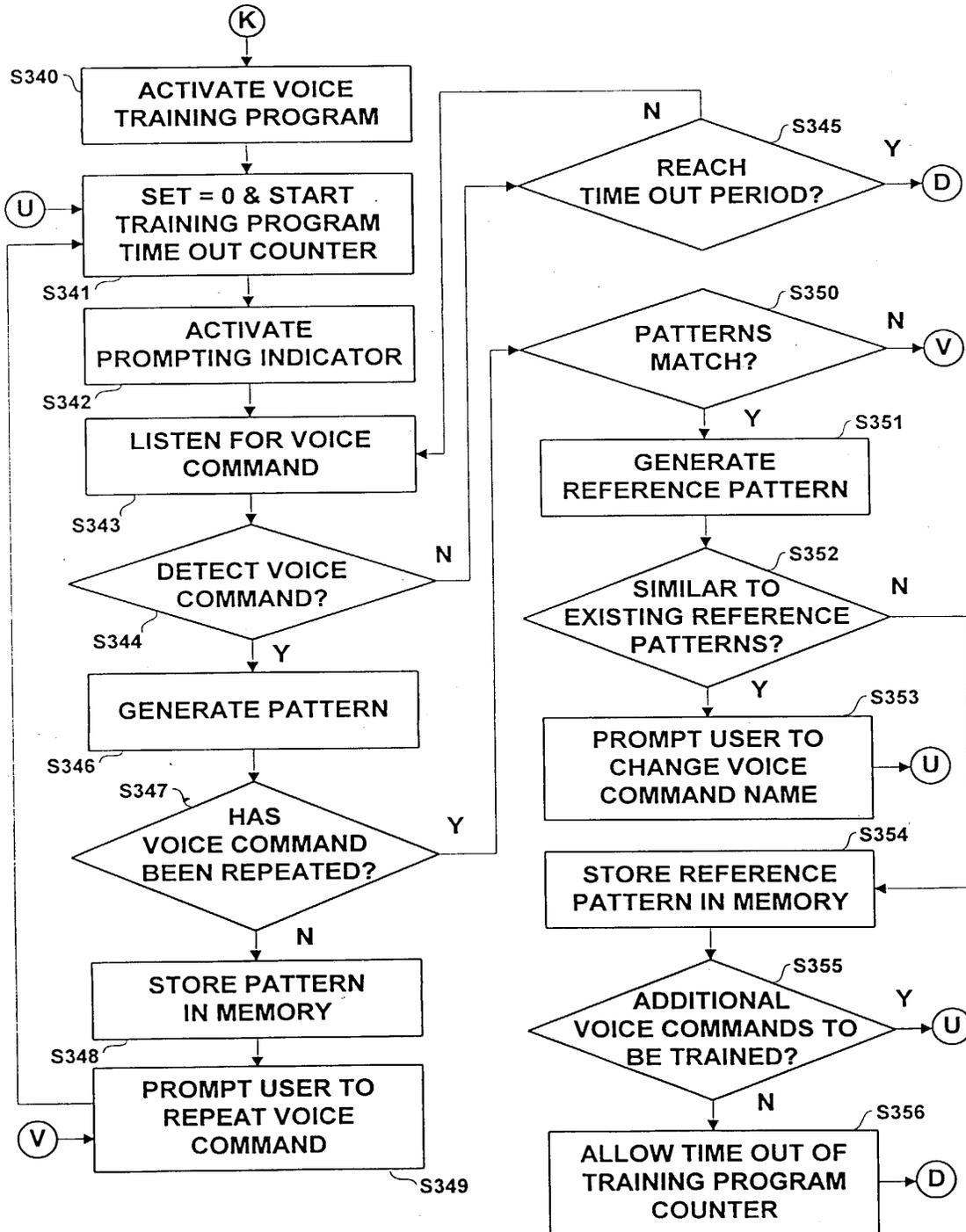


FIG. 16a

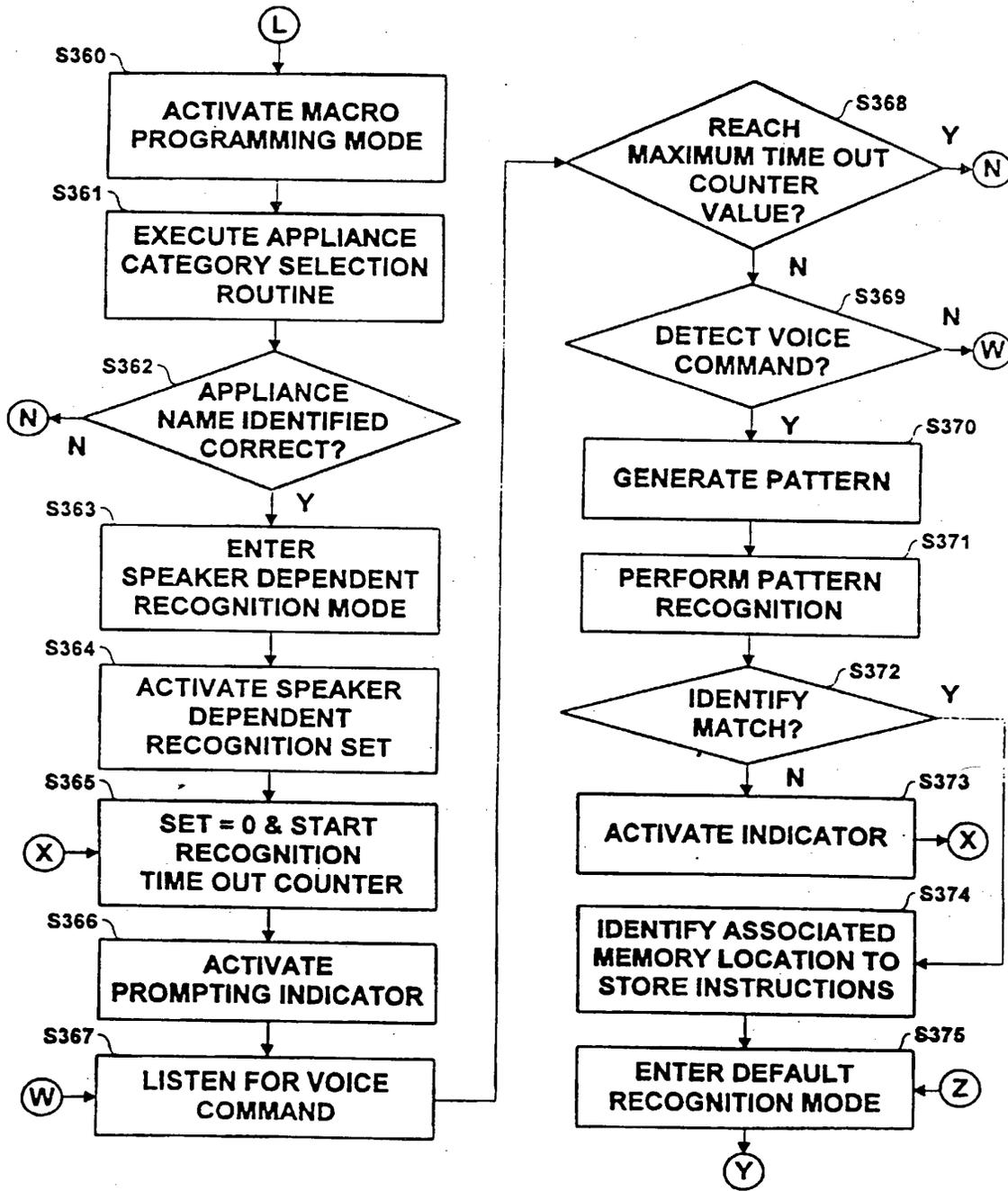
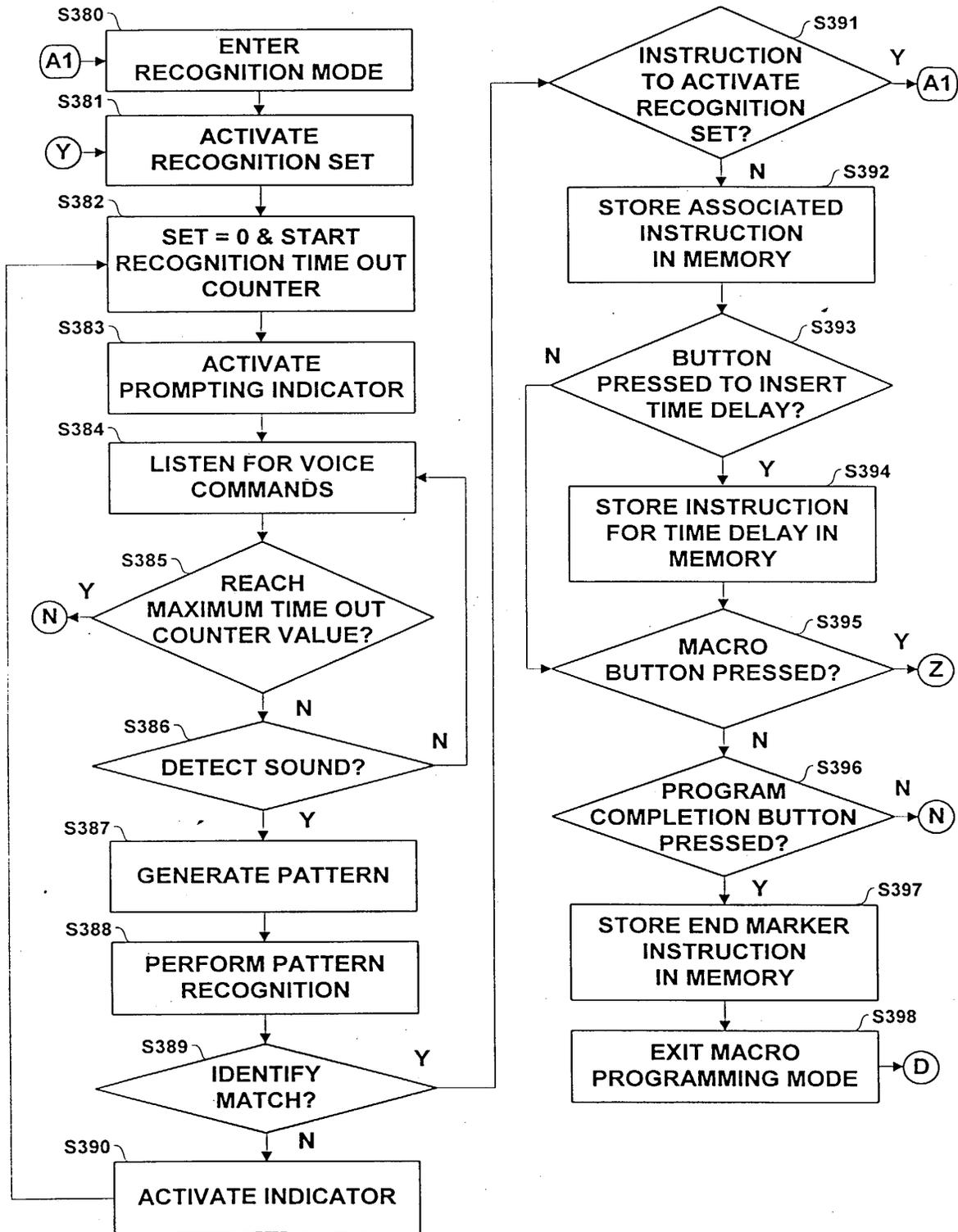


FIG. 16b



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FIG. 17

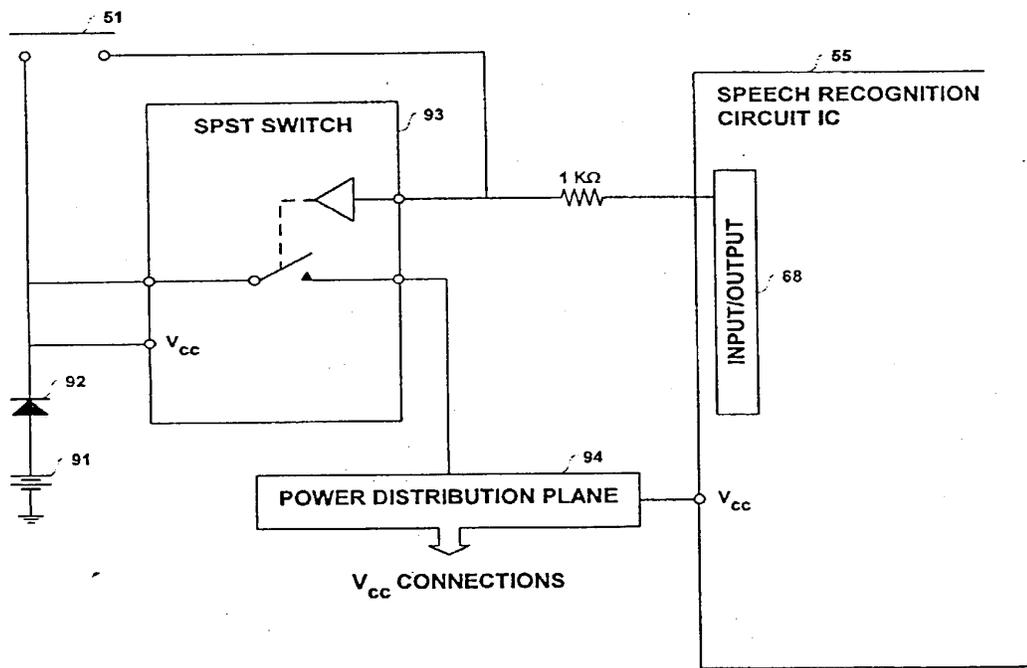
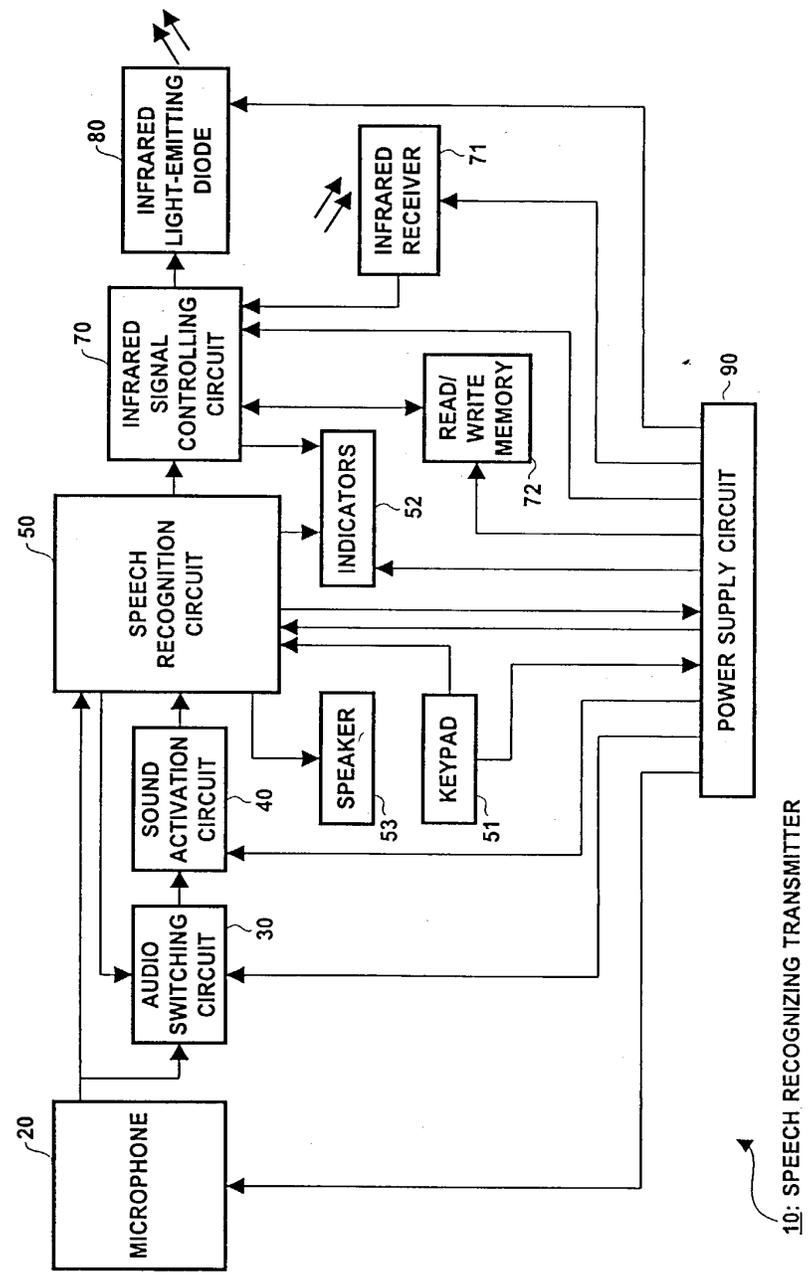


FIG. 18a



10/168935 . 012703

10: SPEECH RECOGNIZING TRANSMITTER

FIG. 18b

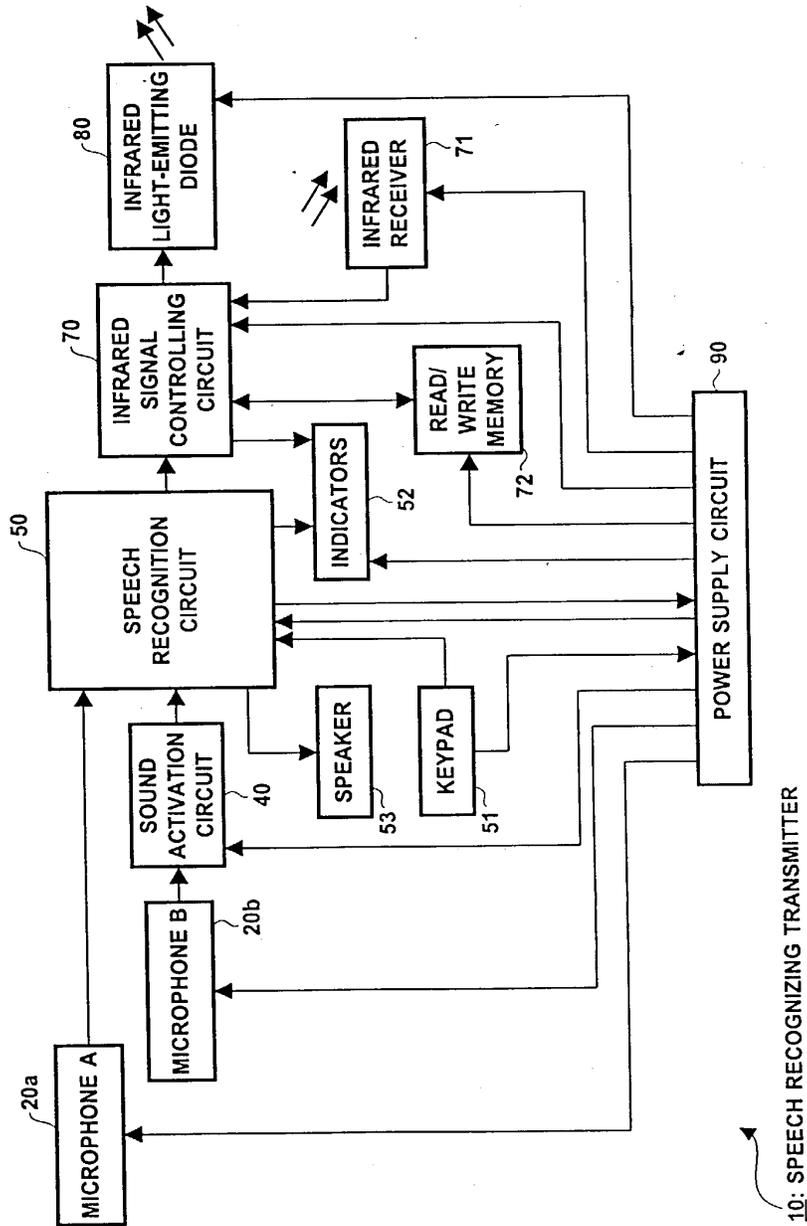
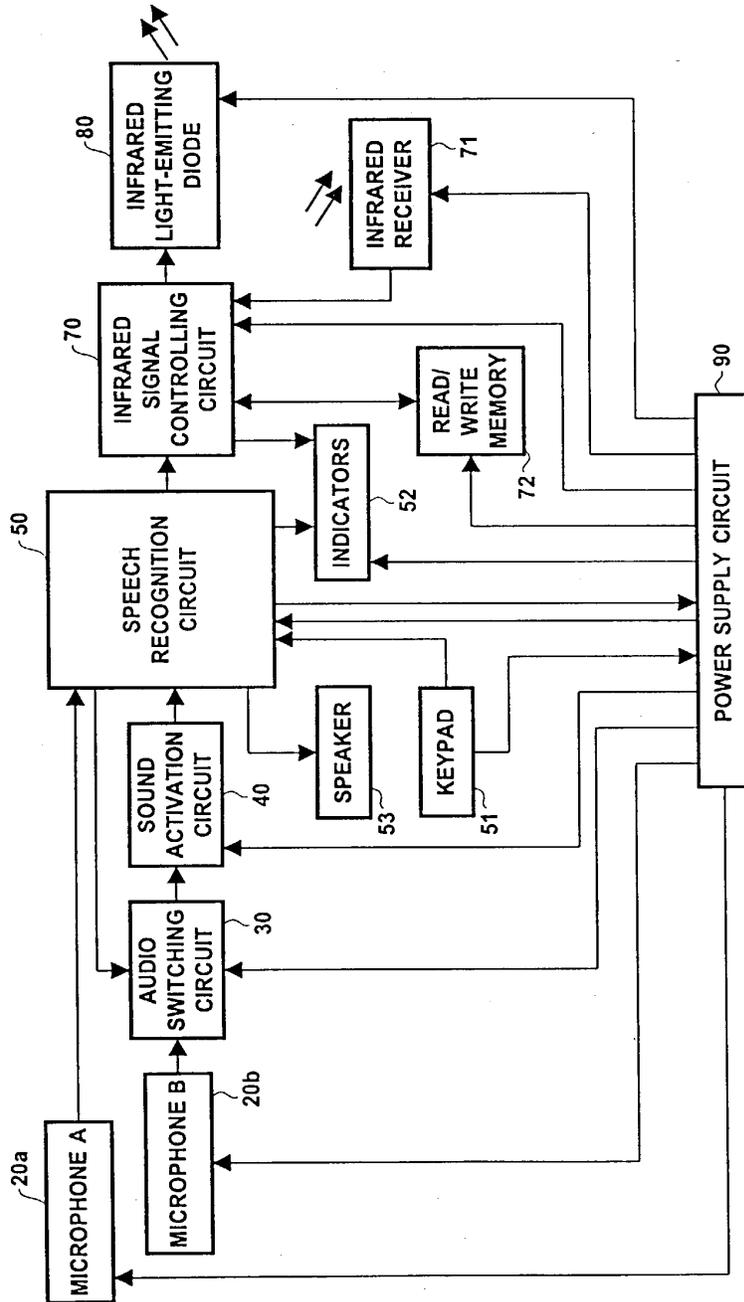


FIG. 18c



10: SPEECH RECOGNIZING TRANSMITTER

10/168935 012703

Declaration for Patent Application

Attorney Docket No. 211548-1

APPLICABLE RULES AND STATUTES**37 CFR 1.56. DUTY OF DISCLOSURE - INFORMATION MATERIAL TO PATENTABILITY (Applicable Portion)**

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

- (1) prior art cited in search reports of a foreign patent office in a counterpart application, and
- (2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentability defines, to make sure that any material information contained therein is disclosed to the Office.

Information relating to the following factual situations enumerated in 35 USC 102 and 103 may be considered material under 37 CFR 1.56(a).

35 U.S.C. 102. CONDITIONS FOR PATENTABILITY: NOVELTY AND LOSS OF RIGHT TO PATENT

A person shall be entitled to a patent unless –

- (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent, or
- (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States, or
- (c) he has abandoned the invention, or
- (d) the invention was first patented or caused to be patented, or was the subject of an inventor's certificate, by the applicant or his legal representatives or assigns in a foreign country prior to the date of the application for patent in this country on an application for patent or inventor's certificate filed more than twelve months before the filing of the application in the United States, or
- (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraph (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent, or
- (f) he did not himself invent the subject matter sought to be patented, or
- (g) before the applicant's invention thereof the invention was made in this country by another who had not abandoned, suppressed, or concealed it. In determining priority of invention there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by the other.

35 U.S.C. 103. CONDITIONS FOR PATENTABILITY; NON-OBVIOUS SUBJECT MATTER (Applicable Portion)

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

35 U.S.C. 112. SPECIFICATION (Applicable Portion)

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Atty. Docket No: 211548-00001

DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name; I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled "HANDS-FREE, VOICE-OPERATED REMOTE CONTROL TRANSMITTER" the specification of which was filed on June 21, 2002 as Application Serial No. 10/168,935 and was amended on _____ (if applicable); () was filed as PCT International Application No. _____ on _____ and was amended under Article 19 on _____ (if applicable). I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above. I acknowledge the duty to disclose to the Patent and Trademark Office all information known to me to be material to patentability as defined in 37 C.F.R. §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

			Priority Claimed	
			Yes	No
09/469,707	United States	12/22/1999	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(Application Serial Number)	(Country)	(Month/Day/Year Filed)	Yes	No
_____	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>
(Application Serial Number)	(Country)	(Month/Day/Year Filed)		

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below:

_____ (Month/Day/Year Filed)

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s) or PCT international application(s) designating the United States of America listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior application(s) in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in 37 C.F.R. §1.56 which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PCT/US00/35107	December 21, 2000	Pending
(Application Serial Number)	(Month/Day/Year Filed)	(Status-Patented, Pending or Abandoned)
_____	_____	_____
(Application Serial Number)	(Month/Day/Year Filed)	(Status-Patented, Pending or Abandoned)

*Not yet assigned, entitled _____ by _____ (Inventor)

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PARKER CSD ELECTRONICS

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P. 3

Declaration for Patent Application

Attorney Docket No. 211548-1

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

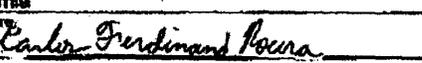
Send correspondence to:

FIRM NAME	PHONE NO.	STREET	CITY & STATE	ZIP CODE
Katten,Michlin Zavis Rosenman Attn: Patent Administrator	312-902-5200	525 West Monroe Street, Suite 1800	Chicago, Illinois	60661-3893

100

Full Name of First or Sole Inventor William Stuart Bush	Citizenship U.S.A.
Residence Address - Street 217 Fifth Place	Post Office Address - Street 217 Fifth Place
City (Zip) Manhattan Beach 90268 CA	City (Zip) Manhattan Beach 90268
State or Country California	State or Country California
Date January 27, 2003	Signature 

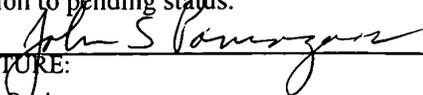
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Full Name of Second Inventor Carlos Ferdinand Roura	Citizenship U.S.A.
Residence Address - Street 1262 Langdale Lane	Post Office Address - Street 1262 Langdale Lane
City (Zip) Tustin 92780 CA	City (Zip) Tustin 92780
State or Country California	State or Country California
Date January 26, 2003	Signature 

Full Name of Third Inventor	Citizenship
Residence Address - Street	Post Office Address - Street
City (Zip)	City (Zip)
State or Country	State or Country
Date	Signature

TOTAL P.01

FORM PTG-190 REV 4-01)		US DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	DT07 Rec'd PCT/PTO 27 JAN 2003
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371			ATTORNEY'S DOCKET NUMBER 211548-00001
			U.S. APPLICATION NO. (if known, see 37 CFR 1.5) 10/168,955
INTERNATIONAL APPLICATION NO.: PCT/US00/35107	INTERNATIONAL FILING DATE December 21, 2000	PRIORITY DATE CLAIMED December 22, 1999	
TITLE OF INVENTION Hand-Free, Voice-Operated Remote Control Transmitter			
APPLICANT(S) FOR DO/EO/US William Stuart Bush, et al.			
<p>Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:</p> <ol style="list-style-type: none"> 1. <input type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. 2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. 3. <input type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1). 4. <input type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. 5. <input type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2)). <ol style="list-style-type: none"> a. <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> has been transmitted by the International Bureau. c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). 6. <input type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)). 7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)). <ol style="list-style-type: none"> a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> have been transmitted by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input type="checkbox"/> have not been made and will not be made. 8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). 10. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)). <p>Items 11. to 16. below concern documents(s) or information included:</p> <ol style="list-style-type: none"> 11. <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98. 12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. 13. <input type="checkbox"/> A FIRST preliminary amendment. 14. <input type="checkbox"/> A substitute specification. 15. <input type="checkbox"/> A change of power of attorney and/or address letter. 16. <input type="checkbox"/> Other items or information: 			
) CERTIFICATE OF MAILING BY "EXPRESS MAIL") "Express Mail" Mailing Label Number) <u>EV 162112163 US</u>) Date of Deposit <u>January 27, 2003</u>) I hereby certify that this paper or fee) is being deposited with the United States) Postal Service "Express Mail Post Office) to Addressee" Service under 37 C.F.R.) §1.10 on the date indicated above and is) addressed to: Commissioner of Patents) and Trademarks, Washington, D.C. 20231.) <u>Ben Frey</u>) (Typed or printed name of person mailing)) <u><i>Ben Frey</i></u>) (Signature of person mailing)

U.S. APPLICATION NO. (if known, see 37 CFR 1.5) 10/168,935		INTERNATIONAL APPLICATION NO. PCT/US00/35107		ATTORNEY'S DOCKET NUMBER 211548-1US	
17. <input type="checkbox"/> The following fees are submitted:				CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492 (A)(1)-(5)): Search Report has been prepared by the EPO or JPO \$ 890.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) \$ 490.00 No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) \$ 750.00 No international preliminary examination fee (37 CFR 1.482) nor international search fee paid to (37 CFR 1.445(a)(2)) paid to USPTO \$ 1040.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) \$ 140.00					
ENTER APPROPRIATE BASIC FEE AMOUNT =				\$	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$ 65.00	
CLAIMS	NUMBER FIELD	NUMBER EXTRA	RATE		
Total claims	1-20 =	-	X\$. -	\$	
Independent claims	1-3 =	-	X\$. -	\$	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+\$ 280.00	\$	
TOTAL OF ABOVE CALCULATIONS =				\$	
Reduction of 1/2 for filing by small entity.				\$	
SUBTOTAL =				\$ 65.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				+	\$
TOTAL NATIONAL FEE =				\$ 65.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28,3.31). \$40.00 per property				+	\$
01 30/2003 LLANDGRA 0000063 10168935 TOTAL FEES ENCLOSED =				\$ 65.00	
02	FC:2617	65.00 OP		Amount to be: refunded	\$
03	FC:2614	126.00 OP			
04	FC:2615	18.00 OP			
				charged	\$
a. <input checked="" type="checkbox"/> A check in the amount of \$674.00 is enclosed to cover the \$465 extension fee, <u>\$65 late oath or declaration charge</u> , \$144 for claim fee for application is enclosed to cover the above fees is enclosed. b. <input type="checkbox"/> Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed. c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which maybe required, or credit any overpayment to Deposit Account No. <u>50-1214</u> . A duplicate copy of this sheet is enclosed. NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.					
SEND ALL CORRESPONDENCE TO: KATTEN MUCHIN ZAVIS ROSENMAN 525 West Monroe, Suite 1600 Chicago, IL 60661-3693 U.S.A.				SIGNATURE: 	
Telephone: (312) 902-5200 Facsimile: (312) 902-1061				NAME: John S. Paniaguas	
				Registration Number: 31,051	



Commissioner for Patents
Washington, DC 20231
www.uspto.gov



Bib Data Sheet

CONFIRMATION NO. 4615

SERIAL NUMBER 10/168,935	FILING DATE 01/27/2003 RULE	CLASS 704	GROUP ART UNIT 2654	ATTORNEY DOCKET NO. 211548-1US	
APPLICANTS William Stuart Bush, Manhattan Beach, CA; Carlos Ferdinand Roura, Tustin, CA;					
** CONTINUING DATA ***** This application is a 371 of PCT/US00/35107 12/21/2000					
** FOREIGN APPLICATIONS *****					
** SMALL ENTITY **					
Foreign Priority claimed <input type="checkbox"/> yes <input type="checkbox"/> no		STATE OR COUNTRY CA	SHEETS DRAWING 30	TOTAL CLAIMS 22	INDEPENDENT CLAIMS 6
35 USC 119 (a-d) conditions met <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> Met after Allowance					
Verified and Acknowledged		Examiner's Signature	Initials		
ADDRESS Katten Muchin Zavis Rosenman Patent Department Suite 1600 525 West Monroe Street Chicago, IL 60661-3693					
TITLE Hands-free, voice-operated remote control transmitter					
FILING FEE RECEIVED 579	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:		<input type="checkbox"/> All Fees		
			<input type="checkbox"/> 1.16 Fees (Filing)		
			<input type="checkbox"/> 1.17 Fees (Processing Ext. of time)		
			<input type="checkbox"/> 1.18 Fees (Issue)		
			<input type="checkbox"/> Other _____		
			<input type="checkbox"/> Credit		

10 JAN 2003 2 7: JAN 2003

PATENT
Attorney Docket No. 211548-1US

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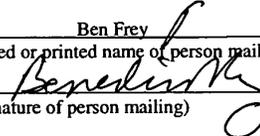
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): William Stuart Bush)
Serial No.: 10/168,935)
Filed: June 21, 2002)
Title: Hands-Free, Voice-Operated)
Remote Control Transmitter)

CERTIFICATE OF MAILING BY EXPRESS MAIL

"Express Mail" Mailing Label Number: EV 162112163 US
Date of Deposit January 27, 2003

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" Service under 37 C.F.R. § 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Box PCT, Washington, D.C. 20231.

Ben Frey
(Typed or printed name of person mailing)

(Signature of person mailing)

Director, U.S. Patent & Trademark Office
Box PCT
Washington, D.C. 20231

PETITION FOR EXTENSION OF TIME

01/30/2003 LLANDGRA 00000063 10168935

01 FC:2253

465.00 OP

Applicant(s) hereby petition(s) under 37 CFR §1.136(a) for an extension of time for reply in the above-identified application for the period required to make the accompanying reply timely, or, if there be no accompanying reply, for the period for which the fee is indicated or the period necessary to prevent abandonment of the above-identified application if longer than the period for which the fee is indicated.

Extension fee for reply within first month:

- () By a small entity (§1.9(f)) \$ 55.00
- () By other than a small entity \$ 110.00

Extension fee for reply within second month:

- () By a small entity (§1.9(f)) \$ 205.00
- () By other than a small entity \$ 410.00

Extension fee for reply within third month:

- (X) By a small entity (§1.9(f)) \$ 465.00
- () By other than a small entity \$ 930.00

Extension fee for reply within fourth month:

Doc #:CHI01 (211548-00001) 50090340v1;01/27/2003/Time:15:10

- By a small entity (§1.9(f)) \$ 725.00
- By other than a small entity \$1,450.00

Extension fee for reply within fifth month:

- By a small entity (§1.9(f)) \$ 985.00
- By other than a small entity \$1,970.00

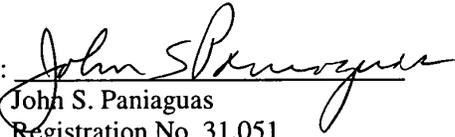
A check in the amount of \$674.00 is enclosed to cover the \$465 extension fee, \$65 late oath or declaration charge, \$144 for claim fee for application is enclosed.

Charge \$ ____ to Deposit Account No. 50-1214.

The Commissioner is hereby authorized to charge any additional fees which may be required in respect to this petition, or credit any overpayment, to Deposit Account No. 50 1214. Should no proper payment for this petition be enclosed, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 50-1214. This sheet is filed in triplicate.

Respectfully submitted,

Date: January 27, 2003

By: 
John S. Paniaguas
Registration No. 31,051

Patent Administrator
Katten Muchin Zavis Rosenman
525 W. Monroe Street, Suite 1600
Chicago, IL 60661-3693
Telephone: 312-902-5200
Facsimile: 312-902-1061

*Power To Inspect
HING-3*

Rec'd PCT/PTO 30 AUG 2002

**PATENT
ATTORNEY DOCKET
NO. 11548/1**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s):	William S. Bush et al.)
Serial No.:	10/168,935)
Filed:	June 21, 2002)
Title:	Hands-Free, Voice-Operated Control Transmitter)
Group Art Unit:	Not Assigned)
Examiner:	Not Assigned)

POWER TO INSPECT AND MAKE COPIES

Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Applicants, by their attorneys, hereby grant Anthony J. Castorina, the power to inspect and have copies made of the above-captioned file.

Respectfully submitted,

Katten Muchin Zavis Rosenman

By: *John S. Paniaguas*
John S. Paniaguas
Registration No. 31,051

Date: August 23, 2002

Katten Muchin Zavis Rosenman
525 West Monroe Street
Suite 1600
Tel: (312) 902-5312
Fax: (312) 577-4532



UNITED STATES PATENT AND TRADEMARK OFFICE

 Commissioner for Patents, Box PCT
 United States Patent and Trademark Office
 Washington, D.C. 20231
 www.uspto.gov

U.S. APPLICATION NUMBER NO. 10/168,935	FIRST NAMED APPLICANT William Stuart Bush	ATTY. DOCKET NO. 211548-IUS
INTERNATIONAL APPLICATION NO. PCT/US00/35107		
I.A. FILING DATE 12/21/2000		PRIORITY DATE

John S Paniaguas
 Katten Muchin Zavis Rosenman
 525 W Monroe Street
 Chicago, IL 60661

CONFIRMATION NO. 4615

371 FORMALITIES LETTER



OC00000008683194

Date Mailed: 08/26/2002

NOTIFICATION OF MISSING REQUIREMENTS UNDER 35 U.S.C. 371 IN THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)

The following items have been submitted by the applicant or the IB to the United States Patent and Trademark Office as an Elected Office (37 CFR 1.495):

- U.S. Basic National Fees
- Indication of Small Entity Status
- Copy of IPE Report
- Copy of the International Application
- Copy of the International Search Report

The following items **MUST** be furnished within the period set forth below in order to complete the requirements for acceptance under 35 U.S.C. 371:

- Oath or declaration of the inventors, in compliance with 37 CFR 1.497(a) and (b), identifying the application by the International application number and international filing date.
- \$65 Surcharge for providing the oath or declaration later than the appropriate 30 months months from the priority date (37 CFR 1.492(e)) is required.

ALL OF THE ITEMS SET FORTH ABOVE MUST BE SUBMITTED WITHIN TWO (2) MONTH FROM THE DATE OF THIS NOTICE OR BY 22 or 32 MONTHS (where 37 CFR 1.495 applies) FROM THE PRIORITY DATE FOR THE APPLICATION, WHICHEVER IS LATER. FAILURE TO PROPERLY RESPOND WILL RESULT IN ABANDONMENT.

The time period set above may be extended by filing a petition and fee for extension of time under the provisions of 37 CFR 1.136(a).

Additionally the following defects have been observed:

- Additional claim fees of \$144 as a small entity, including any required multiple dependent claim fee, are

required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.

SUMMARY OF FEES DUE:

Total additional fees required for this application is **\$209** for a Small Entity:

- **\$65** Late oath or declaration Surcharge.
- Total additional claim fee(s) for this application is **\$144**
 - **\$126** for **3** independent claims over 3.
 - **\$18** for **2** total claims over 20.

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

*A copy of this notice **MUST** be returned with the response.*

ANITA D JOHNSON

Telephone: (703) 305-3661

PART 2 - OFFICE COPY

U.S. APPLICATION NUMBER NO.	INTERNATIONAL APPLICATION NO.	ATTY. DOCKET NO.
10/168,935	PCT/US00/35107	211548-1US

FORM PCT/DO/EO/905 (371 Formalities Notice)

DT17 rec'd PCT/PTO JUN 21 2002

FORM PTO-1390 (REV. 9-2001)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER 211548-1US	
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371				U.S. APPLICATION NO. (If known, see 37 CFR 1.5)	
				10/168935	
INTERNATIONAL APPLICATION NO. PCT/US00/35107		INTERNATIONAL FILING DATE 21 December 2000		PRIORITY DATE CLAIMED 22 December 1999	
TITLE OF INVENTION Hands-Free, Voice Operated Remote Control Transmitter					
APPLICANT(S) FOR DO/EO/US William Stuart BUSH and Carlos Ferdinand ROURA					
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:					
<p>1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.</p> <p>2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.</p> <p>3. <input type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.</p> <p>4. <input type="checkbox"/> The US has been elected by the expiration of 19 months from the priority date (Article 31).</p> <p>5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))</p> <p style="margin-left: 20px;">a. <input type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau).</p> <p style="margin-left: 20px;">b. <input checked="" type="checkbox"/> has been communicated by the International Bureau.</p> <p style="margin-left: 20px;">c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</p> <p>6. <input type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).</p> <p style="margin-left: 20px;">a. <input type="checkbox"/> is attached hereto.</p> <p style="margin-left: 20px;">b. <input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4).</p> <p>7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))</p> <p style="margin-left: 20px;">a. <input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau).</p> <p style="margin-left: 20px;">b. <input type="checkbox"/> have been communicated by the International Bureau.</p> <p style="margin-left: 20px;">c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</p> <p style="margin-left: 20px;">d. <input type="checkbox"/> have not been made and will not be made.</p> <p>8. <input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).</p> <p>9. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</p> <p>10. <input type="checkbox"/> An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</p> <p>Items 11 to 20 below concern document(s) or information included:</p> <p>11. <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</p> <p>12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.</p> <p>13. <input type="checkbox"/> A FIRST preliminary amendment.</p> <p>14. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.</p> <p>15. <input type="checkbox"/> A substitute specification.</p> <p>16. <input type="checkbox"/> A change of power of attorney and/or address letter.</p> <p>17. <input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.</p> <p>18. <input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4).</p> <p>19. <input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).</p> <p>20. <input checked="" type="checkbox"/> Other items or information: <i>postcard</i></p>					

U.S. APPLICATION NO. 10/168935 INTERNATIONAL APPLICATION NO. PCT/US00/35107	ATTORNEY'S DOCKET NUMBER 211548-IUS				
21. <input type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1040.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$890.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$740.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$710.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00 ENTER APPROPRIATE BASIC FEE AMOUNT =		CALCULATIONS PTO USE ONLY \$ 710 00			
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).		\$			
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	\$	
Total claims	5 - 20 =	0	x \$18.00	\$ 0	
Independent claims	1 - 3 =	0	x \$84.00	\$ 0	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$280.00	\$	
TOTAL OF ABOVE CALCULATIONS =				\$	
<input checked="" type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.			+	\$	
SUBTOTAL =				\$ 355	00
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$	
TOTAL NATIONAL FEE =				\$	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +				\$	
TOTAL FEES ENCLOSED =				\$ 355	00
				Amount to be refunded:	\$
				charged:	\$
a. <input type="checkbox"/> A check in the amount of \$ _____ to cover the above fees is enclosed. b. <input checked="" type="checkbox"/> Please charge my Deposit Account No. <u>50-1214</u> in the amount of <u>\$355.00</u> to cover the above fees. A duplicate copy of this sheet is enclosed. c. <input type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. _____. A duplicate copy of this sheet is enclosed. d. <input type="checkbox"/> Fees are to be charged to a credit card. WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.					
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.					
SEND ALL CORRESPONDENCE TO: PCT INTERNATIONAL PROCESSING <div style="text-align: center;"> RECEIVED JUN 27 2002 </div>					
				SIGNATURE  _____ NAME John S. Paniaguas _____ REGISTRATION NUMBER 3051 _____	

PATENT APPLICATION SERIAL NO. 10-168,935

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

07/02/2002 SHAJARRO 00000062 501214 10168935
01 FC:957 355.00 CH

08/26/2002 AJOHNSO2 00000001 501214 10168935

01 FC:959 370.00 CH

Adjustment date: 08/26/2002 AJOHNSO2
07/02/2002 SHAJARRO 00000062 501214 10168935
01 FC:957 355.00 CR

PTO-1556
(5/87)

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2001

Application or Docket Number

10-168,935

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS		
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	22 minus 20 = *	2
INDEPENDENT CLAIMS	6 minus 3 = *	3
MULTIPLE DEPENDENT CLAIM PRESENT <input type="checkbox"/>		

SMALL ENTITY TYPE OR OTHER THAN SMALL ENTITY

RATE	FEE	OR	RATE	FEE
BASIC FEE	370	OR	BASIC FEE	
X\$ 9=	18	OR	X\$18=	
X42=	126	OR	X84=	
+140=		OR	+280=	
TOTAL	514	OR	TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2

CLAIMS AS AMENDED - PART II

	(Column 1)	(Column 2)	(Column 3)
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
	Total *	Minus **	=
	Independent *	Minus ***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <input type="checkbox"/>			

SMALL ENTITY OR OTHER THAN SMALL ENTITY

RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
X\$ 9=		OR	X\$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

	(Column 1)	(Column 2)	(Column 3)
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
	Total *	Minus **	=
	Independent *	Minus ***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <input type="checkbox"/>			

RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
X\$ 9=		OR	X\$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

	(Column 1)	(Column 2)	(Column 3)
AMENDMENT C	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
	Total *	Minus **	=
	Independent *	Minus ***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <input type="checkbox"/>			

RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
X\$ 9=		OR	X\$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
 ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
 *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
 The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Best Available Copy

MULTIPLE DEPENDENT CLAIM FEE CALCULATION SHEET (FOR USE WITH FORM PTO-375)						SERIAL NO. <i>10-168,935</i>	FILING DATE				
						CLAIMS					
AS FILED		AFTER 1 ST AMENDMENT		AFTER 2 ND AMENDMENT							
IND.	DEP.	IND.	DEP.	IND.	DEP.	IND.	DEP.	IND.	DEP.	IND.	DEP.
1						61					
2						62					
3						63					
4						64					
5						65					
6						66					
7						67					
8						68					
9						69					
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40						100					
41											
42											
43											
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45											
46											
47											
48											
49											
50											
TOTAL IND.						TOTAL IND.					
TOTAL DEP.	16					TOTAL DEP.					
TOTAL CLAIMS	22					TOTAL CLAIMS					

PTO-375 (2-79)

MAY BE USED FOR ADDITIONAL CLAIMS OR AMENDMENTS

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 12 FEB 2002	2
V.40	PCT

10

Applicant's or agent's file reference 11548-1PCT	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US00/35107	International filing date (day/month/year) 21 DECEMBER 2000	Priority date (day/month/year) 22 DECEMBER 1999
International Patent Classification (IPC) or national classification and IPC IPC(7): G10L 15/22 and US Cl.: 704/275		
Applicant AMBUSH INTERACTIVE INC.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets.

This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority. (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 0 sheets.

3. This report contains indications relating to the following items:

- I Basis of the report
- II Priority
- III Non-establishment of report with regard to novelty, inventive step or industrial applicability
- IV Lack of unity of invention
- V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability, citations and explanations supporting such statement
- VI Certain documents cited
- VII Certain defects in the international application
- VIII Certain observations on the international application

Date of submission of the demand 20 JULY 2001	Date of completion of this report 23 JANUARY 2002
Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer RICHEMOND DORVIL Telephone No. (703) 305-3603

Form PCT/IPEA/409 (cover sheet) (July 1998)★

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US00/35107

I. Basis of the report

1. With regard to the elements of the international application:*

the international application as originally filed
 the description:
 pages 1-92 , as originally filed
 pages NONE , filed with the demand
 pages NONE , filed with the letter of _____

the claims:
 pages 93-96 , as originally filed
 pages NONE , as amended (together with any statement) under Article 19
 pages NONE , filed with the demand
 pages NONE , filed with the letter of _____

the drawings:
 pages 1-30 , as originally filed
 pages NONE , filed with the demand
 pages NONE , filed with the letter of _____

the sequence listing part of the description:
 pages NONE , as originally filed
 pages NONE , filed with the demand
 pages NONE , filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language _____ which is:

- the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- the language of publication of the international application (under Rule 48.3(b)).
- the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in printed form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- the description, pages NONE
- the claims, Nos. NONE
- the drawings, sheets/fig NONE

5. This report has been drawn as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

**Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US00/55107

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability, citations and explanations supporting such statement**1. statement**

Novelty (N)	Claims <u>1-22</u>	YES
	Claims <u>NONE</u>	NO
Inventive Step (IS)	Claims <u>NONE</u>	YES
	Claims <u>1-22</u>	NO
Industrial Applicability (IA)	Claims <u>1-22</u>	YES
	Claims <u>NONE</u>	NO

2. citations and explanations (Rule 70.7)

Claims 1-22 lack an inventive step under PCT Article 33(s) as being obvious over Kimura et al., US Patent No. 5,199,080 in view of Mathurin, US Patent No. 5,444,673.

As per claims 1, 5, 22, 9-11, 12-17, 18-20, 21, Kimura et al. disclose a voice actuated remote control system for controlling appliances, (see Title), comprising:

a microphone for receiving voice signals, (see Fig. 5, item 12);

a speech recognition system for receiving voice signals, (see Fig. 5, Block 15A), said speech recognition system having a low power consumption mode, (see Fig 9, block S3), and speech recognition mode for decoding said voice signals and generating control signals for controlling an appliance, (see col. 9, lines 15-40);

an appliance control circuit which includes a transmitter, (see Fig. 5, block 17), said appliance control circuit for receiving said control signals from said speech recognition and transmitting an appliance control signal to a selected appliance, (see Fig. 5, blocks 16, 19A and 17).

Kimura et al. fail to explicitly teach a voice actuated remote control and means for automatically switch between a sound activation mode to a speech recognition mode as a function of the amplitude of the voice signals. However, this feature is well known in the art as evidenced by Mathurin which discloses a voice actuated remote control wherein the speech recognition system include means for automatically switch between a sound activation mode to a speech recognition mode as a function of the amplitude of the voice signals, (see col. 2, lines 3-17). It would have been obvious to one of ordinary skill the art at the time the invention was made to use means for automatically switching between activation mode and recognition mode based on the amplitude of the voice signal in Kimura et al. voice operated remote control because Mathurin teaches one of ordinary skill in the art the benefit of using means for switching between a speech activation mode to a speech recognition mode in order to effectively perform recognition of the voice signal.

As per claims 2, 4, 6, 7, Kimura et al. disclose a system (Continued on Supplemental Sheet.)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US00/35107

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Boxes I - VIII

Sheet 10

V. 2. REASONED STATEMENTS - CITATIONS AND EXPLANATIONS (Continued):

wherein the said transmitter is configured to wirelessly transmit appliance control signals to said appliance, (s22 Fig. 1, signal RC).

As per claims 3, 8, Kimura et al. disclose a system wherein the said transmitter is an infrared transmitter, (see Fig. 5, block D1).

----- NEW CITATIONS -----

NONE

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
28 June 2001 (28.06.2001)

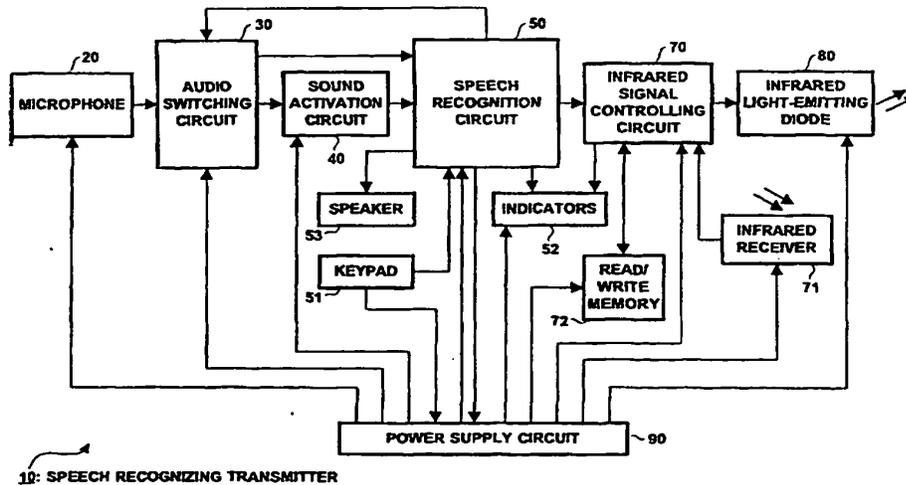
PCT

(10) International Publication Number
WO 01/46946 A1

- (51) International Patent Classification: **G10L 15/22**
 - (21) International Application Number: **PCT/US00/35107**
 - (22) International Filing Date:
21 December 2000 (21.12.2000)
 - (25) Filing Language: **English**
 - (26) Publication Language: **English**
 - (30) Priority Data:
09/469,707 22 December 1999 (22.12.1999) **US**
 - (71) Applicant (for all designated States except US): **AM-BUSH INTERACTIVE, INC.** [US/US]; 217 Fifth Place, Manhattan Beach, CA 90266 (US).
 - (72) Inventors; and
 - (75) Inventors/Applicants (for US only): **BUSH, William, Stuart** [US/US]; 217 Fifth Place, Manhattan Beach, CA 90266 (US). **ROURA, Carlos, Ferdinand** [US/US]; 1714 West 255th Street, Lomita, CA 90717 (US).
 - (74) Agents: **PANIAGUAS, John, S.** et al.; Katten Muchin Zavis, 525 West Monroe Street, Suite 1600, Chicago, IL 60661 (US).
 - (81) Designated States (national): **AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CU, CZ, DE, DK, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW.**
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(54) Title: **HANDS-FREE, VOICE-OPERATED REMOTE CONTROL TRANSMITTER**



(57) Abstract: A wireless, programmable, sound-activated and voice-operated remote control system which generates and transmits an appliance control signal to a selected appliance in response to a voice command has a speech recognition (50) for recognizing the voice command. The speech recognition circuit (50) has a low power sound activation circuit (40) for detecting the presence of voice signals from the microphone (20) and an audio switching circuit (30) for automatically switching between sound activation mode and speech recognition mode. The present invention may be pre-programmed with a universal library of codes for controlling various appliance categories and appliances produced by various manufacturers within each category.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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HANDS-FREE, VOICE-OPERATED REMOTE CONTROL TRANSMITTER

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BACKGROUND OF THE INVENTION**1. Field of Invention**

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This invention relates to devices for remotely controlling electronic equipment, and more particularly, to a wireless, user-programmable, voice-activated and voice-operated remote control system for controlling appliances.

2. Description of Prior Art

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Historically, appliances, for example, electronic appliances, such as, televisions, VCRs, digital satellite systems, audio systems, and related accessories, have been remotely controlled by hand-held transmitters used to generate signals to receivers incorporated into the electronics of the remotely controlled appliances. Signals for such appliances correspond to control commands, such as channel selection/tuning, power on/off, audio volume adjustment, and muting controls, typically generated by the user by depressing buttons on a remote control transmitter keypad. The basic composition and operation of such remote control systems are well known in the art.

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For convenience, such remote control transmitters are generally designed to be sufficiently small to be hand-held during operation. There are several disadvantages in using such hand-held transmitters. For example, the small size and mobility often contribute to misplacement or loss of the transmitter. Also, for device operators with restricted physical mobility or sight limitations, hand-held remote controls may not provide sufficient access to the command controls of the remotely controlled appliances.

5 Also, if an operator's hands are engaged in an activity, an interruption in the activity may be required to operate the hand-held remote control, causing inconvenience to the operator and potentially having an adverse effect on productivity.

Additional problems occur as a consumer acquires various remotely controlled appliances, where each is typically supplied with a separate remote control transmitter. As the number of separate remote control transmitters increases, locating, distinguishing, and locating the appropriate transmitters becomes increasingly difficult. In response to this problem, universal remote control transmitters, pre-programmed by the manufacturers with control commands, typically coded infrared signals, have been developed to operate many different remotely controlled electronic appliances, for example, as disclosed in U.S. Pat. No. 4,774,511. In addition to universal remote control transmitters, learning remote control transmitters have been developed which receive the control command signals, typically infrared codes, from the remote control transmitters provided with remotely controlled appliances and generally store the frequencies and pulses into memory, with the signals becoming associated with buttons located on the keypad of the learning remote control transmitter. After programming is complete, depressing the keypad buttons prompts the learning remote control transmitter to re-transmit the codes stored within its memory. This allows the user to consolidate the control of several remotely controllable appliances into a single hand-held remote control transmitter. An example of such a system is disclosed in U.S. Patent No. 5,142,398. For additional convenience to the user, the learning capability has been combined with universal remote control transmitters which are pre-programmed by the manufacturers with control commands necessary to operate many different remotely controlled electronic appliances, for example as disclosed in U.S. Pat. No. 5,691, 710.

30 All of the above-mentioned systems require the user to establish physical contact, typically in the form of manually depressing keypad buttons, to transmit a control command to the remotely controlled appliance. As such, the above-mentioned systems due to their small size are often misplaced causing frustration to the user.

As such, voice-operated remote control systems have recently been developed which operate in response to user-spoken commands instead of commands

5 selected by manually depressing keypad buttons. U.S. Pat. Nos. 5,199,080; 5,247,580;
5,267,323 and 5,226,090 disclose various embodiments of voice-operated remote control
systems which employ voice control commands instead of control commands entered
through buttons on a keypad. Unfortunately, such systems are not truly hands-free,
requiring manual intervention by the user during use. In particular, such remote control
10 systems as disclosed in the above-mentioned patents, are all based upon the use of a "talk
switch"; which must be manually depressed to enter a voice command when the
transmission of a remote control signal is desired.

U.S. Pat. No. 5,226,090 further discloses a voice-operated remote control
system which contains a detector for detecting whether a voice command is received or
15 not. A detected signal from the detector is applied to a power supply circuit. When there
is no voice command received as detected by the detector, the power supply control
circuit cuts off electric energy supplied to a speech recognition circuit. The voice
command detector circuit is implemented by a detecting program stored in the ROM in
a controller. The detecting program determines whether the talk switch has been
20 depressed. The transmitter operates depending on whether the talk switch has been
depressed. If the talk switch has been depressed, the transmitter is enabled to remote
control signals. Once the talk switch is released, the transmitter is kept in a low power
consumption mode, waiting for voice commands to be applied. As indicated above, the
means for generating and transmitting a remote control signal based on the recognized
25 spoken voice command is not hands-free, requiring the manual intervention of pressing
a talk switch to accomplish these functions.

Various other systems are known which use speech recognition to control
appliances. For example, U.S. Patent No. 5,852,804 discloses a system for controlling
several external appliances connected to a speech recognition system. However, the
30 system disclosed in the '804 patent requires physical interconnections between the
control system and the appliance which makes it difficult for a user to add additional
appliances or change controlled appliances.

U.S. Patent No. 5,878,394 discloses a system which includes connections
to a remote control network for transmitting infrared codes and a graphical user interface

5 on a personal computer (PC). In addition to the inconvenience of establishing the remote
control network, a user must have access to a PC and desire to make the PC available for
such control functions. The system disclosed in the '394 patent has only limited utility
for consumers who have access to a PC or can afford the expense of a PC and thus
excludes a significant portion of consumers who may otherwise desire to add speech
10 recognition control to their electronic appliances if an inexpensive alternative is available.

U.S. Patent No. 5,774,859 discloses a subscriber information system with
a speech interface, similar to the system disclosed in U.S. Patent No. 5,878,394 the
system in the '859 patent is based upon a PC-class processor. Operation of this system
is dependent upon receiving information from an information distribution center or head-
15 end installation and therefore lacks the advantages of a stand-alone device.
Unfortunately, the remote control is not capable of independently completing the speech
recognition process and transmitting infrared signals indicated by such recognition results
to controlled appliances. Furthermore, this system also requires a PC-class processor.

Inconvenience is another problem that occurs as a user intends to perform
20 multiple control functions involving one or more controlled appliances and must recall
and enter a series of voice commands to a voice-operated remote control system. U.S.
Patent No. 5,852,804 discloses a system, where one speech command may be defined
which is capable of manipulation of more than one connected appliance. However, this
system requires that each controlled appliance be physically connected to the system and
25 that the controlled appliance be manually manipulated during setup for each function to
be executed upon recognition of the speech command. Also, if a single command is to
be used to execute a series of controlled appliance functions, its capability is limited
unless time delays of variable lengths may be inserted within the series of control
functions to accommodate the initialization periods for certain controlled appliances. For
30 example, if a voice command sends signals to a television to power it on and turn to a
specified channel, a period of time may elapse between the receipt of the power on
command until the television warms up and is ready to receive additional commands.
Such initialization periods vary from appliance to appliance and therefore means is
needed to allow a user to adjust the time delay as necessary.

5 There are various other problems with known systems which utilize voice
recognition to control appliances. For example, one problem occurs as the list of voice
commands grows. Generally, each time a speech recognition product detects a spoken
word, it compares the word to those in a recognition vocabulary. In general, as a
recognition vocabulary increases in size, recognition time increases and accuracy
10 decreases. The more words in a recognition vocabulary, the more likely the speech
recognition circuit will make a mistake and accuracy generally diminishes. Without the
capability to utilize multiple vocabulary recognition sets, the commands available for
selection must all be available at the same time, meaning they must all reside in the same
recognition vocabulary set. Thus, the user may be inconvenienced by the limited
15 command availability of a small recognition vocabulary or the diminishing speech
recognition accuracy and longer recognition times resulting as the single recognition
vocabulary is increased in size. Another disadvantage of a single recognition vocabulary
is that the recognition of voice command always yields the same response. In a multiple
recognition vocabulary set scheme, the same voice command may yield different results
20 upon recognition if placed within different vocabulary recognition sets. A still further
disadvantage of a single recognition vocabulary is that the recognition vocabulary words
must be phonetically distinctive from each other which may limit the use of words that
may be intuitive for their intended function but are too phonetically similar to other
words in the recognition vocabulary, forcing the user to remember a word that is less
25 intuitive. In a multiple recognition vocabulary set scheme, words that are not
phonetically distinctive from each other may still be used by placing such words in
different recognition vocabulary sets.

 Another problem with known systems occurs when a device is limited to
executing software for a single speech recognition mode for recognizing spoken
30 commands to remotely control appliances. This problem becomes apparent if an
appliance has the ability to process a series of remote control signals arriving within a
predetermined time of each other differently than if the codes arrive at intervals outside
of this predetermined time. For example, many televisions are capable of receiving the
remote control signal transmissions for the digits one, two and three in rapid succession

5 and responding by switching to channel 123 instead of changing to channel 1, then to
channel 2 and then to channel 3. As such, a user must be able to quickly submit a voice
command following the recognition of a prior voice command, and then the recognition
of the latter voice command, the submission of a remote control signal and the detection
10 of the signal by the appliance must occur within the time limit if the appliance is to
interpret the commands as a related series of commands instead of individual commands.

Thus, there is a need for a stand-alone, wireless remote control that can
be positioned in a location remote to both the user and the controlled appliances, which
can be activated and operated entirely via voice commands, conveniently compatible with
commercially available remote controlled appliances, and can be operated by a plurality
15 of users and can be programmed by a user to operate in a customized manner.

SUMMARY OF THE INVENTION

20 The present invention relates to a method and apparatus that enables a user
to control the function of one or more electric appliances or other electrical equipment
solely with voice commands. An important aspect of the invention relates to voice-
actuated mode switching for switching the present invention from a low power
consumption mode.

25 A hands-free speech recognizing transmitter in accordance with the
invention, which may be a light-weight small base mounted unit, is adapted to be located
near the controlled appliances. A voice-operated selection mechanism is provided for
selecting any one of a number of categories of appliances to be controlled. A universal
remote control code library may be provided which allows codes to be selected for
control of different types of appliances as well as appliances manufactured by different
30 manufacturers. Infrared signal receiving, decoding and storage capabilities further
enhance the invention by providing means to learn infrared codes from other remote
control transmitters, such as an appliance's original remote control transmitter. This
feature is advantageous for appliances whose codes are not contained in the universal
library stored in the invention's memory and also serves to render the invention much less

5 susceptible to obsolescence than speech recognizing transmitters disclosed in the prior art.

A scheme is provided where both speaker independent and speaker dependent vocabulary may be used as voice commands. A speaker independent vocabulary structure provides the user with the means of navigating multiple linked
10 recognition vocabulary sets. At any one time, a single recognition set is made active by the speech recognition circuit. A voice command in one recognition vocabulary set may be used to activate another recognition vocabulary set. In this fashion, a user may verbally navigate among different types of remote control functions and target appliances in an intuitive fashion, while minimizing the number of alternative words from which the
15 speech recognition circuit must select during any given recognition process.

With the total recognition vocabulary partitioned into smaller recognition vocabulary sets, improvements result in recognition time and accuracy because, in general, as a recognition vocabulary increases in size, recognition time increases and accuracy decreases. Furthermore, recognition vocabulary sets are created such that the
20 contents within each set have either functional similarities or otherwise share a relationship that is intuitive to the user. To prevent confusion that may arise with respect to the active recognition vocabulary set at any given time, the present invention monitors conditions with a time-out counter and an error counter to automatically return to a general default mode if certain conditions are met. In other words, a predetermined
25 number of recognition errors or a period during which no successful recognition occurs will result in a known default state.

Custom speaker dependent voice commands may be trained by the user and associated with infrared signals during product setup processes. These speaker dependent commands may be accessible from the vocabulary structure described above.

30 The present invention has the capability of transmitting multiple control signals, such as infrared signals, to one or more appliances in response to a single voice command by the user. Such macro programs may be programmed by the user during a product setup process. For example, a user may desire that the response to the voice command "Video" is for the invention to issue commands to turn a TV power on, wait

5 for the TV to warm up until it is ready to receive control signals, such as infrared signals, set the channel to "3," select the VCR for control, turn on the VCR, and execute the VCR's play function. As another example, the user may desire that the response to the user-trained voice command "Sports" is for the invention to issue commands to a TV to turn to channel 123.

10 The system may be configured to be self-contained in a single free-standing or stand-alone housing. The housing may contain a directional microphone mounted to be rotationally adjusted by the user to enable the user to adjust the sensitivity of the microphone so that the microphone's high sensitivity region is pointed toward the user and microphone noise generating sources, such as an appliance's loudspeaker are
15 located in a region of low microphone sensitivity. Visual indication lights may be provided in a manner to remain in line of sight with the user to communicate operation status, such as availability for recognition and results of prior recognition attempts. A small keypad may be provided to assist the user during product setup sequences. A speaker is also provided to enable output speech synthesized prompts to further assist the
20 user during setup sequences.

DESCRIPTION OF THE DRAWINGS

These and other advantages of the present invention are readily understood with reference to the following specification and attached drawings wherein:

25 FIG. 1 is a functional block diagram of the electronic elements and circuits in one embodiment of the present invention;

FIG. 2a is a functional block diagram showing the details of the speech recognition circuit in one embodiment of the present invention;

30 FIG. 2b is a functional block diagram showing the details of the infrared signal controlling circuit in one embodiment of the present invention;

FIG. 2c is a schematic circuit diagram showing the details of the audio switching circuit and the sound activation circuit in one embodiment of the present invention;

5 FIGs. 2d-2f illustrate alternate embodiments of the sound activation circuit illustrated in Fig. 2c.

FIG. 3 is a perspective view of the physical housing for one embodiment of the present invention;

FIG. 4a is a side view of the housing illustrated in FIG. 3.

10 FIG. 4b is an exploded perspective view of the housing illustrated in FIG. 3.

FIG. 4c is a partial sectional view of the housing illustrated in FIG. 3.

FIG. 5 is a functional block diagram showing the default operation modes of one embodiment of the present invention;

15 FIG. 6 is a functional block diagram showing the sound activation mode sequence steps for one embodiment of the present invention;

FIG. 7 is a functional block diagram showing the different recognition modes that may be utilized when different recognition vocabulary sets are activated in one embodiment of the present invention;

20 FIG. 8 is a functional block diagram showing the sequence of steps for the response prompting recognition mode for one embodiment of the present invention;

FIG. 9 is a functional block diagram showing the sequence of steps for the pattern queuing recognition mode for one embodiment of the present invention;

25 FIG. 10 is a functional block diagram showing a continuation of the sequence of steps for pattern queuing recognition mode for one embodiment of the present invention shown in FIG. 9;

FIG. 11 is a functional block diagram showing the sequence steps for executing a macro program in one embodiment of the present invention;

30 FIGS. 12A and 12B is a functional block diagram showing the sequence steps for initiating the product setup process for one embodiment of the present invention;

FIGS. 13A-13C is a functional block diagram showing the sequence steps for selecting a controlled appliance code during a product setup process for one embodiment of the present invention;

5 FIGS. 14A and 14B is a functional block diagram showing the sequence steps for learning an infrared signal from another remote control transmitter during a product setup process for one embodiment of the present invention;

 FIG. 15 is a functional block diagram showing the sequence steps for teaching custom, speaker dependent voice command names during a product setup
10 process for one embodiment of the present invention;

 FIGS. 16A and 16B is a functional block diagram showing the sequence steps for creating a macro program during a product setup process for one embodiment of the present invention;

 FIG. 17 is a schematic circuit diagram showing the details of the power supply circuit of one embodiment of the present invention;
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 FIG. 18a is a functional block diagram of an alternative embodiment of an audio switching circuit in accordance with one embodiment of the present invention;

 FIG. 18b is a functional block diagram of an alternate embodiment utilizing separate microphones for the sound activation circuit and speech recognition circuit in accordance with the present invention;
20

 FIG. 18c is a functional block diagram of another alternate embodiment utilizing separate microphones for the sound activation circuit and speech recognition circuit in accordance with the present invention.

25 **DETAILED DESCRIPTION**

 The present invention relates to a truly hands-free universal control unit system for controlling various appliances, such as entertainment appliances, for example, TVs, VCRs, stereo's and the like and may also be used for non-entertainment appliances and virtually any device that is amenable to remote control. The universal remote control system in accordance with the present invention is user programmable to enable any
30 number of appliances to be programmed by the user. In order to facilitate portability and eliminate the inconvenience associated with power cords/cables, the universal control system in accordance with one embodiment of the invention may be battery operated. During periods when no voice commands are being issued the system enters a sleep or

5 sound activation mode. An important aspect of the invention relates to the ability of the system to switch from a sleep mode to an active mode solely by voice commands, to provide true hands-free remote operation.

A block diagram of the system in accordance with the present invention is illustrated in FIG. 1 and generally identified with the reference numeral 10. As will be discussed in more detail below, the system 10 enables hands-free operation of one or more appliances in a wireless manner.

Referring to FIG. 1, the system 10 includes a microphone 20, an audio switching circuit 30, a sound activation circuit 40, a speech recognition circuit 50, and a transmitter, for example, an infrared signal controlling circuit 70 and one or more infrared light-emitting diodes 80. The system 10 may also contain an infrared receiver 15 71, a read/write memory device 72 for storage of received IR signal data one or more indicators 52, a keypad 51 and a speaker 53. A power supply circuit 90 is also included. The power supply 90 may be configured for DC operation to enable portability of the system 10 or alternatively AC operation.

20 An output signal from the microphone 20 is electrically connected to an automatic audio switching circuit 30. The microphone 20 may be one or more directional microphones, which have higher sensitivity to sound generated in predetermined regions in relation to the microphone's position than in other predetermined regions. A suitable microphone is a model number M118HC directional microphone, available from Lucent Technologies and described in detail in; "DM 1000 Component Directional Microphone", pages 1 and 2, available from Lucent Technologies, hereby incorporated by reference. Sound arriving at the microphone is converted into an electric audio output signal by the microphone 20 and is directed to the audio switching circuit 30. Depending on the state of the audio switching circuit 30, the microphone audio signal output is directed to the speech recognition circuit 50 if the speech recognition circuit 50 is not in a sound activation mode. Conversely, if the speech recognition circuit 50 is in sound activation mode, the audio switching circuit 30 routes the microphone audio signal output to a sound activation circuit 40.

5 In the sound activation mode, the output signal of the microphone 20 is electrically connected to the sound activation circuit 40 which includes an amplification circuit (shown in detail in FIG. 2c), that amplifies the signal and a trigger circuit 43 (shown in FIG. 2c) that receives the amplified signal from the output of the amplification circuit. An output of the trigger circuit 43 is electrically connected to an input/output pin
10 of the speech recognition circuit 50. If the amplified signal is of sufficient amplitude to activate the trigger circuit 43, the output of the trigger circuit causes a logic state change on the input/output pin of the speech recognition circuit 50, causing the invention to change modes from a sleep or sound activation mode to an awake or speech recognition mode.

15 The mode change may be done in software and/or hardware to cause the logic state of a mode output pin 65 (shown in FIG. 2a) of the speech recognition circuit 50, connected to an input control of the audio switching circuit, to cause the audio switching circuit 30 to route the microphone output signal to the speech recognition circuit 50. Once the logic state is changed to an awake or speech recognition mode, voice
20 commands may then be received and recognized by the speech recognition circuit 50. The speech recognition circuit 50 may include output pins that are electrically connected to a infrared signal controlling circuit 70. Upon recognition of a voice command associated with an instruction to the transmitter, for example, an infrared signal controlling circuit 70, the speech recognition circuit 50 sends one or more signals using
25 the output pins to the infrared signal controlling circuit 70.

 The system 10 as illustrated and described herein translates the voice commands to infrared signals for controlling the appliance by way of an infrared link. In particular, as will be discussed in more detail below, the output from the speech recognition circuit 50 is directed to a wireless transmitter, formed from an infrared signal
30 controlling unit 70 and one or more infrared light emitting diodes 80 capable of transmitting infrared light in one or more wavelengths. As such, the present invention utilizes conventional infrared remote control microcontroller- based technologies, including the conventional universal appliance code libraries that are familiar to those skilled in the art. Alternatively, the system may utilize other wireless links, other than

5 infrared or in addition thereto, such as RF, ultrasonic and optical links. In addition, certain aspects of the invention including the mode changing from a sleep to an awake mode are adapted to be used with appliances that are either wired and wirelessly coupled to the system. For example, the appliances may be coupled to the system 10 over a power distribution network. In all such applications, the principles of the present invention enable truly hands free control of the appliances.

10 Referring back to FIG. 1, for applications utilizing infrared signals to control the appliance, the infrared signal controlling circuit 70 is electrically connected to one or more infrared light emitting diodes 80. The infrared signal controlling circuit 70 receives and interprets signals from the speech recognition circuit 50 and if the signals
15 communicate instructions to transmit infrared signals to a controlled appliance, the infrared signal controlling circuit 70 identifies the appropriate remote control code and sends a remote control signal representing the code to the infrared light emitting diode(s) 80, which transmits the signal to the controlled appliance.

20 An infrared receiver 71, a read/write memory 72, and an indicator 52d may be electrically connected to the infrared signal controlling circuit 80. The infrared receiver 72 detects and receives the infrared remote control signals transmitted by other remote control transmitters in a learn mode. The infrared signal controlling circuit 70 receives these signals as digital output from the infrared receiver 72. The infrared signal controlling circuit 70 decodes and stores the digital signals as codes in the read/write
25 memory 72 for later transmission. The indicator 52d may be used to provide a visual indicator to the user during said infrared signal receiving and transmitting operations.

30 A keypad 51, indicators 52a, 52b and 52c, and a speaker 53 may be electrically connected to the speech recognition circuit 50. The keypad 51 buttons may be utilized by the user to send signals to the input pins of the speech recognition circuit 50 during a product setup process and to provide a power switch for the invention. The indicators 52 may be utilized to provide the user with visual status of the system during setup and operation. The speaker 53 is driven by the speech recognition circuit 50 pulse width modulation output and is primarily used to provide synthesized speech prompts to the user during product setup processes.

5 Software executed by the speech recognition circuit 50 monitors conditions with a sound activation time-out counter and an error recognition counter. Upon the attainment of predetermined conditions discussed below, the speech recognition circuit 50 software enters a low power consuming sleep or sound activation mode.

10 A power supply circuit 90 electrically connects a power source (not shown) to circuitry distributing electric power to the electronic elements of the present invention. The power source may be either AC or DC or a combination thereof. For example, commercially available alkaline batteries or rechargeable battery packs are suitable for a DC power supply.

15 Reference is made to FIG. 17 which shows the power supply circuit 90 in greater detail than that shown in FIG. 1. As previously discussed, one of the buttons present on the keypad 51 may be connected to a momentary switch, which, when depressed and held for a sufficient duration of time, establishes an electrical connection between a power source 91 and an input control pin of a digitally controlled CMOS single-pole, single-throw (SPST) analog switch 93. An example of a commercially
20 available SPST switch for such purposes is a model number ADG701, available from Analog Devices, Inc. and described in a data sheet entitled; CMOS Low Voltage 2 Ω SPST Switches, Rev a, pages 1-8 available from Analog Devices, Inc., hereby incorporated by reference. The input control pin responds to this electrical connection with the power source 91 in a manner equivalent to receiving a logic high digital input,
25 resulting in a closed electrical connection between switch 93 source and drain pins and allowing a connection to be established between the power source 91 and a power distribution plane 94. When the speech recognition circuit IC 55 becomes electrically connected with the power source 91 as described above, the software stored within its ROM 61 executes a program to set a predetermined output pin 68 to a logic high state.
30 The output pin 68 is electrically connected to the input control pin of the switch 93. Thus, the response of the speech recognition circuit IC 55 to receiving electric energy during a power up sequence is to cause switch 93 to establish a closed electrical connection between its source and drain pins. This electrical connection within switch 93 allows the power source 91 to be electrically connected to the power distribution plane

5 94 which distributes electric energy throughout the printed circuit board assembly 16 for use by components requiring electric energy for operation.

 The software contained within the ROM 61 of the speech recognition circuit 50 may respond to the recognition of a speech command such as "*Power*" when the appropriate recognition vocabulary set is active and under the conditions described below by executing a command to change the logic state of said output pin 68 to a logic low condition. This logic low is then received by the input control pin of switch 93, which responds by creating an open connection between switch 93 source and drain pins, and thus disconnecting power distribution plane 94 from the power source 91. Thus, the present invention may be powered down via voice command. If the power switch 93 is open as shown in FIG. 17, the circuit elements reliant on this connection to receive energy do not receive electric energy. Also shown in FIG. 17 is a protection diode 2, for example, a commercially available 1N4001, located in series with the power source 91 and other electrical connections to prevent damage to other printed circuit board assembly 16 components in the event batteries are inserted with incorrect polarity orientation.

20 FIG. 2a illustrates the speech recognition circuit 50 in greater detail. The electronic elements of the speech recognition circuit 50 that process the microphone audio signal output received from the audio switching circuit 30 may be in the form of a microcontroller-based integrated circuit, IC chip 55. Such microcontroller-based ICs specifically designed for speech applications in consumer electronic products are well described in the prior art and are commercially available. An example of a suitable IC is a type RSC-300/364 speech recognition microcontroller as manufactured by Sensory, Inc. of Sunnyvale, California and as described in a data sheet entitled; RSC-300/364 Recognition Synthesis Control, published by Sensory, Inc. copyright 1999, and Data Book RSC-300/364; pages 1-50, published by Sensory Inc, Sunnyvale, California, copyright August 1999, hereby incorporated by reference. Alternately, other microcontrollers can be used as well as digital signal processors. In particular, the IC 55 contains as a minimum a preamplifier 56, an analog to digital converter (A/D) 57, a speech processing unit 58, an automatic gain control (AGC) 59, a microcontroller 60, a read-only memory (ROM) 61, a random access memory (RAM) 62, a pulse width

5 modulation (PWM) output 67 or a digital to analog converter (not shown), a mode output
65 pin, a clock 63, an external memory interface 66, and two general purpose
input/output (I/O) ports 68. Also included in the speech recognition circuit 50 are a clock
source 64, a read/write memory device for storage of speech reference pattern data 54,
and, optionally, additional read/write memory device(s) 69 or ROM devices (not shown)
10 connected to the external memory interface 66. The description of the operation of the
speech recognition circuit 55 is provided in general terms for the specific speech
recognition IC mentioned above and is specific only in areas where the present invention
departs from prior art disclosures or is beneficial to the explanation of aspects of the
present invention. It should also be noted that, as an alternate to the speech recognition
15 IC 55, a conventional microprocessor or a digital signal processor capable of executing
speech recognition software algorithms may be used. Any of the speech recognition
circuit elements described above that are not included in said conventional processors
may be provided in circuitry external to said IC.

The present invention executes pattern generation algorithms and speech
20 recognition algorithms that are known to those skilled in the art. One speech recognition
algorithm for speaker independent recognition uses a pre-trained neural network
described in prior art, for example, as is provided by Sensory, Inc. as described below.
One process for speaker dependent speech recognition involves creating a reference
pattern for each voice command word or phrase during a user-controlled product setup
25 process. During this set-up process, a pattern is generated when a voice command is
spoken by the user. A pattern is a compact representation of the significant acoustic
information in a voice command word or phrase. A speaker dependent reference pattern
is created by averaging patterns generated as the voice command is spoken two or more
times and the reference pattern is stored in a read/write memory 54. After the setup
30 process is complete, speaker dependent speech recognition then involves comparing an
unknown pattern generated from a voice command spoken by the user to the speaker
dependent reference patterns within a specified recognition vocabulary set. This
comparison may involve distance measurements and calculations of the fit of the
unknown pattern to each of the reference patterns to determine the closest matching

5 reference pattern. However, the present invention may implement one or more generally known algorithms, including but not limited to pattern matching that compares an unknown pattern with reference patterns, neural networks, and/or hidden Markov models.

10 One embodiment of the present invention makes both speaker independent and speaker dependent speech recognition available to the user by providing factory-programmed speaker independent commands that require no additional user voice training and providing speaker dependent command training capability to allow the user to create custom names for appliances, functions, and macro programs. Speaker independent speech recognition is designed to recognize words spoken by a plurality of users and is language dependent. Speaker independent command reference data are
15 generally derived from recordings of the specified spoken commands from several hundred individuals with different speech characteristics and accents in conditions similar to the environment of a product's intended use. Therefore, speaker independent commands require no voice training from the user. Speaker dependent recognition generally involves a user training a product to recognize specific words, and is therefore
20 not language dependent. The implementation of linked recognition sets as previously described also allows the user to easily access and navigate among both speaker dependent and speaker independent recognition vocabulary sets. Other embodiments of the present invention may be of the form of a speaker independent only version or a speaker dependent version where a user may follow a set-up sequence to train speaker dependent words in place of the speaker independent structure of the embodiment
25 described herein.

When the speech recognition circuit 50 is not in a sound activation mode, the audio switching circuit 30 provides an electric connection between the microphone audio signal output and the preamplifier 56 in the speech recognition circuit 50. The
30 preamplifier 56 provides signal amplification to a level suitable for analog to digital conversion. The analog to digital converter (A/D) 57, preferably having an accuracy of at least 12 bits, is coupled to the output of the preamplifier 56 and converts the incoming audio waveform into digital representations of the incoming signal. The digital output of the analog to digital converter 57 is directed to the speech processing unit 58. The

5 speech processing unit 58 is controlled by the controller 60 and utilizes RAM 62 for
temporary storage of data, control information and result registers, and an arithmetic logic
unit (not shown) to produce band-pass-filtered representations of the input waveform in
several frequency bands. The output of the speech processing unit 58 is received by the
controller 60. Utilizing code stored in ROM 61 as discussed below, and register space
10 and data space provided by the RAM 62, the controller 60 analyzes the filtered input
waveforms to produce a pattern in real time that contains the significant acoustic
information in the input signal. The controller 60 then executes recognition algorithm
software to determine which voice command in the active recognition vocabulary set is
the best match and was most likely spoken by the user. The controller 60, utilizing
15 control code stored in the ROM 61, determines the appropriate operation of the system
associated with the recognition result, such as generating appropriate outputs at general
purpose input/output ports 68. An automatic gain control (ACG) 59 is controlled by the
controller 60 and provides feedback to the preamplifier 56 for adjustment of the level of
amplification performed on the microphone audio signal output due to variations in the
20 input signal.

The speech recognition circuit 50 may include one or more microphone
gain resistors, such as user-adjustable thumbwheel potentiometer 35, as well as capacitors
(not shown), as part of the preamplification circuitry. Some or all of these components
25 may be integrated into preamplifier 56. Such preamplification circuitry is well known
to those skilled to the electronic arts and, for example, is described in the previously
referenced in Data Book RSC-300/364, pages 1-50, published by Sensory Inc.,
Sunnyvale, California, copyright August 1999.

The IC 55 contains at least one oscillator which functions as a clock 63,
30 driven by a clock source 64 external to the IC 55. The IC 55 contains an external
memory bus 66 which serves as an interface for addressing additional ROM or RAM
located external to the IC if additional memory capacity is needed for control code or
data. The pulse width modulation (PWM) output pins 67 are electrically connected to
a speaker 53 and used primarily to provide synthesized speech prompts and/or audio

5 sounds to direct the user during product set-up sequences. The digital to analog converter (not shown) is electrically connected to an audio amplifier (not shown), and may be used as an alternate to the pulse width modulation (PWM) output 67, electrically connected to the speaker 53 to provide synthesized speech prompts.

10 Executing software code stored in the ROM 61, the controller 60 utilizes register space in the RAM 62 to control the logic states of predetermined control register bits to determine if the clock 63 is enabled or disabled and if the controller 60 is in a low power consuming mode or not. The controller 60 may place the speech recognition circuit 50 into a low power consuming sound activation mode by changing the logic states of said control register bits, removing the clock source 64 from the oscillator 63 of
15 IC 55. The controller 60 software also changes the logic state of a mode output 65 pin of the speech recognition circuit 50, as it enters the sound activation mode. An input control for the audio switching circuit 30 is electrically connected to said mode output 65 pin which changes logic states as the speech recognition circuit changes modes between speech recognition mode and sound activation mode. The input control for the
20 audio switching circuit 30 changes as the logic state of the mode output pin changes, causing the electric signal output from the microphone 20 to be electrically connected to the sound activation circuit 40. The audio switching circuit connections are shown in detail in FIG. 2c.

25 The speech recognition circuit 50 remains in this sound activation mode until the sound activation circuit 40 causes a bit transition at a predetermined input 68 pin. The bit transition changes the state of the previously set control register bits which removes the speech recognition circuit 50 from the low power consuming sleep or sound activation mode and enables the oscillator clock 63. Once the oscillator clock 63 is started and initialized, the code stored in the ROM 61 instructs the controller 60 to place
30 the speech recognition circuit 50 into speech recognition mode running a continuous listening pattern generation and recognition software routine. The software also instructs the controller to change the logic state of the mode output 65 pin.

Stopping and restarting the speech recognition circuit 50 as previously described does not cause a reset of the controller 60, nor cause loss of contents of internal

5 registers and thus allows the input/outputs 68 to remain where last set. By removing the oscillator clock source, the power requirement for the speech recognition circuit is significantly reduced, but the ability to maintain its energy supply allows the speech recognition circuit to retain the contents of its internal register and previously set input/output 68 conditions and resume operation in a relatively uninterrupted manner. 10 Furthermore, the energized speech recognition circuit remains capable of detecting input events at the IC 55 input 68 pins even when placed in low power consuming sound activation mode, further supporting the hands-free activation capability of the sound activated circuit 40.

The present invention may also contain software code stored in the ROM 15 61 to provide a user with a means of navigating a vocabulary structure consisting of multiple, partitioned recognition vocabulary sets. At any one time, no more than a single recognition vocabulary set is made active by the speech recognition circuit. With the total recognition vocabulary partitioned into smaller recognition vocabulary sets, improvements in recognition time and accuracy result because, in general, as a 20 recognition vocabulary increases in size, recognition time increases and accuracy decreases. Recognition vocabulary sets are generally created such that the voice commands, represented by the reference data within each said set, have either functional similarities or otherwise share a relationship that is intuitive to the operator. A voice command in one recognition vocabulary set may activate another recognition vocabulary 25 set. In this fashion, a user may verbally navigate among different types of function selections and target appliance selections in an intuitive fashion, while limiting the number of alternative words among which the speech recognition circuit must discriminate during any given recognition process. Furthermore, since a pattern generated by a voice command is compared only to the words in the active recognition 30 vocabulary set, the use of phonetically similar words is possible if such similar words are placed in different recognition vocabulary sets.

To prevent confusion that may arise with respect to the active recognition vocabulary set at any given time, the present invention monitors conditions with a time-out counter and an error counter to automatically return to a general default mode if

5 certain conditions are met. In other words, when no match is found or a period elapses in which no recognition attempts occur, the system returns to a known default state.

When a voice command submitted by the user is recognized by speech recognition circuit 50 as a match with one of the active recognition vocabulary set reference commands, the controller 60 executes the control code instruction associated with the matching reference command. The control code instruction may direct the controller 60 to (a) activate a new recognition vocabulary set; (b) utilize IC 55 output 68 pins to communicate instructions to the infrared signal controlling circuit 70; or (c) disconnect predetermined elements of the present invention circuitry from the power supply circuit for long term deactivation of the unit. A control code instruction directing the controller 60 to activate a new recognition vocabulary set may also direct the controller 60 to enter a new operating mode utilizing different pattern generating and/or speech recognition software.

The present invention may be provided with a user selectable default recognition vocabulary set, which is appropriate for an intended appliance category, to which the software causes the controller 60 to return following the recognition of certain voice commands or as the result of other predetermined conditions such as the elapse of time-out periods or the detection of a specified number of speech recognition errors. Recognition vocabulary sets contain reference command data representing the group of voice commands the invention is expecting to receive at any time, i.e. when a particular recognition vocabulary set is active.

The software running while a default recognition vocabulary set is available for speech recognition may typically be executing a routine where the speech recognition circuitry remains continuously available to generate patterns from detected voice commands unless otherwise processing a previous voice command for recognition or measuring the silence level to provide compensation for background noise. As indicated previously, when a voice command submitted by the user is recognized by speech recognition circuit 50 as a match with one of the default recognition vocabulary set reference commands, the controller 60 executes the control code instruction(s) associated with the matching reference command. The control code instruction(s) may

5 direct the controller 60 to activate a new recognition vocabulary set or utilize IC 55
output 68 pins to communicate instructions to the infrared signal controlling circuit 70.
Control code instructions directing the controller 60 to activate a new recognition
vocabulary set may also direct the controller 60 to enter a new operating mode utilizing
different pattern generating and/or speech recognition software.

10 FIG. 2b illustrates the infrared signal controlling circuit 70 in greater
detail. More specifically, the infrared signal controlling circuit 70 includes a controller
76, an interface 75 to the speech recognition circuit, one or more clock sources 73, and
one or more infrared driver circuits 74. Preferably the electronic elements of the
controller are in the form of a microcontroller integrated circuit, IC chip 76 as shown
15 in FIG. 2b. Such microcontroller-based ICs specifically designed for infrared remote
control transmitter applications which support infrared signal learning are well described
in the prior art and are commercially available. An example of a commercially available
controller for such purpose is a model number Z86L98, available from Zilog, Inc. and
described in detailed in; Preliminary Product Specification DS5000 701-IRX 1298, Z86
20 L81/86/98 28-Pin Low-Voltage Infrared Microcontroller, pages 1-55, available from
Zilog, Inc., Campbell California, hereby incorporated by reference. Other
microcontrollers as well as digital signal processors are also suitable.

The controller IC 76 generally contains, a controller, a read-only memory
(ROM), a random access memory (RAM), a clock, an external memory interface, a timer,
25 a modulator, one or more input ports, one or more output ports, and an encoder. A
plurality of stored infrared instruction codes and a plurality of program instructions are
generally stored within a ROM memory. The RAM is used by controller IC 76 to store
data for operations and control. The controller IC 76 oscillator derives its source from
clock source 73, such as a crystal or a ceramic resonator. The controller IC 76 is
30 electrically connected to an infrared receiver 71 that receives externally transmitted
infrared function codes (from a teaching transmitter, not shown) and supplies them to
controller IC 76 where they are conventionally decoded by the decoder, shown internally
to controller IC 76 in FIG. 2a. The external memory interface is used by the controller
IC 76 to store and access learned infrared signal codes in the external read/write memory

5 72. An infrared driver, which is generally transistor-based, is electrically connected to controller IC 76 and electrically connected to infrared light-emitting diode 80. An indicator light-emitting diode 52d is also connected to controller IC 76 which provides the user message prompts and other information, such as indicating operating stages and prompting desired user actions, for assisting in the programming of the present invention.

10 The general operation of this type of microcontrollers is well described in the prior art. Therefore, description of the operation of the infrared signal circuit controller herein is provided in general terms and is specific only in areas where the present invention departs from prior art disclosures or is beneficial to the explanation of aspects of the present invention. For conventional microcontrollers designed for remote control transmitter applications, the universal library of appliance codes are generally
15 stored within the ROM memory of the controller IC 76 or stored within a ROM memory external to controller IC 76 and accessible through an external memory interface. Codes acquired through infrared code learning are typically stored in a read/write memory external to controller IC 76. The memory devices are typically organized into a plurality
20 of pages with the various infrared function codes for a particular appliance model being generally assigned to a specific memory page.

As shown in FIG. 2b, an interface 75 provides electrical connections between the speech recognition circuit 50 and the controller IC 76. A plurality of output pins $PO_0, PO_1, \dots PO_{r-1}$ at the controller IC 76 are electrically connected as data inputs
25 to each of a series of multiplexers ($MUX_0, MUX_1, \dots MUX_{n-1}$) within the interface 75, which in one embodiment may be a programmable logic device configured to operate a switching matrix, connecting controller IC 76 outputs to controller IC 76 inputs. A suitable programmable logic device is a MACH 4 CPLD logic device, available from Lattice Semiconductor Corporation and described in detail in Publication 17466, Rev j,
30 MACH 4 CPLD FAMILY High Performance EE CMOS Programmable Logic, by Lattice Semiconductor Corporation, hereby incorporated by reference. The output 68 pins of the speech recognition IC 55 are electrically connected as select inputs $SI_0, SI_1, \dots SI_{m-1}$ to each of the multiplexers contained within the interface

5 75. The output of each multiplexer is electrically connected exclusively to one input pin
PI₀, PI₁, ... PI_{n-1} of controller IC 76.

 In response to the speech recognition circuit 50 recognition of a voice
command associated with an operation to send an instruction to the infrared signal
controlling circuit 70, the output 68 pins send a binary instruction to the select pin inputs
10 of the interface 75 multiplexers shown in FIG. 2a. Depending on the binary instruction
sent, each multiplexer may select zero or one of the data inputs to be electrically
connected to the multiplexer output. The interface 75 further controls the output enable
of each multiplexer such that the output is enabled only if one of the data inputs has been
selected for that multiplexer. This process produces an input at controller IC 76 input
15 pins that is equivalent to that resulting from a button depress on a keypad of a
conventional remote control transmitter which generates circuit connections. The
controller IC 76 software interprets the instruction received at its input pin(s) and
responds by (a) identifying a section of the ROM to be made available for subsequent
access if the instruction is associated with an appliance category selection; (b) by
20 identifying a memory location within its internal ROM and retrieving the control code
stored therein if the instruction is associated with a command stored within the universal
library of codes stored in ROM or (c) retrieving a learned infrared code stored in
read/write memory 72 if the instruction is associated with a learned infrared signal. If the
response to the received instruction is to transmit an infrared signal, the controller 76
25 utilizes its formatting program and its modulator to generate the precise carrier frequency,
pulse width, pulse modulation, and overall timing format for a signal based upon the
control code retrieved, and submits the signal to an infrared driver 74 which drives one
or more infrared light emitting diodes 80. The infrared light emitting diode 80 converts
the electrical signal received into an infrared signal which is transmitted to one or more
30 target appliances.

 FIG. 2c illustrates the audio switching circuit 30 and the sound activation
circuit 40 in greater detail. FIG. 2c shows the present invention in the sound activation
mode as indicated by the audio switching circuit 30 maintaining a switch closure and
therefore electrical connection between the microphone 20 output and the sound

5 activation circuit 40. The audio switching circuit 30 in the preferred embodiment of the present invention contains a commercially available digitally controlled, single-pole, double-throw (SPDT) analog switch, for example, a model number ADG 719 (CMOS Switch); available from Analog Devices and described in a data sheet entitled; CMOS Low Voltage 4 Ω SPDT Switch ADG 719, Rev a, pages 1-8, available from Analog
10 Devices, hereby incorporated by reference. The operation of the audio switching circuit 30 and the sound activation circuit 40 as shown in FIG. 2c is described in greater detail below.

15 Figures 2d through 2f show alternative embodiments of the sound activation circuit 40 shown in Fig. 2c. In particular, Fig. 2d shows a sound activation circuit 40 with a microphone load resistance value and a time constant value for a timing circuit that differ from the respective values shown in Fig. 2c. Different values affect the microphone 20 sensitivity while in sound activation mode and the time constant duration of said timing circuit, respectively, in manners that are well known to those skilled in the electronic arts. The sound activation circuit 40 shown in Fig. 2d also includes fewer
20 components than that shown in Fig. 2c. The general operation of the sound activation circuit 40 described below and shown in Fig. 2c also describes the sound activation circuit 40 shown in Fig. 2d.

25 Fig. 2e shows another alternative sound activation circuit 40 that combines an additional Schmitt trigger inverter 43f, a 2- input NAND gate 44, a resistor and a capacitor with the sound activation circuit 40 shown in Fig. 2d. In comparison to the sound activation circuits shown in Fig. 2c and Fig. 2d, the sound activation circuit 40 shown in Fig. 2e is less susceptible to activation by sounds that exceed a predetermined activation amplitude threshold, but are not maintained at or above said threshold for at
30 least a predetermined duration. Thus, in comparison to the circuits shown in Figures 2c and 2d, the sound activation circuit 40 shown in Fig. 2e is responsive to such sounds as spoken words that exceed an activation amplitude threshold for at least a predetermined duration, but is less responsive to incidental sounds that do not meet both amplitude and duration criteria.

5 Assuming that the system is in sound activation mode, the output signal from
microphone 20 is electrically connected by audio switching circuit 30 to the sound
activation circuit 40 as shown in Fig. 2e. The sound activation circuit 40 contains one
or more audio amplification stages that amplify the electric signal output from the
microphone 20. Fig. 2e shows an audio signal amplification stage based upon an NPN
10 transistor 41a, followed by another audio signal amplification stage based upon an NPN
transistor 41b.

The sound activation circuit 40 also contains trigger circuitry. The trigger
circuitry shown in Fig. 2e utilizes four inverting Schmitt trigger circuits, shown as part
of IC 43 because the IC's are commercially available which integrate several such circuits
15 into a single device package. The amplified output signal from the last audio
amplification stage is electrically connected to an input of a first inverting trigger 43a.
If the resulting amplified electric audio signal representing the sound received by
microphone 20 reaches a predetermined amplitude threshold equal in magnitude to a
logic state change (bit transition) at the input of inverting trigger 43a, the inverting trigger
20 43a activates, outputting a logical low, and leading to a logical high output at inverting
trigger 43b and inverting trigger 43f.

The logical high output of inverting trigger 43b leads to a logical high condition
at a first input pin of a 2-input NAND gate 44. The logical high output of the inverting
trigger 43f is electrically connected to a resistor/capacitor time delay circuit that is
25 electrically connected to a second input pin of 2-input NAND gate 44. If the output of
the inverting trigger 43b is held in a logical condition for a predetermined duration, the
time delay circuit will allow the second input of 2-input NAND gate 44 to reach the
equivalent of a logical high condition. If both input pins of 2-input NAND gate 44
are simultaneously held in logical high conditions, indicating that sound exceeding said
30 activation amplitude threshold continues to be detected after the time delay, then the
output of 2-input NAND gate 44 transitions from a logical high condition to a logical low
condition. The output pin of 2-input NAND gate 44 is electrically connected to the input
pin 68 of the speech recognition circuit 50. Although not shown in Fig. 2e, 2-input
NAND gate 44 is electrically connected to a power source and is electrically connected

5 to a common ground. The general operation of such signal amplification, triggering and time delay circuits are well known to those skilled in the electronics art.

The sound activation circuit 40 also contains a potentiometer which allows resistance modification within the amplification circuit. This potentiometer is accessible to the user in the form of a thumbwheel knob 45 which the user can adjust to change a resistance value within the amplification circuit which modifies the sensitivity of the
10 sound activation circuit.

The logic state change at the output pin of 2-input NAND gate 44 causes a bit transition at the input 68 pin of speech recognition circuit controller 60. As described below this bit transition is detected by controller 60 which responds by removing the speech recognition circuit from the low power consuming sound activation mode and
15 enabling the controller clock 63. This activates speech recognition circuit 50 for subsequent speech recognition processing as shown in step S503 in Fig. 5. The software also instructs controller 60 to change the logic state of mode output 65 pin.

The speech recognition circuit 50 then maintains mode output 65 pin in the logic state consistent with the speech recognition mode. As shown in Fig. 2e, an input control pin of audio switching circuit 30 is electrically connected to said mode output 65 pin, causing the state of audio switching circuit 30 to be controlled by said mode output pin. As described below the logic stage change at mode output 65 pin results in a logic state change at the input control pin of audio switching circuit 30, causing said circuit to
20 electrically connect microphone 20 output signal to speech recognition circuit 50, disconnecting it from sound activation circuit 40, as shown in a step S504 in Fig. 5. This connection is maintained until speech recognition circuit 50 determines that predetermined conditions have been met to return to the sound activation mode.

Fig. 2f shows yet another alternative sound activation circuit 40 that combines
30 additional Schmitt trigger inverters 43d-43f, 3-input NAND gates 46a-46c, digitally controlled analog switches 47a and 47b, and multiple timing circuits including resistors, capacitors and diodes with the sound activation circuit 40 shown in Fig. 2d. In comparison to the sound activation circuits shown in Fig. 2c and Fig. 2d, the sound activation circuit 40 shown in Fig. 2f is less susceptible to activation by sounds that

5 exceed a predetermined activation amplitude threshold, but are not maintained at or
above said threshold for at least a predetermined duration. This sound activation circuit
40 is also less susceptible to activation by certain sounds, including speech, that exceed
a predetermined activation amplitude threshold and are maintained at or above said
10 threshold for a period of time that exceeds a predetermined duration. Thus, in
comparison to the circuits shown in Figures 2c and 2d, the sound activation circuit 40
shown in Fig. 2f is responsive to such sounds as spoken words that exceed an activation
amplitude threshold for at least a predetermined first duration, but is less responsive to
incidental sounds that do not meet both amplitude and duration criteria. Furthermore, in
15 comparison with Fig. 2e, the sound activation circuit 40 shown in Fig. 2f is less
responsive to sounds that continue to exceed a predetermined activation amplitude
threshold for a predetermined second duration, thus allowing for further restriction of the
durations of sounds that may activate the system from a sound activation mode.

Assuming that the system is in sound activation mode, the output signal from
microphone 20 is electrically connected by the audio switching circuit 30 to the sound
20 activation circuit 40 as shown in Fig. 2f. The sound activation circuit 40 contains one or
more audio amplification stages that amplify the electric signal output from microphone
20. Fig. 2f shows an audio signal amplification stage based upon an NPN transistor 41a,
followed by another audio signal amplification stage based upon an NPN transistor 41b.

The sound activation circuit 40 also contains trigger circuitry. The trigger
25 circuitry shown in Fig. 2f utilizes six inverting Schmitt trigger circuits, shown as part of
IC 43 because IC are commercially available which integrate several such circuits into
a single device package. The amplified output signal from the last audio amplification
stage is electrically connected to an input of a first inverting trigger 43a. If the resulting
amplified electric audio signal representing the sound received by microphone 20 reaches
30 a predetermined amplitude threshold equal in magnitude to a logic state change (bit
transition) at the input of inverting trigger 43a, inverting trigger 43a activates, outputting
a logical low. A logical low at the output of inverting trigger 43a leads to a logical high
output at inverting trigger 43b and a logical low condition at a first input of a 3-input
NAND gate 46c, preventing the output of 3-input NAND gate 46c from transitioning to

5 a logical low condition while the input of inverting trigger 43b is held in a logical low condition.

A logical high output of the inverting trigger 43b leads to a logical low condition at the output of inverting trigger 43c and a logical high condition at a first input of a 3-input NAND gate 46b. As shown in Fig. 2f, the output of 3-input NAND gate 46b is electrically connected to a timing circuit including a diode, resistor and capacitor that is electrically connected to an input of an inverting trigger 43f. A logical high condition at the first input of the 3-input NAND gate 46b leads to a logical low at the output of 3-input NAND gate 46b unless a second input of 3-input NAND gate 46b is held in a logical low condition by a timing circuit described below that is electrically connected to the second input of 3-input NAND gate 46b.

A logical low condition at the output of 3-input NAND gate 46b leads to a logical low condition at the input of inverting trigger 43f, remaining in this condition for at least a duration determined by a time constant value of the associated timing circuit electrically connected to the input of inverting trigger 43f. A logical low condition present at the input of inverting trigger 43f leads to a logical low at the output of inverting trigger 43e. A logical low at the output of inverting trigger 43e leads to a logical high output at inverting trigger 43d and a logical low condition at a second input of 3-input NAND gate 46c, preventing the output of 3-input NAND gate 46c from transitioning to a logical low condition while the input of inverting trigger 43f is held in a logical low condition. A logical low at the output of inverting trigger 43e also leads to a logical low condition at a second input of 3-input NAND gate 46b, returning the output of 3-input NAND gate 46b to a logical high condition and maintaining this condition for at least a duration determined by a time constant value of the associated timing circuit electrically connected to the second input of 3-input NAND gate 46b. Also electrically connected to the second input of 3-input NAND gate 46b is a control input pin of a digitally controlled analog switch 47b as shown in Fig. 2f. A logical low condition at the second input of 3-input NAND gate 46b causes the switch 47b to open and remain open for a duration determined by the duration of the presence of a logical low condition at the output of inverting trigger 43e plus a time constant value of the associated timing circuit

5 electrically connected to the second input of 3-input NAND gate 46b. The open position of switch 47b disconnects an electrical connection between a third input of 3-input NAND gate 46c and a circuit that remains in a logically low condition.

As shown in Fig. 2f, the output of inverting trigger 43d is electrically connected to a timing circuit including a diode, resistor and capacitor that is electrically connected to a control input pin of a digitally controlled analog switch 47a. A logical high condition at the output of inverting trigger 43d causes the switch 47a to close and remain closed for a duration determined by the duration of the presence of a logical high condition at the output of inverting trigger 43d plus a time constant value of the associated timing circuit electrically connected to the control input pin of switch 47a. The closure of switch 47a establishes an electrical connection between the output of 3-input NAND gate 46a and a third input to 3-input NAND gate 46c.

As indicated previously, a logical high output of inverting trigger 43b leads to a logical low condition at the output of inverting trigger 43c. The output of inverting trigger 43c is electrically connected to a timing circuit including a diode, resistor and capacitor that is electrically connected to a first input of a 3-input NAND gate 46a. A logical low condition at the output of inverting trigger 43c leads to a logical high condition at the output of 3-input NAND gate 46a which is held in said logical high condition for a duration determined by the duration of the presence of the logical low signal received from the output of inverting trigger 43c plus a time constant value of the associated timing circuit electrically connected to the first input of a 3-input NAND gate 46a. A logical high condition at the output of 3-input NAND gate 46a leads to a logical high condition at the third input to 3-input NAND gate 46c while an electrical connection is maintained by switch 47a and switch 47b remains open.

Thus, as shown in Fig. 2f and described above, the three inputs to 3-input NAND gate 46c may be simultaneously held in logical high condition if sound exceeding a predetermined threshold is initially detected, continues to be detected after a predetermined period of time, and ceases to be detected within a following predetermined period of time. If said sound is detected and continues to be present after a predetermined time delay, then the second and third input pins of 3-input NAND gate 46c are held in a

5 logical high condition. If the sound ceases before a timing circuit returns the third input
pin of 3-input NAND gate 46c to a logical low condition, then the first input pin of 3-
input NAND gate 46c will return to a logical high condition and the output of 3-input
NAND gate 46c will transition from a logical high condition to a logical low condition.
The output pin of 3-input NAND gate 46c is electrically connected to the input pin 68 of
10 the speech recognition circuit 50. Although not shown in Fig. 2f, 3-input NAND gates
46a-46c are electrically connected to a power source and are electrically connected to a
common ground. The general operation of such signal amplification, triggering and time
delay circuits are well known to those skilled in the electronics art.

15 Sound activation circuit 40 also contains a potentiometer which allows resistance
modification within the amplification circuit. This potentiometer is accessible to the user
in the form of a thumbwheel knob 45 which the user can adjust to change a resistance
value within the amplification circuit which modifies the sensitivity of the sound
activation circuit.

20 The logic state change at the output pin of 3-input NAND gate 46c causes a bit
transition at input 68 pin of speech recognition circuit controller 60. As described below,
this bit transition is detected by controller 60 which responds by removing the speech
recognition circuit from the low power consuming sound activation mode and enabling
the controller clock 63. This activates the speech recognition circuit 50 for subsequent
speech recognition processing as shown in a step S503 in Fig. 5. The software also
25 instructs the controller 60 to change the logic state of mode output 65 pin.

30 The speech recognition circuit 50 then maintains mode output 65 pin in the logic
state consistent with the speech recognition mode. As indicated previously and shown
in Fig. 2f, an input control pin of audio switching circuit 30 is electrically connected to
said mode output 65 pin, causing the state of audio switching circuit 30 to be controlled
by said mode output pin. The logic state change at mode output 65 pin results in a logic
state change at the input control pin of audio switching circuit 30, causing said circuit to
electrically connected microphone 20 output signal to speech recognition circuit 50,
disconnecting it from sound activation circuit 40, as shown in step S504 in Fig. 5. This

5 connection is maintained until speech recognition circuit 50 determines that predetermined conditions have been met to return to the sound activation mode.

Alternate schemes may also be employed to electrically connect microphone 20 output to the speech recognition circuit 50 and the sound activation circuit 40. One alternate embodiment is shown in FIG. 18a which employs a commercially available digitally controlled (digitally enabled input control), single-pole, single-throw (SPST) analog switch, instead of the SPDT switch employed within the embodiment 10 described above, within the audio switching circuit 30. As shown in FIG. 18a, an electrical connection is always maintained between the microphone 20 output and the speech recognition circuit 50, but the switch is used to either electrically connect or disconnect the sound activation circuit 40 to the microphone 20 output depending on the 15 state of the mode pin 65 of the speech recognition circuit 50. The speech recognition circuit 50 controls the mode pin 65 logic state as described in further detail below for the embodiment discussed above such that the sound activation circuit 40 is electrically connected to the microphone 20 output only when the invention is placed into sound 20 activation mode.

Another alternate embodiment is shown in FIG. 18b which employs two microphones 20a and 20b, the output of each is dedicated to the speech recognition circuit 50 or the sound activation circuit 40, respectively. Thus, the microphone outputs remain exclusively electrically connected to the speech recognition circuit 50 or the 25 sound activation circuit 40. For this scheme, no switch is used, but an additional microphone is introduced, and the sound activation circuit 40 is allowed to harmlessly trigger during the speech recognition mode.

Another alternate embodiment is shown in FIG. 18c, which is a combination of the two alternate schemes presented above. This scheme employs two 30 microphones 20a and 20b, the output of each is dedicated to the speech recognition circuit 50 or the sound activation circuit 40, respectively. As shown in FIG. 18c, an electrical connection is always maintained between the microphone 20a output and the speech recognition circuit 50, but an SPST switch as described above is used to either electrically connect or disconnect the sound activation circuit 40 to the microphone 20b

5 output depending on the state of the mode pin 65 of the speech recognition circuit 50. The speech recognition circuit 50 controls the mode pin 65 logic state in the same manner as described later in further detail for the preferred embodiment such that the sound activation circuit 40 is electrically connected to the microphone 20 output only when the invention is placed into sound activation mode.

10

PHYSICAL UNIT

FIGS. 3 and 4a-4c illustrate an exemplary embodiment of a housing for the present invention. Referring first to FIG. 3, shown is speech recognizing transmitter 10 with a housing which includes a main housing portion 11, a microphone base 12 which holds a microphone 20 and that may be rotated independently from said main enclosure section 11, as described below and a removable battery access panel (not shown) on the bottom of the unit. Two ports 96, 98 in the form of openings are provided in the top of the microphone base 12, through which sound is received by the microphone.

15

20

An opening in the main enclosure section 11 is provided for sound generated from a speaker 53. The opening may be formed from many small openings in the indicated area which may take the form of slits or cross-hatched pattern openings through which sound generated by the speaker 53 may pass through the main enclosure section 11.

25

The indicators 52a, 52b, 52c and 52d are light-emitting diodes operating in visible light wavelengths that are used to communicate operating status to the user. Openings may also be provided in the main enclosure 11 for each of said indicators.

30

A keypad 51 may be provided to enable the user access to buttons used primarily to communicate with the system during product setup processes. Openings are provided in the main enclosure 11 for each button of said keypad.

A user-adjustable thumbwheel potentiometer 35 may also be provided to allow the microphone sensitivity adjustment for electric audio signals directed to a speech recognition circuit. A user-adjustable thumbwheel potentiometer 45 may be provided to allow adjustment of the amplification level of electric audio signals directed to a sound

5 activation circuit. Openings may be provided in the main enclosure 11 for each of said thumbwheel potentiometers.

Four vibration-absorbing, adhesive-backed feet 19 made of rubber or similar compounds that are conducive to vibration absorption may be mounted to the bottom of main enclosure section 11.

10 An infrared receiver 71 or other wireless signal detecting device may be mounted within the front portion of the main enclosure section 11 with an opening through which infrared light is received and detected.

FIG. 4a is a side elevational view of the physical structure of one embodiment of the present invention. In addition to those components shown in FIG. 3., FIG. 4a shows infrared light-emitting diode 80 and a battery holding compartment 18. Openings are provided in the main enclosure section 11 for each of the indicators and for mating of the removable battery access panel 17 (FIG. 4b) to the main enclosure section 11. Electronic components are either mounted upon or are electrically connected by wiring to a printed circuit board assembly 16 shown with hidden lines.

20 FIGS. 4b and 4c show the rotatable IR transmitter and rotatable microphone feature in more detail. In particular, referring first to the rotatable microphone feature, the housing 11 may be formed from a front housing portion 82 and rear housing portion 84. The front and rear housing portions 82 and 84 are formed within continuous edges 86 and 88, respectively, to enable the front 82 and rear housing portion 84 to be joined together with a suitable adhesive, such as an epoxy, or by way of ultrasonic welding or otherwise formed to be coupled together. Each of the front 82 and rear 84 housing portions includes a semi-circular opening 85, 87 formed at the top of the housing 11. Semicircular annular notches 95 and 97 are formed adjacent to each of the semicircular openings 85 and 87. As will be discussed in more detail below, these semicircular annular notches 95 and 97 are for receiving a microphone base 12 and enabling it to rotate. In particular, the microphone base 12, for example, as discussed above, includes a outer rim portion 99 formed as a disk. The outer rim portion 99 is adapted to be received in a semi-circular annular notches 95 and 97 in order to enable the microphone base 12 to be rotatably mounted with respect to the housing 11.

25

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5 Electrical conductors 21 are used to connect the microphone 20 to the circuitry described above. In order to protect the electrical connection between the electrical conductors 21 and the microphone from being damaged as a result of rotation of the microphone base 12, sufficient slack is provided in the conductors 21.

10 As discussed above, the microphone 20 may be a directional microphone. As such, the microphone 20 is provided with a pair of sound ports 22 and 23. Rectangular openings 96 98 are provided in the microphone base 12 to allow sound to reach the microphone ports 22 and 23.

15 A radially extending rib 100 may be provided on the outer rim portion 99. An axially extending rib 102 may be formed in one of the semicircular annular notches 95, 97 to form a stop. In particular, the axial rib 102 is adapted to engage the radial rib 100 on the outer rim portion 99 of the microphone base 12 to limit rotation of the microphone base 12.

20 Another important feature of the invention relates to the fact that the infrared light emitting diode 80 may be rotatably mounted relative to the rear housing portion 84. In particular, an opening 104 may be provided in the rear housing portion 84. A pair of spaced apart plates 106 and 108 may be formed adjacent to the opening 104 and configured to extend into the rear housing portion 84 as generally shown in FIG. 4b. A pair of protuberances 110 may be formed on the upper and lower plate 106 and 108 to form a pivot axis.

25 The infrared light emitted diodes 80 may be carried by an irregularly shaped housing 112 having a top side 114 and a bottom side 116. The housing 112 is open on one end and contains apertures 118 and 120 in the top 114 and bottom 116 sides. The apertures 118 and 120 are configured to receive the protuberances 110 and the top 106 and bottom plates 108 disposed inward in the rear housing portion 84 to enable the housing portion 112 to rotate relative to the rear housing portion 84. An extending protuberance 81 enables a user to rotate the housing 112 to adjust the physical orientation of the light emitting diode 80.

30 The housing portion 112 is adapted to carry the infrared light emitting diodes 80. Electrical conductors 89 are used to provide an electrical connection between

5 the infrared light emitting diode 80 and the balance of the circuitry. The conductors 89 are provided with sufficient slack to avoid effecting the electrical connections to the electrical conductors when the housing 112 is rotated.

As mentioned above, the system may be AC or DC. In DC embodiments as shown in FIG. 14b, a battery access hatch 17 may be provided on the bottom of the housing 11.

SOFTWARE

FIG. 5 is a flowchart form of two default modes of the present invention. A sound activation mode is the default mode when the invention is operating in a low power consuming manner in a step S501. Otherwise, a continuous listening speech recognition mode is the default mode in a step S505 unless a user is performing product setup processes. In normal use, the speech recognition circuit 50 remains electrically connected to the power supply circuitry 90 and receives electric power while in both of these modes. It should be noted that means is also provided to electrically disconnect the electric power source from the section of the power supply circuit that distributes electric power to other electronic elements within the present invention if it is desirable to prevent unintentional activation or if the invention is not to be used for an extended period of time. The command to disconnect power from said electronic elements is not included within a default recognition vocabulary set to prevent unintentional deactivation of the invention and to prevent confusion with using the invention to power on and off controlled appliances. The command is placed in a recognition vocabulary set that must be accessed by a command in another recognition vocabulary set to ensure recognition of said command is intentional.

When the power supply electric source is electrically connected to the power supply circuit 90 section that distributes electric power to other electronic elements, the operation of the invention depends on whether or not the invention is in sound activation mode as shown in a step S501. The user can visually determine this state because no indicators 52a, 52b, 52c or 52d are illuminated during the sound activation mode. If the system is not in the sound activation mode, then it is either in the

5 default speech recognition mode listening for voice commands as shown in a step S505 or temporarily executing a speech recognition routine involving another recognition vocabulary set. Again, it should be noted that an exception applies if the user is performing a product setup process, during which time the invention may also enter modes where it is waiting for the user to depress a button.

10 If it is temporarily executing a speech recognition routine involving another recognition vocabulary set, the invention will automatically return to the default speech recognition mode after the user has completed submitting voice commands within the recognition vocabulary set active at that time. The conditions under which other speech recognition routines cease and the default speech recognition mode becomes
15 active are described later.

While in the sound activation mode as shown in a step S502, the microphone 20, the audio switching circuit 30, the sound activation circuit 40 and the speech recognition circuit IC 55, as a minimum, receive electric energy from the power supply circuit 90. The microphone 20, the audio switching circuit 30, the sound
20 activation circuit 40 and the speech recognition circuit IC 55, as a minimum, have low power consuming characteristics while in the sound activation mode. When the microphone 20 receives an acoustic signal from an area surrounding the present invention, the microphone 20 converts the acoustic signal into an electric signal. Depending on the state of the audio switching circuit 30, the electric signal output from
25 the microphone 20 is electrically connected to either the sound activation circuit 40 if the system is in sound activation mode or the speech recognition circuit 50 if the system is in speech recognition mode. The audio switching circuit 30 is set to one of these two possible states. As shown in FIG. 2c, an input control for the audio switching circuit 30 is electrically connected to a speech recognition circuit 50 mode output 65 pin which
30 changes logic states as the speech recognition circuit changes modes between sound activation mode and speech recognition mode. The input control for the audio switching circuit 30 automatically detects the logic state of said mode output pin and changes the electrical connections for the electric signal output from the microphone 20 accordingly.

5 Assuming that the system is in sound activation mode, the output signal
from the microphone 20 is electrically connected by the audio switching circuit 30 to the
sound activation circuit 40 as shown in FIG. 2c. The sound activation circuit 40 contains
one or more audio amplification stages that amplify the electric signal output from the
microphone 20. FIG. 2c shows an audio signal amplification stage based upon an NPN
10 transistor 41a, followed by another audio signal amplification stage based upon an NPN
transistor 41b. The sound activation circuit 40 also contains a trigger circuit. The trigger
circuit shown in FIG. 2c utilizes a series of three inverting Schmitt trigger circuits, shown
collectively as IC 43 because IC are commercially available which integrate several such
circuits into a single device package. The amplified output signal from the last audio
15 amplification stage is electrically connected to an input of a first trigger circuit. If the
resulting amplified electric audio signal representing the sound received by the
microphone 20 reaches a predetermined amplitude threshold equal in magnitude to a
logic state change (bit transition) at the input of the trigger circuit, the trigger circuit
activates, indicating the sound has been detected as shown in a step S502. The first
20 inverting trigger circuit then outputs a logical low, leading to a logical high output at the
second inverting trigger followed by a logical low output at the third inverting trigger in
IC 43. It is the output of the third inverting trigger that is electrically connected to the
input pin 68 of the speech recognition circuit 50. The general operation of such signal
amplification and triggering circuits are well know to those skilled in the electronics arts.

25 The sound activation circuit 40 also contains a potentiometer which allows
resistance modification within the amplification circuit. This potentiometer is accessible
to the user in the form of a thumbwheel knob 45 which the user can adjust to change a
resistance value within the amplification circuit which modifies the sensitivity of the
sound activation circuit.

30 As indicated above, the logic state change of the output pin on the trigger
circuit causes a bit transition at the input 68 pin of the speech recognition circuit
controller 60. This bit transition is detected by the controller 60 which responds by
removing the speech recognition circuit from the low power consuming sound activation
mode and enabling the controller clock 63. This activates the speech recognition circuit

5 50 for speech recognition processing as shown in a step S503. The software also
instructs the controller 60 to change the logic state of the mode output 65 pin.

10 The speech recognition circuit 50 then maintains the mode output 65 pin
in the logic state consistent with the speech recognition mode. As indicated previously
and shown in FIG. 2c, an input control pin of the audio switching circuit 30 is electrically
15 connected to the mode output 65 pin, causing the state of the audio switching circuit 30
to be controlled by the mode output pin. The logic state change at mode output 65 pin
results in a logic state change at the input control pin of the audio switching circuit 30,
causing the circuit to electrically connect the microphone 20 output signal to the speech
recognition circuit 50, disconnecting it from the sound activation circuit 40, as shown in
20 a step S504. This connection is maintained until the speech recognition circuit 50
determines that predetermined conditions have been met to return to the sound activation
mode.

25 After the controller clock 63 is initialized and stabilized, and the audio
switching circuit 30 has connected the microphone 20 signal output to the speech
recognition circuit 50, the controller 60 utilizes the ROM 61 to activate the speech
recognition mode software as shown in a step S505. A sound activation mode time-out
counter and a recognition error counter are set to zero as shown in a step S506. The
30 sound activation time-out counter tracks elapsed time between attempts made by the
speech recognition circuit 50 to recognize sounds and if a predetermined time value
TMAX elapses between recognition attempts, the speech recognition circuit software
initiates a routine to enter sound activation mode and changes the logic states of the
previously described control register bits. The recognition error counter tracks the
number attempts made by the speech recognition circuit 50 to recognize sounds for which
no match is identified. The use of the recognition error counter is further described later.
Each time a match is identified during speech recognition processing, the sound
activation time-out counter value and the recognition error counter value are reset to zero
value.

 A green light-emitting diode 52a is activated and remains illuminated in
a step S507 while the speech recognition mode is available to execute a pattern

5 generation algorithm to provide a visual indicator to the operator that the invention is
ready to receive a voice command. It should be noted that this indicator will briefly
deactivate during a silence level detection period, pattern generation or during speech
recognition processing to inform the user that the speech recognition circuit 50 is
temporarily unavailable to receive a voice command, but the green light-emitting diode
10 52a re-illuminates after the silence level detection period is completed or recognition
processing routine returns a result.

When the speech recognition circuit 50 is activated from a sound
activation mode, the default speech recognition mode software executes a continuous
listening routine. The green light-emitting diode 52a illuminates while the speech
15 recognition circuit is waiting to detect sounds for which to create patterns and submit for
recognition processing as shown in step S508. During this mode, the speech recognition
circuitry executes a software routine that cycles among states where it monitors
environmental sound level until a suitable silence level is detected, generates a pattern
for a detected sound, compares the duration of the acquired pattern representing the
20 detected sound to a defined duration for the active recognition vocabulary set commands,
and when the duration of the detected sound pattern is consistent with said active
recognition vocabulary set duration, executes a recognition algorithm to determine if a
match can be identified for the acquired unknown pattern and one of the commands in
the active recognition vocabulary set. Acquired patterns that are not consistent in
25 duration with recognition vocabulary set commands (too long or too short) are ignored,
and the speech recognition circuit software returns to execute the silence level detection
routine. The silence level detection routine listens (remains in a detection mode) until
the noise level drops below a predetermined threshold, meaning a certain silence level
is achieved. During this silence level detection routine, result codes are returned and
30 compared to a noise threshold value until a result code is returned indicating the noise
level has dropped below the predetermined threshold. Pattern generation can then be
performed if a sound is detected. This cycle is shown as steps S508 through S517. Such
continuous listening software routines are well known to those skilled in the art.

5 The default mode speech recognition circuit software cycles between a
silence level detection routine and a listening (ready for pattern generation) routine shown
in steps S508, S509 and S510 while waiting for the detection of a sound. The sound
activation time-out counter value is periodically compared to the predetermined value
TMAX in a step S509. If the time-out period elapses before a sound is detected, the
10 speech recognition circuit 50 executes software code to enter the sound activation mode
and disable the clock 63 from the clock source 64 as shown in FIG. 6. If the time-out
period has not elapsed, the speech recognition circuit 50 continues to cycle between a
sound level detection routine and a listening (ready for pattern generation) routine,
returning to steps S508, S509 and S510.

15 If sound is detected in a step S510, the green light-emitting diode 52a
ceases to illuminate and a pattern is generated to represent the acoustically significant
elements of the sound in a step S511. The duration of the acquired unknown pattern for
the detected sound is compared to determine if its duration is consistent with the duration
of the recognition vocabulary set commands in a step S512. The duration check obviates
20 the need to complete the speech recognition process if the pattern generated for the
unknown sound, word, or phrase is either shorter or longer in duration than the
commands in the active recognition vocabulary set, thus serving as a quick filter to allow
the speech recognition circuit 50 to remain available for pattern generation for a increased
proportion of the time. If an acquired pattern for a sound is found to be inconsistent in
25 duration with the commands in the active recognition vocabulary set, the value of the
recognition error counter is incremented by one and the value of TMAX is reset to zero
in a step S515 and a red light-emitting diode 52c illuminates briefly to provide a visual
indicator to the operator in a step S516. The recognition error counter value is then
compared to a value EMAX, which is a predetermined value for the maximum number
30 of recognition errors allowed, to determine if the two values are equal in a step S517. If
the recognition error counter value is equal to value EMAX, the speech recognition
circuit 50 executes software to enter the sound activation mode and disable the controller
clock 63 from the clock source and shown in FIG. 6. If the recognition error counter
value is not equal to value EMAX, the green light-emitting diode 52a is activated and

5 remains illuminated and the speech recognition circuit 50 executes software which cycles between the silence level detection routine and the listening (ready for pattern generation) routine in steps S508, S509 and S510.

10 If the pattern generated in step S511 is found to be consistent in duration with the recognition vocabulary set command duration in a step S512, then the acquired unknown pattern is analyzed by the speech recognition circuit controller 60, utilizing a recognition algorithm stored in its ROM 61, to determined if it can be classified as a match with any of the reference commands within the active recognition vocabulary set and if the likelihood of correctly recognizing the unknown pattern exceeds a predetermined threshold in a step S513. The result of this comparison is identified in a step S514.

15 If a match for the acquired pattern is not identified in step S514, the value of the recognition error counter is incremented by one and the value of TMAX is reset to zero in a step S515 and the red light-emitting diode 52c illuminates briefly to provide a visual indicator to the operator that no match was identified in a step S516. The recognition error counter value is then compared to value EMAX in a step S517. If the recognition error counter value is equal to value EMAX, the speech recognition circuit 50 executes software stored in its ROM 61 to enter the sound activation mode and disable the clock 63 from the clock source 64 and as shown in FIG. 6. If the recognition error counter value is not equal to value EMAX, the green light-emitting diode 52a is activated and remains illuminated and the speech recognition circuit 50 executes software which cycles between the silence level detection routine and the listening (ready for pattern generation) routine in steps S508, S509 and S510.

20 If a match for the acquired pattern is identified in a step S514, the speech recognition circuit 50 software identifies the operation associated with the matching recognition vocabulary set command in a step S518 and determines if the operation is to send an instruction to the speech recognition circuit controller 60 to activate a new recognition set vocabulary or to output a signal to the infrared controlling circuit 70 using the speech recognition circuit input/output 68 pins. The signal to the infrared controlling circuit 70 communicates either a appliance category selection command in a step S520

5 or a command to transmit one or more infrared signals for specified functions to the currently controlled appliance in a step S521.

Following the submission of a signal to the infrared signal controlling circuit 70, the speech recognition circuit controller 60 executes software stored in its ROM 61 to reset the values TMAX and EMAX to zero in a step S506, activates the green
10 light-emitting diode 52a in a step S107 and returns to a continuous listening routine which cycles between the silence level detection routine and the listening (ready for pattern generation) routine in steps S508, S509 and S510. FIG. 7 shows the steps followed when the speech recognition circuit controller 60 receives a signal instructing it to activate a new recognition set.

15 The present invention uses conventional silence level detection, continuous listening, pattern generation, and speech recognition algorithms to perform the aforementioned software routines. These algorithms are well documented in the prior art and are familiar to those skilled in the electronics arts. For example, exemplary speech recognition algorithms are available from Sensory, Inc., Sunnyvale, California,
20 under their brand name Sensory Speech 5.0 Technology. Other speech recognition algorithms which contain some of the features in the present invention include Voice Direct™, TSSP and Voice Activation™ software, all available from Sensory, Inc.. Other speech recognition algorithms are also suitable.

As indicated in steps S509 and S517 in FIG. 5, the speech recognition
25 circuit software periodically monitors the status of two counter values that are independently controlled by the software. If either of these two values, the sound activation time-out counter value or the recognition error counter value, has reached its maximum allowed value TMAX or EMAX, respectively, the speech recognition circuit
30 50 changes the mode of the system from speech recognition mode to sound activation mode. Otherwise, as indicated in steps S506 and S515 shown in FIG. 5, these counters are also reset to zero.

FIG. 6 shows in a step S620 the sound activation mode is entered only from a default recognition mode. If the active recognition vocabulary set is not a default recognition vocabulary set operating in a default recognition mode, then upon attainment

5 of a maximum allowed counter value for a time-out counter or a recognition error counter, the software will return to a default recognition mode before the sound activation mode is entered as shown by a step S620 in FIG. 6 referring to a step S505 in FIG. 5.

Reference is made to FIG. 6. Step S621 shows that when operating in a default recognition mode, and upon the attainment of the value TMAX for the sound activation time-out counter value or the value EMAX for the recognition error counter value, the speech recognition circuit 50 inactivates or disables the electronic elements that are not needed during sound activation mode, such as indicators 52a, 52b, 52c and 52d to reduce power consumption during the sound activation mode. In a step S622, the system enters a sound activation mode as described previously by changing the states of control register bits that disable the clock oscillator 63 from its clock source 64 and place the speech recognition circuit in a low power consuming mode and setting the mode output 65 pin to the logic state defined for sound activation mode.

As shown in step S623, an input control for the audio switching circuit 30 is electrically connected to said mode output 65 pin which changes logic states as the speech recognition circuit changes modes between speech recognition mode and sound activation mode. The input control for the audio switching circuit 30 detects the logic state of the mode output pin and electrically connects the electric signal output from the microphone 20 to the sound activation circuit 40.

As shown in steps S624, S625 and S626, the speech recognition circuit remains in this sound activation mode, listening for sound. While in the sound activation mode, the microphone 20, the audio switching circuit 30, the sound activation circuit 40 and the speech recognition circuit IC 55, as a minimum, receive electric energy from the power supply circuit 90. The microphone 20, the audio switching circuit 30, the sound activation circuit 40 and the speech recognition circuit IC 55, as a minimum, have low power consuming characteristics at least while in the sound activation mode. When the microphone 20 receives an acoustic signal from an area surrounding the present invention, the microphone 20 converts the acoustic signal into an electric signal. The state of the audio switching circuit 30 is set to electrically connect the electric signal output from the microphone 20 to the sound activation circuit 40. The sound activation

5 circuit 40 contains one or more audio amplification stages, shown in FIG. 2c, that amplify
the electric signal output from the microphone 20. The sound activation circuit 40 also
contains a trigger circuit 43 shown in FIG. 2c. The amplified output signal from the last
audio amplification stage is electrically connected to an input of the trigger circuit. If the
10 resulting amplified electric audio signal representing the sound received by the
microphone 20 reaches a predetermined amplitude threshold equal in magnitude to a
logic state change (bit transition) at the input of the trigger circuit, the sound activation
circuit activates, indicating the sound has been detected at a step S625 in FIG. 6 and
referring to a step S502 in FIG. 5. The sound activation circuit is shown in detail in FIG.
2c.

15 As indicated in a step S518 shown in FIG. 5, when a match is identified
during the pattern recognition process and the operation associated with the recognized
command is an instruction to activate a different recognition vocabulary set, the software
will execute the instruction to enter the appropriate recognition mode for the indicated
recognition vocabulary set in step S628 shown in FIG. 7. Recognition modes are
20 commercially available that are capable of executing software that involves different
recognition routines, such as continuous listening, pattern queuing and response
prompting recognition as described below.

The continuous listening recognition mode was described previously in
the explanation of FIG. 5 steps. A continuous listening routine may also be executed for
25 a non-default recognition vocabulary set. For brevity, an additional description of this
mode is not provided. Instead, the system returns to step S505 in FIG. 5, after which the
same basic process follows. The primary exception being that when the maximum
allowed time-out or recognition error counter value is attained, the speech recognition
circuit 50 will not enter sound activation mode, but will instead enter the default
30 continuous listening recognition mode as indicated in a step S620 in FIG. 6.

A response prompting recognition mode is shown in FIG. 8. When the
speech recognition circuit software activates a recognition vocabulary set and executes
a response prompting routine as shown in a step S630, the user is expected to select a
voice command from the active recognition vocabulary set and respond when prompted

5 by an illuminated green light emitting diode **52b**. A green light emitting diode **52a**
remains illuminated in this mode when the speech recognition circuit **50** is available to
generate patterns to indicate to the user that the active recognition mode is not the default
recognition mode. As defined previously for the continuous listening recognition mode,
10 a time-out counter and a recognition error counter are set to zero when the response
prompting recognition mode is activated. However, the maximum allowed values for
both of these counters are typically less than those for continuous listening recognition
mode.

Following the prompting of the user by the illumination of a green light
emitting diode **52b** in a step **S632**, the software enters a pattern generating mode in a step
15 **S633**, waiting for a voice command to be detected. If a maximum allowed time-out value
TMAX1 is attained before a voice command is detected, the software will terminate the
response prompting routine and return to the default continuous listening recognition
mode as shown in a step **S634**. Until time **TMAX1** has expired, the speech recognition
circuit remains available to generate a pattern when a voice command is detected as
20 shown in steps **S635**, **S633** and **S634**. If a voice command is detected in a step **S635**, a
pattern is generated in a step **S636** and submitted for pattern recognition processing in a
step **S637**.

During step **637** the acquired unknown pattern is analyzed by the speech
recognition circuit controller **60**, utilizing a recognition algorithm stored in its ROM **61**,
25 to determined if it can be classified as a match with any of the reference commands
within the active recognition vocabulary set and if the likelihood of correctly recognizing
the unknown pattern exceeds a predetermined threshold. The result of this comparison
is identified in a step **S638**.

If a match for the acquired pattern is not identified, the value of the
30 recognition error counter is incremented by one in a step **S638** and the red light-emitting
diode **52c** illuminates briefly to provide a visual indicator to the operator that no match
was identified in a step **S640**. The recognition error counter value is then compared to
a maximum allowed recognition error counter value **EMAX1** in a step **S641**. If the
recognition error counter value is equal to value **EMAX1**, the speech recognition circuit

5 **50** executes software stored in its ROM **61** to terminate the response prompting routine and return to a default continuous listening recognition mode as shown in a step **S641** and a step **S505** in FIG. 5. If the recognition error counter value is not equal to value **EMAX1**, the green light-emitting diode **52b** is activated and remains illuminated and the speech recognition circuit **50** executes software to enter a pattern generating mode,
10 returning to a step **S633** and waiting for a voice command to be detected. As previously indicated, until time **TMAX1** has expired, the speech recognition circuit remains available to generate a pattern when a voice command is detected as shown in steps **S635**, **S633** and **S634**.

15 If a match for the acquired pattern is identified in a step **S638**, the speech recognition circuit **50** software identifies the operation associated with the matching recognition vocabulary set command in a step **S642** and determines if the operation is to send an instruction to the speech recognition circuit controller **60** to activate a new recognition vocabulary set or not. If a new recognition vocabulary set is to be activated, the software executes the instruction to enter the appropriate recognition mode for the
20 indicated recognition vocabulary set in a step **S628** shown in FIG. 7.

 If the operation associated with the recognized command is to send an instruction to the speech recognition circuit controller **60** to activate a macro sequence of commands, then software begins to execute the macro program as indicated in a step **S700** in FIG. 11, which is described later.

25 As shown in a step **S644**, if the operation associated with the recognized command is to send an instruction to the speech recognition circuit controller **60** to output a signal to the infrared controlling circuit **70**, the software uses the speech recognition circuit input/output **68** pins. The signal to the infrared controlling circuit communicates either a appliance category selection command in a step **S645** or a
30 command to transmit an infrared signal for a specified function to the currently controlled appliance in a step **S646**.

 Following the submission of a signal to the infrared signal controlling circuit **70**, the speech recognition circuit controller **60** executes software stored in its ROM **61** to determine whether to remain in the active recognition vocabulary set to

5 receive additional voice commands or to terminate the response prompting routine and
return to a default continuous listening recognition mode as shown in a step **S647** and a
step **S505** in FIG. 5. If remaining in the active recognition vocabulary set, the software
resets the values **TMAX1** and **EMAX1** to zero in a step **S631**, activates the response
prompting green light-emitting diode **52b** in a step **S632** and enters a pattern generating
10 mode in a step **S633**, waiting for a voice command to be detected until either **TMAX1**
or **EMAX1** counter values are attained, at which time the software will terminate the
response prompting routine and return to a default continuous listening recognition mode
as shown in steps **S634** or **S641**, followed by a step **S505** in FIG. 5.

A pattern queuing recognition mode is shown in FIG. 9. Generally,
15 pattern queuing involves the user providing a voice command after each prompt within
a series of prompts. The number of prompts in the series is predetermined. A pattern is
generated for each voice command as it is received, and the pattern is queued into
memory. After patterns have been generated and queued into memory for all received
voice commands, the voice commands are submitted one by one for recognition.
20 Following recognition of each pattern, the operation instruction associated with the
command in the active recognition vocabulary set identified as a match with the unknown
pattern is queued into memory. When all patterns within the series have been recognized,
and all associated operation instructions have been queued into memory, the controller
60 performs each of the operation instructions in a defined order.

25 For example, the system utilizes a pattern queuing routine to allow a user
to submit a string of consecutive voice commands, which may be separated by brief
pauses, selected from a vocabulary recognition set which includes the names of digits
zero through nine. In this example, a user submits the word "channel" during the
continuous listening default routine. When the word "channel" is recognized, the
30 software activates the recognition vocabulary set including digit names and initiates a
pattern queuing routine, prompting the user to submit one, two or three digit names to
identify a desired channel number for an appliance.

When the speech recognition circuit software activates a recognition
vocabulary set and executes a pattern queuing routine as shown in a step **S660**, the user

5 is expected to select a voice command from the active recognition vocabulary set and
respond when prompted by an illuminated green light emitting diode 52b. The green
light emitting diode 52a remains illuminated in this mode when the speech recognition
circuit 50 is available to generate patterns to indicate to the user that the active
recognition mode is not the default recognition mode. As defined previously for the
10 continuous listening recognition mode, a time-out counter is set to zero when the pattern
queuing recognition mode is activated as shown in a step S661. However, the maximum
allowed value TMAX2 for this counter is typically less than that for continuous listening
recognition mode. Also at this time, a pattern counter and a queue counter are set to zero
in a step S662.

15 The pattern counter value is incremented each time after a pattern is
generated until a maximum pattern counter value MAXP is attained. In this manner each
pattern counter number value is representative of a single generated pattern and the
maximum number attained by said counter is equal to the number of patterns generated.
The value MAXP represents the maximum number of patterns the routine will generate
20 before terminating the pattern generation process and beginning a speech recognition
process. The minimum value for the pattern counter before the routine will generate
speech recognition processing is one. If no patterns are generated within the time
allowed, then the software returns to the default continuous listening mode.

The queue counter is utilized in a similar manner to the pattern counter,
25 except that it is used to track operation instructions identified during a speech recognition
process. As a match is identified for an unknown pattern during the pattern recognition
process, the operation instruction of the associated recognition vocabulary set command
determined to be the best match is queued into memory until all generated patterns are
processed through the speech recognition process. In this manner each queue counter
30 number value is representative of an operation instruction now associated with a single
generated pattern and is useful in retaining sequential order during the storage and
retrieval of said instruction from memory. The maximum value attained by said queue
counter is equal to the number of patterns generated. Unknown patterns for which no

5 match is identified during the speech recognition process are ignored, in which cases the queue counter is not incremented.

Following the production of a visual prompt by the green light emitting diode **52b** in a step **S663**, the speech recognition circuit **50** software begins a listening routine (ready to generate a pattern) awaiting a voice command in a step **S664**. As shown in steps **S664**, **S665** and **S670**, the speech recognition circuit **50** system remains in this routine until either a voice command is detected in a step **S665** or the time-out counter value reaches the value **TMAX2** in step **S670**. As shown in a step **S666** a pattern is generated by the speech recognition circuit **50** when a voice command is detected in a step **S665**. The generated unknown pattern is queued into **RAM 62** in a step **S667**.

15 As shown in a step **S668**, the value of the pattern counter is then compared with the value **MAXP**. If the pattern counter value is less than the value of **MAXP**, then the pattern counter value is incremented by one and the green light emitting diode **52b** provides a visual prompt in a step **S663** for the user to submit another voice command. This process continues to cycle through these steps **S663** through **S669** until either the pattern counter reaches the value **MAXP** in step **S668**, indicating the maximum number of patterns allowable have been generated, or until a time-out occurs as described previously. If a time-out does occur at a step **S670**, the value of the pattern counter is compared to the value zero in a step **S671**. If the pattern counter value is equal to zero, then the system returns to the default continuous listening mode as shown in a step **S505** in FIG. 5. If the pattern counter value is not equal to zero, then patterns have been generated.

20 Generated patterns are then submitted by the system for processing by the pattern recognition algorithm in a step **S672**, one pattern at a time, in reverse order from the pattern generation order. Suitable pattern recognition algorithms have been described above.

30 If a match for an acquired pattern is identified in a step **S673**, the speech recognition circuit **50** software identifies the operation associated with the matching recognition vocabulary set command and queues this operation instruction into **RAM 62** in a step **S674**. The queue counter is then incremented by the value one in a step **S675**.

5 The pattern counter is then decremented by the value one in a step S676. The pattern
counter value is then compared to the value zero in a step S677 to determine if there are
any unknown patterns queued in RAM 62 which have not been submitted for speech
recognition processing. If the pattern counter value is not equal to zero, then the software
submits the next unknown pattern for speech recognition processing in a step S678 and
10 returns to step S672 to perform pattern recognition. The software continues to cycle
through steps S672 through step S678 until the pattern counter value is equal to value
zero in step S677. If a match for an acquired pattern is not identified in a step S673, the
pattern counter value is decremented by one in a step S676 before proceeding to step
S677.

15 When the pattern counter value is equal to value zero in step S677 in FIG.
9, the software compares the queue counter value to the value zero in a step S680 in FIG.
10 to determine if there are any operation instructions queued in the RAM 62. If the
value of the queue counter is not equal to the value zero, the software retrieves from
RAM 62 the operation instruction associated with the current value of the queue counter
20 in a step S681. The speech recognition circuit 50 executes the operation instruction in
a step S682 by sending a signal through the input/outputs 68 pins to the infrared signal
controlling circuit 70. The processing of said signal received by the infrared signal
controlling circuit is described later. The speech recognition circuit 50 software then
decrements the queue counter value by the value one in a step S683 and returns to step
25 S680 to determine if all operation instructions have been retrieved from RAM 62. The
software continues to cycle through steps S680 through step S683 until the queue counter
value is equal to value zero in step S680 at which time the system returns to the default
continuous listening mode as shown in a step S505 in FIG. 5.

30 As shown in a step S682, the operation instruction associated with the
recognized command is processed by the speech recognition circuit controller 60 to
determine an output signal to the infrared controlling circuit 70, which is sent via the
speech recognition circuit input/output 68 pins.

The routine S690 identifies the processing steps performed within the
infrared signal controlling circuit 70. The signal from the speech recognition circuit

5 output 68 pins is received by inputs of the infrared signal controlling circuit 70 and
processed to determine the associated remote control function in a step S691. The output
from the speech recognition circuit output 68 pins provides a signal that is the
informational equivalent to that of a signal generated when a button is depressed on a
keypad of a conventional remote control transmitter. Thus the input to the controller of
10 the infrared signal controlling circuit 70 can be uniquely associated with a function
similarly to the input received from a conventional keypad generated circuit connection.
The controller of the infrared signal controlling circuit 70 interprets the signal received
at its input pin(s) by identifying a memory location in a step S692 and retrieving the
control code stored therein. This controller generates a signal based upon the control
15 code in a step S693 and submits the signal to an infrared driver 74, which drives one or
more infrared light emitting diodes 80 in a step S694. The infrared light emitting diode
80 converts the electrical signal into an infrared signal which is transmitted to one or
more target appliances in a step S695.

In one embodiment of the invention, as discussed above, an interface is
20 provided as part of the infrared signal controlling circuit 70. The interface simulates the
function of a switch matrix, connecting one or more inputs of the controller of the
infrared signal controlling circuit 70 to one or more of its outputs as typically results
when a keypad button is depressed. When the speech recognition circuit 50 sends a
signal to this interface, the interface allows electrical connections to be established,
25 similar to a keypad button depression, between inputs and outputs of the controller of the
infrared signal controlling circuit 70. One embodiment of the interface includes a
programmable logic device as discussed above and is shown in FIG. 2b, described above.
The interface provides an advantage since it is programmable and thus can be easily
modified for use with a variety of controllers for infrared signal controlling circuits 70.

30 As indicated in a step S643 in FIG. 8, the recognition of a single voice
command may generate a series of control signals to one or more target appliances. Such
a sequence of control signals is hereafter referred to as a macro. Each macro must be
created by the user during a product setup process described below. Macros may contain
operation instructions for appliance category selection, infrared signal codes and/or time

5 delays. Macros are stored in the read/write memory 54 controlled by the speech recognition circuit 50 and may be associated with a user trained speaker dependent command.

As indicated in a step S700, once a macro name is recognized, the speech recognition circuit 50 software retrieves the first instruction stored in the read/write 54 memory location associated with the recognized command. If the instruction retrieved is determined to be a time delay in a step S701, the software executes a time delay in a step S702 and returns to step S700 to retrieve the next instruction from memory. If the instruction is not a time delay, the speech recognition circuit 50 software sends a signal utilizing the speech recognition circuit input/output 68 pins to the infrared signal controlling circuit 70 in step S703. As indicated in a step S704, after a signal is sent to the infrared signal controlling circuit 70, the software returns to the read/write 54 memory location associated with the recognized command to determine if another instruction is to be retrieved and processed. If so, the system retrieves the instruction, returning to step S700. The system continues to cycle through steps S700 through step S704 until an end marker is reached by the software in the memory location in a step S704, at which time the system returns to the default continuous listening mode as shown in step S505 in FIG. 5.

As previously indicated, the output from the speech recognition circuit input/output 68 pins provides sufficient information to the infrared signal controlling circuit 70 to generate a signal that is equivalent to that generated when a button is depressed on a keypad of a conventional remote control transmitter. The routine S710 identifies the processing steps performed within the infrared signal controlling circuit 70. The signal from the speech recognition circuit input/output 68 pins is received by inputs of the infrared signal controlling circuit 70. If the signal contains an instruction to select an appliance category in a step S711, the infrared signal controlling circuit 70 responds in a step S712 by making the memory locations associated with said appliance category active for subsequent access. If the signal contains an instruction to identify, generate and submit an infrared signal to a target appliance, then the infrared signal controlling circuit 70 performs these processes as indicated in steps S713 through S717. The

5 controller of the infrared signal controlling circuit 70 interprets the signal received at its
input pins in a step S713 and identifies a memory location in a step S714, retrieving the
control code stored therein. This controller generates a signal based upon the control
code in a step S715 and submits the signal to an infrared driver 74, which drives an
infrared light emitting diode 80 in a step S716. The infrared light emitting diode 80
10 converts the electrical signal into an infrared signal which is transmitted to one or more
target appliances in a step S717.

Automatic Mute Control Sequencing:

15 A mute operation sequencing feature may be selected, activated, and operated by a
user in a completely hands-free manner. For example, a voice command such as “mute”
may be added to a “Control” recognition vocabulary set, and each time “mute” is
recognized by the system while the “Control” recognition vocabulary set is active, the
software will sequence through different values of a muting mode variable MMV. Each
20 value of MMV represents a submode with respect to an automated mute command
sequencing feature. In a first mode OFF, the automated mute command sequencing
feature is disabled and the system operates as described previously. In a second mode,
automatic muting mode AMM, a muting signal is generally issued to a controlled
appliance when the unit is activated from sound activation mode and enters speech
25 recognition mode to aid subsequent speech recognition by reducing background noise
generated by a controlled appliance. A mute canceling signal may later be automatically
issued to the controlled appliance following the recognition of one or more predetermined
spoken commands or, for example, when certain conditions are met such as attainment
of a predetermined time-out counter value and/or attainment of a predetermined
30 recognition counter value. In a third mode, recognition error muting mode REM, a
muting signal is automatically issued to a controlled appliance upon the detection of one
or more types of recognition errors. The recognition errors causing such action may be
limited to only specific error types such as that generated when the continuous listening

5 algorithm detects that environmental noise is loud enough to potentially diminish the accuracy of subsequent speech recognition. A mute canceling signal may be generated similarly to that of the AMM mode described above. Once a muting mode is selected, the software will remain in that mode until intentionally changed by the user.

10 In addition to the variable MMV, the software may also utilize one or more variables to track the muted/non-muted status MS of the controlled appliance at any particular time. Values for the variable MS may represent a “no muting activated” status NMA that indicates the controlled appliance is not muted, an “automated muting activated” status AMA that indicates an automated mute signal has been sent to the controlled appliance and the appliance is currently muted, and a “command muting activated” status CMA that
15 indicates that the user has issued a voice command such as “Sound” to intentionally mute the controlled appliance.

If the software is executing the default continuous listening recognition mode while MMV is set to mode AMM or mode REM, and MS indicates that a NMA status exists, the successful recognition of predetermined voice commands associated with vocabulary
20 recognition set “sub-menus” may also cause a muting signal to be issued, causing the controlled appliance to remain muted during the recognition processing of commands selected from said sub-menus and spoken by the user. Upon returning to the default continuous listening recognition mode, a mute canceling signal is automatically sent to the controlled device.

25 Reference is made to FIGURES 5 through 11 to further describe the automated mute sequencing feature. If the MMV is set to OFF mode the software performs as described in the previous explanations associated with these figures. If the MMV is set to mode AMM or mode REM, the software follows the processes shown in FIGURES 5 through 11 and described in the previous explanations associated with these figures as well as the
30 additional activities associated with the automated mute sequencing feature described below.

Referring to FIG. 5, if the MMV is set to mode AMM, then in addition to the activities previously described for a step S505, the software also checks the status of MS.

5 If MS is set to CMA status, then a voice command such as "Sound" has previously been
recognized by the speech recognition software, which indicates a user desires that the
controlled appliance remain muted. Thus, if MS is set to CMA status, no subsequent
automatic muting signals will be issued until the user sets MS to a status other than
CMA, which may be accomplished, for example, by the next recognition of the voice
10 command "Sound." If MS is set to AMA status, then a muting signal is automatically
sent to the controlled appliance, with the infrared signal generated in the manner
described in previous explanations. The software executes a default continuous listening
recognition mode as shown in steps S506 through S517 and described previously. As
also previously described, the software periodically monitors the status of independent
15 time-out and recognition error counters to determine when to return to sound activation
mode. If a predetermined time value TMM elapses before a spoken command is
detected, as shown in a step S509, then a mute canceling signal is sent to the controlled
appliance and the software follows steps S620 through S626 shown in FIG. 6 to return
to sound activation mode. Similarly, if a predetermined maximum number of recognition
20 errors EMM is attained as shown in a step S517, then a mute canceling signal is sent to
the controlled appliance and the software follows steps S620 through S626 shown in FIG.
6.

If a match for a spoken command is identified in a step S514 shown in FIG. 5, then
as previously described for a step S518, the software determines if the operation
25 associated with the recognized command is an instruction to activate a different
recognition vocabulary set or an instruction to output a signal to the infrared controlling
circuit 70. If an instruction is to be sent to the infrared controlling circuit 70, then a mute
canceling signal is automatically sent to the controlled appliance prior to said instruction
being sent, unless the instruction is associated with a recognized command such as
30 "Sound," which indicates the user desires the controlled device remain muted. In this
case, recognition of the command "Sound" would cause variable MS to be set to CMA
status as described above. If the software determines that the operation associated with
the recognized command is an instruction to activate a different recognition vocabulary
set, the software then proceeds to a step S628 shown in FIG. 7 to determine the

5 appropriate recognition mode and then proceeds appropriately to FIGURE 5, 8 or 9 as described in the previous explanations associated with these figures.

The software continues to follow the steps shown in FIGURES 5 through 11 until returning to the default continuous listening recognition mode as shown in a step S620 of FIG. 6, steps S634, S641 and S647 of FIG. 8; step S671 of FIG. 9; step S680 of FIG. 10; or step S704 of FIG. 11. Upon returning to the default continuous listening recognition mode, a mute canceling signal is sent to the controlled appliance.

An alternative mute canceling sequence may be employed for some recognition modes. For example, during pattern queuing recognition mode, it may be advantageous to issue a mute canceling signal prior to the software's return to the default continuous listening recognition mode. In this case, the mute canceling signal may be issued at a step S677 of FIG. 9 when the software has determined that all queued patterns have been recognized. This approach reduces the time the controlled appliance remains muted and prevents certain command functions, such as a volume increase function, from causing the MS variable to lose synchronization with the controlled appliance's mute status. Appliances in a muted condition are commonly removed from said muted condition upon receipt of certain signals such as a volume increasing signal. For example, if the software is operating in a pattern queuing recognition mode with an active vocabulary recognition set containing volume control commands and has recognized the consecutive commands "Up," "Up," "Up," the software may issue the mute canceling signal and then issue the volume control commands to increase the volume of the controlled appliance by three level adjustments.

When the software returns to the default continuous listening recognition mode from another recognition mode and variable MS indicates a NMA status, subsequent recognition of voice commands associated with sub-menu recognition vocabulary sets may cause an automatic muting signal to be generated and sent to a controlled appliance. Similarly to the above description, this capability allows recognition processing of subsequent spoken commands selected from the associated recognition vocabulary set to be performed in a noise-reduced environment, thus improving recognition accuracy.

5 For example, upon recognition of a command "Change" contained within the default
mode recognition vocabulary set, the software automatically issues a muting signal to the
controlled appliance prior to entering the recognition mode associated with the "Change"
recognition vocabulary set. Upon entering the recognition mode associated with the
"Change" sub-menu, the user may then issue voice commands such as "Up," "Down" or
10 "Back" that cause sequential channel changing while the controlled appliance remains
muted. When the software returns to the default continuous listening recognition mode,
a mute canceling signal may then be issued, automatically returning the controlled
appliance to a non-muted condition.

The recognition error detection automatic muting mode REM operates in the same
15 fashion as the mode AMM except that a muting command is not automatically issued as
the system transitions from sound activation mode to speech recognition. Instead, when
the software is executing the default continuous listening recognition mode and a
recognition error is detected, a muting signal is automatically sent to the controlled
appliance. As indicated above, the recognition errors causing such action may be limited
20 to only specific types such as that generated when the continuous listening algorithm
detects that environmental noise is loud enough to potentially diminish the accuracy of
subsequent speech recognition. A mute canceling signal may be generated using the
same means as described above.

It should also be noted that the above-described automated mute control
25 sequencing features may be combined in various forms to generate additional alternative
modes to those described above.

5

PRODUCT SETUP

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As indicated in a step **S201** in FIG. 12a, one of the buttons present on keypad **51** controls the state of a power switch. If the power switch is open as shown in a step **S202**, the power source is not electrically connected to sections of the power supply circuit **90** which have electrical connections to certain circuit elements and therefore, these circuit elements do not receive electric energy. When this power switch is closed, the power source is electrically connected to sections of the power supply circuit **90** which have electrical connections to certain circuit elements and therefore, these circuit elements do receive electric energy. Step **S203** shows that when the power supply button is momentarily depressed and the power switch is placed into a closed state, the speech recognition controller **60** executes a reset, sets a time-out counter to value zero and starts the time-out counter, which increments as time elapses. As shown in a step **S205**, controller **60** enters a waiting state where it monitors input **68** pins to determine if inputs are received from depressed buttons located on keypad **51**.

20

If no inputs are detected, i.e. no buttons are depressed, before the time-out counter reaches its maximum value **SMAX** as shown in step **S214**, the controller **60** executes code stored in ROM **61** to enter an appliance category selection routine shown in step **S220** in FIG. 12b, which is described later.

25

If the user desires to enter an appliance code to select a specific appliance manufacturer's control codes from the universal appliance code library as shown in a step **S206**, the user presses the code button as shown in step **S207**. FIG. 13a through FIG 13c show the sequence of steps involved in programming such appliance codes.

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If the user desires to use the system infrared signals from another remote control transmitter as shown in a step **S208**, the user presses the learn signal button as shown in step **S209**. FIG. 14a and FIG 14b show the sequence of steps involved in learning infrared codes.

If the user desires to teach the system custom speaker dependent names to be later associated with devices, functions or macros as shown in a step **S210**, the user presses the name command button as shown in step **S211**. FIG. 15 shows the sequence of steps involved in user voice training for custom names.

5 If the user desires to create a macro program as shown in a step S212, the user presses the macro button as shown in step S213. FIG. 16a and FIG. 16b show the sequence of steps involved in creating macro programs.

 A reset as shown in step S203 may also be initiated when the invention is powered up and operating by depressing the setup button as shown in step S204. This
10 reset follows the same sequence as that resulting from an initial power up as shown in steps S203 through in FIG. 12a and FIG. 12b.

 If no inputs are detected, i.e. no buttons are depressed, before the time-out counter reaches its maximum value SMAX as shown in step S214 in FIG. 12a, the controller 60 executes code stored in ROM 61 to enter an appliance category selection
15 routine shown in step S220 in FIG. 12b.

 A response prompting recognition mode for appliance category selection is shown in FIG. 12b. The speech recognition circuit 50 software executes a response prompting routine as shown in a step S221 and activates the appliance category name recognition vocabulary set as shown in step S222. As defined previously for speech
20 recognition modes, a time-out counter is set to zero and started in a step S223 when the response prompting recognition mode is activated. The user is then expected to select a voice command from the appliance category name recognition set and respond when prompted by an illuminated green light emitting diode 52a as shown in a step S224. For example, the appliance category name recognition set may be comprised of such voice
25 command options as "television," "video," "satellite," and "cable" among which the user may select.

 Following the prompting of the user by the illumination of a green light emitting diode 52a in a step S224, the system enters a pattern generating mode in a step S225, waiting for a voice command to be detected. If a maximum allowed time-out value
30 TMAXD is attained before a voice command is detected, the software will terminate the response prompting routine and enter the default continuous listening recognition mode as shown in a step S226. Until time TMAXD has expired, the speech recognition circuit remains available to generate a pattern when a voice command is detected as shown in steps S225, S226 and S227. If a voice command is detected in a step S227, a pattern is

5 generated in a step **S228** and submitted for pattern recognition processing in a step **S229**.

During step **S229** the acquired unknown pattern is analyzed by the speech recognition circuit controller **60**, utilizing a recognition algorithm stored in its ROM **61**, to determine if it can be classified as a match with any of the reference commands within the active recognition vocabulary set and if the likelihood of correctly recognizing the unknown pattern exceeds a predetermined threshold. The result of this comparison
10 is identified in a step **S230**.

If a match for the acquired pattern is not identified, the red light-emitting diode **52c** illuminates briefly to provide a visual indicator to the operator that no match was identified and the value of the recognition time-out counter is reset to the value zero and restarted as shown in a step **S223**. The green light-emitting diode **52a** is then
15 activated and remains illuminated as shown in step **S224** and the speech recognition circuit **50** executes software to enter a pattern generating mode, returning to a step **S225** and waiting for a voice command to be detected. As previously indicated, until time **TMAXD** has expired, the speech recognition circuit remains available to generate a
20 pattern when a voice command is detected as shown in steps **S225**, **S226** and **S227**.

If a match for the acquired pattern is identified in a step **S230**, the speech recognition circuit **50** software identifies the instruction associated with the matching recognition vocabulary set command, and issues a prompt, which may be a speech synthesis prompt, an audio sound or light-emitting diode indication, in a step **S231** to
25 identify the appliance category name recognized. The speech recognition circuit **50** then outputs a signal to the infrared controlling circuit **70**, using output **68** pins to communicate the appliance category selection command in a step **S232**. The infrared controlling circuit **70** receives the signal and responds as shown in step **S233** by making the memory section associated with the appliance category selected available for access.

30 Following the submission of a signal to the infrared signal controlling circuit **70**, the speech recognition circuit controller **60** executes software stored in its ROM **61** to return to a default continuous listening recognition mode as shown in a step **S234** and a step **S505** in FIG. 5. If the appliance category name identified in step **S231** is incorrect, step **S234** also shows that the user may elect to press the setup button,

5 returning to step S204 in FIG. 12a and begin the process again.

10 While the present invention discloses the combined use of buttons and speech recognition during some of the product setup processes, it is also noted that the functions performed by depressing such buttons as the code button, learn signal button, name command button and macro buttons may also be performed through the use of speech recognition means disclosed herein. For example the linked recognition vocabulary set structure disclosed may be used to accommodate hands-free setup of the product in addition to the hands-free activation and operation features. For example, a command such as "Setup" may be added to a "Control" recognition vocabulary set sub-menu described later in this disclosure. Upon recognition of the "Setup" command, a
15 recognition vocabulary set specific to product setup commands may be activated and contain such command options as "Code," "Learn Signal," "Name Command," and "Macro." A response prompting recognition mode may be used to activate this recognition vocabulary in the same manner described previously.

20 Recognition of these commands automatically initiate the appropriate setup processes, providing an equivalent result to that of depressing the respective setup buttons. For a setup process that involves additional selections such as the macro program creation described below, additional commands such as "new command," "done," and "delay" may be provided within the recognition vocabulary sets made available during the setup processes.

25

APPLIANCE CODE SELECTION

30 If the controller 60 detects an input corresponding to a depress of the code button shown in step S207 in FIG. 12a, a signal is sent to the infrared signal controlling circuit 70, using output 68 pins to instruct the infrared signal controlling circuit to enter a programming mode. As shown in step S240 in FIG. 13a, the controller of the infrared controlling circuit executes a programming routine from software stored within its ROM, which includes setting to value zero and starting a programming time-out counter in a step S241. The programming routine prepares the controller of the infrared signal controlling circuit 70 for subsequent receipt of a series of instructions. A first instruction

5 identifies the intended appliance category, which is then followed by a series of
instructions, where each instruction represents an identifier digit of an appliance code.
The appliance code is comprised of a predetermined number of said identifier digits and
uniquely identifies a specific control code set of the remote control command codes for
a particular appliance. When the controller of the infrared signal controlling circuit 70
10 receives instructions identifying all the identifier digits of an appliance code, it is capable
of identifying the memory location within the universal appliance code library stored
within its ROM where the remote control command codes for the intended appliance type
are stored. The control codes are then made available for subsequent signal transmission
and resulting control of the intended appliance. As indicated previously, universal
15 remote controls employing such universal appliance code libraries are well documented
in prior art. The controller of the infrared controlling circuit 70 illuminates red light-
emitting diode 52d during the programming mode period.

The speech recognizing circuit controller 60 executes code stored in ROM
61 to enter a response prompting recognition mode for appliance category selection
20 shown in step S242. The speech recognition circuit 50 software executes a response
prompting routine and activates the appliance category name recognition vocabulary set
as shown in step S243. As defined previously for speech recognition modes, a time-out
counter is set to zero and started in a step S244 when the response prompting recognition
mode is activated. The user is then expected to select a voice command from the
25 appliance category name recognition set and respond when prompted by an illuminated
green light emitting diode 52a as shown in a step S245. As indicated previously, the
appliance category name recognition set may be comprised of such voice command
options as "television," "video," "satellite," and "cable" among which the user may
select.

30 Following the prompting of the user by the illumination of a green light
emitting diode 52a in a step S245, the software enters a pattern generating mode in a step
S246, waiting for a voice command to be detected. If a maximum allowed time-out value
TMAXD is attained before a voice command is detected, the software will terminate the
response prompting routine, and the programming time-out counter is allowed to expire

5 as shown in step S292. Until time TMAXD has expired, the speech recognition circuit remains available to generate a pattern when a voice command is detected as shown in steps S246, S247 and S248. If a voice command is detected in a step S248, a pattern is generated in a step S249 and submitted for pattern recognition processing in a step S250.

10 During step S250 the acquired unknown pattern is analyzed by the speech recognition circuit controller 60, utilizing a recognition algorithm stored in its ROM 61, to determine if it can be classified as a match with any of the reference commands within the active recognition vocabulary set and if the likelihood of correctly recognizing the unknown pattern exceeds a predetermined threshold. The result of this comparison is identified in a step S251.

15 If a match for the acquired pattern is not identified, the red light-emitting diode 52c illuminates briefly to provide a visual indicator to the operator that no match was identified and the value of the recognition time-out counter is reset to the value zero and restarted as shown in a step S244. The green light-emitting diode 52a is then activated and remains illuminated as shown in step S245 and the speech recognition circuit 50 executes software to enter a pattern generating mode, returning to a step S246 and waiting for a voice command to be detected. As previously indicated, until time TMAXD has expired, the speech recognition circuit remains available to generate a pattern when a voice command is detected as shown in steps S246, S247 and S248.

20 If a match for the acquired pattern is identified in a step S251, the speech recognition circuit 50 software identifies the instruction associated with the matching recognition vocabulary set command, and issues a prompt, which may be a speech synthesis prompt, an audio sound or light-emitting diode indication, in a step S252 to identify the appliance category name recognized. The speech recognition circuit 50 then outputs a signal to the infrared controlling circuit 70, using output 68 pins to communicate the appliance category selection command in a step S253. The infrared controlling circuit 70 receives the signal and responds by making the memory section associated with the appliance category selected available for access in a step S254. The infrared controlling circuit 70 then sets equal to value zero and restarts the programming time-out counter in a step S256.

5 Following the submission of a signal to the infrared signal controlling
circuit 70, the speech recognition circuit controller 60 executes software stored in its
ROM 61 to enter a pattern queuing recognition mode as shown in a step S257 and to
activate the digits recognition set as shown in step S258. If the appliance category name
identified in step S252 is incorrect, step S255 shows that the programming time-out
10 counter is allowed to expire as shown in step S292, before returning to step S204 in FIG.
12a and beginning the process again.

 As shown in steps S257 and S258 in FIG. 13a, the speech recognition
circuit software executes a pattern queuing routine and activates the digit name
recognition vocabulary set. For example, the digit name recognition set may be
15 comprised of such voice command options as "zero," "one," "two," ... "nine" among
which the user may select.

 As defined previously, a time-out counter is set to value zero and started
when the pattern queuing recognition mode is activated as shown in a step S260 in FIG.
13b. Also at this time, a pattern counter and a queue counter are set to value zero in a
20 step S261. The user selects an appliance code from a listing of the universal library of
code supplied with the system and issues a spoken command identifying the first digit of
the code when prompted by an illuminated green light emitting diode 52b as shown in
a step S262.

 The pattern counter value is incremented each time after a pattern is
25 generated until a maximum pattern counter value MAXC is attained. In this manner each
pattern counter number value is representative of a single generated pattern and the
maximum number attained by said counter is equal to the number of patterns generated.
The value MAXC represents the maximum number of patterns the routine will generate
before terminating the pattern generation process and beginning a speech recognition
30 process. The minimum value for the pattern counter before the routine will generate
speech recognition processing is one. If no patterns are generated within the time
allowed, then the software returns to the default continuous listening mode as described
later.

5 The queue counter is utilized in a similar manner to the pattern counter,
except that it is used to track operation instructions identified during a speech recognition
process. As a match is identified for an unknown pattern during the pattern recognition
process, the operation instruction of the associated recognition vocabulary set command
determined to be the best match is queued into memory until all generated patterns are
10 processed through the speech recognition process. In this manner each queue counter
number value is representative of an operation instruction now associated with a single
generated pattern and is useful in retaining sequential order during the storage and
retrieval of said instruction from memory. The maximum value attained by said queue
counter is equal to the number of patterns generated. Unknown patterns for which no
15 match is identified during the speech recognition process are ignored, in which cases the
queue counter is not incremented.

 Following the production of a visual prompt by the green light emitting
diode **52b** in a step **S262**, the speech recognition circuit **50** software begins a listening
routine (enters a state where it remains ready to generate a pattern) awaiting a voice
20 command in a step **S263**. As shown in steps **S263**, **S264** and **S265**, the speech
recognition circuit **50** software remains within said routine until either a voice command
is detected in a step **S264** or the time-out counter value reaches the value **TMAX2** in step
S265. As shown in a step **S266** a pattern is generated by the speech recognition circuit
50 when a voice command is detected in a step **S264**. Said generated unknown pattern
25 is queued into **RAM 62** in a step **S267**.

 As shown in a step **S268**, the value of the pattern counter is then compared
with the value **MAXC**. If the pattern counter value is less than the value of **MAXC**, then
the pattern counter value is incremented by one in a step **S269** and the green light
emitting diode **52b** provides a visual prompt in a step **S262** for the user to submit another
30 voice command. This process continues to cycle through these steps **S262** through **S269**
until either the pattern counter reaches the value **MAXC** in step **S268**, indicating the
maximum number of patterns allowable have been generated, or until a time-out occurs
as described previously. If a time-out does occur at a step **S265**, the user allows the
programming time-out counter to expire as shown in step **S292** in FIG. 13c, before

5 returning to step S204 in FIG. 12a and beginning the process again or allowing the invention to automatically enter the default recognition mode.

Generated patterns are then submitted by the software for processing by the pattern recognition algorithm in a step S270, one pattern at a time, in reverse order from the pattern generation order.

10 If a match for an acquired pattern is identified in a step S271, the speech recognition circuit 50 software identifies the operation associated with the matching recognition vocabulary set command and queues this operation instruction into RAM 62 in a step S272. The queue counter is then incremented by the value one in a step S273. The pattern counter is then decremented by the value one in a step S274. The pattern
15 counter value is then compared to the value zero in a step S275 to determine if there are any unknown patterns queued in RAM 62 which have not been submitted for speech recognition processing. If the pattern counter value is not equal to zero, then the software submits the next unknown pattern for speech recognition processing in a step S276 and returns to step S270 to perform pattern recognition. The software continues to cycle
20 through steps S270 through step S276 until the pattern counter value is equal to value zero in step S275. If a match for an acquired pattern is not identified in a step S271, the pattern counter value is decremented by one in a step S274 before proceeding to step S275.

When the pattern counter value is equal to value zero in step S275 in FIG.
25 13b, the software compares the queue counter value to the value zero in a step S280 in FIG. 13c to determine if there are any operation instructions queued in the RAM 62. If the value of the queue counter is not equal to the value zero, the software retrieves from RAM 62 the operation instruction associated with the current value of the queue counter in a step S282. The speech recognition circuit 50 executes said operation instruction in
30 a step S283 by sending a signal through the outputs 68 pins to the infrared signal controlling circuit 70. The processing of said signal received by the infrared signal controlling circuit is described later. The speech recognition circuit 50 software then decrements the queue counter value by the value one in a step S284 and returns to step S280 to determine if all operation instructions have been retrieved from RAM 62. The

5 software continues to cycle through steps S280 through step S284 until the queue counter value is equal to value zero in step S280 at which time the software issues a prompt, which may be a speech synthesis prompt, an audio sound or light-emitting diode indication, in a step S281 to identify the appliance code recognized, and then enters the default continuous listening mode as shown in a step S505 in FIG. 5.

10 As shown in a step S283, the operation instruction associated with the recognized command is processed by the speech recognition circuit controller 60 to determine an output signal to the infrared controlling circuit 70, which is sent via the speech recognition circuit output 68 pins.

15 S285 identifies the processing steps performed within the infrared signal controlling circuit 70. The signal from the speech recognition circuit output 68 pins is received by inputs of the infrared signal controlling circuit 70 and processed to determine an identifier associated with a recognized digit name in a step S286. The output from the speech recognition circuit output 68 pins is equivalent to a signal generated when a button is depressed on a keypad of a conventional remote control transmitter. Thus the
20 input to the controller of the infrared signal controlling circuit 70 is essentially the same as received from keypad generated circuit connections which are well documented in prior art. The controller of the infrared signal controlling circuit 70 stores the identifier associated with the signal received in a memory location in a step S287. Identifiers are determined and stored for each instruction received from the speech recognition circuit
25 50 until all instructions are received as determined in a step S288. The set of identifiers are then analyzed by the controller of the infrared controlling circuit 70 to determine if a they collectively comprise a valid appliance code in a step S289. If a valid code exists, the remote control functions associated with that code are assigned to the previously identified appliance category in a step S293 and the programming mode is terminated in
30 a step S294.

If the code is not valid, the code is not accepted in a step S290 and any previously established code remains active. Light-emitting diode 52d illuminates in a step S291 and the programming time-out counter is allowed to expire in a step S292. FIG. 13c also shows that, as the programming time-out counter is allowed to expire, the

5 time-out counter for the speech recognition circuit 50 is also allowed to expire, after which the speech recognition circuit 60 executes software stored in its ROM 61 to return to a default continuous listening recognition mode.

Following the submission of the last signal to the infrared signal controlling circuit 70, the speech recognition circuit controller 60 executes software
10 stored in its ROM 61 to return to a default continuous listening recognition mode as shown in a steps S281 in FIG. 13c and a step S505 in FIG. 5. If the appliance category name identified in step S281 is incorrect, the user may elect to press the setup button, returning to step S204 in FIG. 12a and begin the process again.

15 INFRARED SIGNAL LEARNING

If the controller 60 detects an input corresponding to a depress of the learn signal button shown in step S209 in FIG. 12a, a signal is sent to the infrared signal controlling circuit 70, using output 68 pins to instruct the infrared signal controlling circuit to enter infrared signal learning program mode. As shown in step S300 in FIG.
20 14a, the controller of the infrared controlling circuit executes a learning program routine from software stored within its ROM, which includes setting to value zero and starting a programming time-out counter in a step S301. The signal learning program routine prepares the controller of the infrared signal controlling circuit 70 for subsequent receipt of a series of instructions. A first instruction identifies the intended appliance category, which is then followed by instructions to enter infrared signal learning mode. As
25 indicated previously, learning remote controls are well documented in prior art, for example as disclosed in U.S. Patent Nos. 4,905,279 and 5,959,751, hereby incorporated by reference. The controller of the infrared controlling circuit illuminates red light-emitting diode 52d in different manners to communicate the status of the signal learning process to the user during this programming mode.
30

The speech recognizing circuit controller 60 executes code stored in ROM 61 to enter a response prompting recognition mode for appliance category selection shown in step S302. The speech recognition circuit 50 software executes a response prompting routine and activates the appliance category name recognition vocabulary set

5 as shown in step S303. As defined previously for speech recognition modes, a time-out counter is set to zero and started in a step S304 when the response prompting recognition mode is activated. The user is then expected to select a voice command from the appliance category name recognition set and respond when prompted by a speech synthesis prompt, an audio sound and/or the illumination of a green light emitting diode 52a as shown in a step S305. As indicated previously, the appliance category name recognition set may be comprised of such voice command options as "television," "video," "satellite," and "cable" among which the user may select.

10 Following the prompting of the user, the software enters a pattern generating mode in a step S306, waiting for a voice command to be detected. If a maximum allowed time-out value TMAXD is attained before a voice command is detected, the software will terminate the response prompting routine and return to a default continuous listening recognition mode, and the programming time-out counter is allowed to expire as shown in step S292 as shown in FIG. 13c. Until time TMAXD has expired, the speech recognition circuit remains available to generate a pattern when a voice command is detected as shown in steps S306, S307 and S308. If a voice command is detected in a step S308, a pattern is generated in a step S309 and submitted for pattern recognition processing in a step S310.

15 During step S310 the acquired unknown pattern is analyzed by the speech recognition circuit controller 60, utilizing a recognition algorithm stored in its ROM 61, to determine if it can be classified as a match with any of the reference commands within the active recognition vocabulary set and if the likelihood of correctly recognizing the unknown pattern exceeds a predetermined threshold. The result of this comparison is identified in a step S311.

20 If a match for the acquired pattern is not identified, the red light-emitting diode 52c illuminates briefly to provide a visual indicator to the operator that no match was identified and the value of the recognition time-out counter is reset to the value zero and restarted as shown in a step S304. The green light-emitting diode 52a is then activated and remains illuminated as shown in step S305 and the speech recognition circuit 50 executes software to enter a pattern generating mode, returning to a step S306

5 and waiting for a voice command to be detected. As previously indicated, until time TMAXD has expired, the speech recognition circuit remains available to generate a pattern when a voice command is detected as shown in steps S306, S307 and S308.

10 If a match for the acquired pattern is identified in a step S311, the speech recognition circuit 50 software identifies the instruction associated with the matching recognition vocabulary set command, and issues a prompt, which may be a speech synthesis prompt, an audio sound or light-emitting diode indication, in a step S312 to identify the appliance category name recognized. The speech recognition circuit 50 then outputs a signal to the infrared controlling circuit 70, using output 68 pins to communicate the appliance category selection command in a step S313. The infrared
15 controlling circuit 70 receives the signal and responds by making the memory section associated with the appliance category selected available for access in a step S314. The infrared controlling circuit 70 then sets equal to value zero and restarts the programming time-out counter in a step S317.

20 Following the submission of a signal to the infrared signal controlling circuit 70, the speech recognition circuit controller 60 executes software stored in its ROM 61 to enter a default recognition mode and to activate a default recognition set as shown in a step S320 in FIG. 14b. If the appliance category name identified in step S312 is incorrect, step S316 shows that the programming time-out counter is allowed to expire as shown in step S292 shown in FIG. 13c, before returning to step S204 in FIG. 12a and
25 beginning the process again. FIG. 13c also shows that, as the programming time-out counter is allowed to expire, the time-out counter for the speech recognition circuit 50 is also allowed to expire, by reaching the value TMAXD, after which the speech recognition circuit 60 executes software stored in its ROM 61 to return to a default continuous speech recognition mode.

30 As indicated above, once the appliance category is identified and communicated to the infrared signal controlling circuit 70, the speech recognition circuit controller 60 executes software stored in its ROM 61 to enter a default recognition mode and to activate a default recognition vocabulary set as shown in a step S320 in FIG. 14b. This default recognition vocabulary set is made available to enable the user to navigate

5 the recognition vocabulary structure via spoken commands to identify a command with which to associate the next infrared signal to be learned.

As described previously for speech recognition modes, a recognition time-out counter is set to zero and started in a step S321 when the default recognition mode is activated. The user is then expected to select a voice command from the default
10 recognition vocabulary set and respond when a green light emitting diode 52a is illuminated as shown in a step S322. The default recognition vocabulary set may be comprised of such voice command options as "power," "channel," "change," "volume," "sound," "control" and "private" among which the user may select.

Following the prompting of the user by the illumination of a green light
15 emitting diode 52a in a step S322, the software enters a mode where it is available for pattern generating in a step S323, waiting for a voice command to be detected. If a maximum allowed time-out value TMAXL is attained before a voice command is detected, the software will terminate the speech recognition routine and return to a default continuous listening recognition mode, and the programming time-out counter is allowed
20 to expire as shown in step S292 shown in FIG. 12c. Until time TMAXL has expired, the speech recognition circuit remains available to generate a pattern when a voice command is detected as shown in steps S323, S324 and S325. If a voice command is detected in a step S325, a pattern is generated in a step S326.

As shown in a step S327, the acquired unknown pattern is analyzed by the
25 speech recognition circuit controller 60, utilizing a recognition algorithm stored in its ROM 61, to determine if it can be classified as a match with any of the reference commands within the default recognition vocabulary set and if the likelihood of correctly recognizing the unknown pattern exceeds a predetermined threshold. The result of this comparison is identified in a step S328.

30 If a match for the acquired pattern is not identified, the red light-emitting diode 52c illuminates briefly to provide a visual indicator to the operator that no match was identified and the value of the recognition time-out counter is reset to the value zero and restarted as shown in a step S321. The green light-emitting diode 52a is then activated and remains illuminated as shown in step S322 and the speech recognition

5 circuit 50 executes software to enter a pattern generating mode, returning to a step S323 and waiting for a voice command to be detected. As previously indicated, until time TMAXL has expired, the speech recognition circuit remains available to generate a pattern when a voice command is detected as shown in steps S323, S324 and S325.

10 If a match for the acquired pattern is identified in a step S328, the speech recognition circuit 50 software identifies the operation associated with the matching recognition vocabulary set command in a step S329 and determines if the operation is to send an instruction to the speech recognition circuit controller 60 to activate a different recognition set vocabulary or to output a signal to the infrared controlling circuit 70 using the speech recognition circuit output 68 pins. If the instruction is to activate a different
15 recognition vocabulary set, step S330 shows that the routine returns to a step S320. The user may continue to navigate through different linked, recognition vocabulary sets until a voice command is recognized that is associated with a remote control function that is associated with a read/write memory 72 location. If the operation involves sending a signal to the infrared signal controlling circuit as shown in a step S331, said signal
20 communicates an instruction for a remote control function type that is associated with a memory location within read/write memory 72, controlled by the infrared signal controlling circuit 70. The controller of the infrared signal controlling circuit 70 identifies said memory location and targets this memory location for storage of an infrared code to be received as shown in a step S332.

25 The controller of the infrared signal controlling circuit 70 activates a red light-emitting diode 52d in a step S333 to prompt a user that it is ready to receive a transmitted infrared code and enables one or more of its input pins to detect and receive signals generated by the infrared receiver 71, which is electrically connected to one or more of said input pins. For one embodiment of the invention, infrared receiver 71 is a
30 commercially available photo IC capable of providing digital output to the controller of the infrared signal controlling circuit 70. Alternative schemes, utilizing other infrared light detecting devices with or without signal processing circuitry, may also be used as the IR receiver 71. As shown in a step S334, the infrared signal is received from the IR receiver 71 of the present invention by the controller of the infrared signal controlling

5 circuit 70 as digital data. The controller of the infrared signal controlling circuit 70
decodes and converts the received digital data into a control code format and stores the
resulting control code into a memory location within read/write memory 72, controlled
by the infrared signal controlling circuit 70. The memory location is associated with the
remote control function type associated with the recognized voice command spoken by
10 the user.

The controller of the infrared signal controlling circuit 70 activates a red
light-emitting diode 52d in a step S335 to inform the user if the infrared signal learning
process was capable of successfully receiving, formatting and storing the infrared signal
or not. This red light-emitting diode 52d provides prompts in different manners to
15 distinguish between a successful learning process and a process during which an error
was encountered. A successfully learned and stored infrared signal may be later
transmitted by the invention while in an operation mode upon recognition of the voice
command with which the learned infrared signal is associated.

Following an attempt to learn an infrared signal, the controller of the
infrared signal controlling circuit executes software stored within its ROM to reset to
20 value zero and start the programming time-out counter, returning to a step S317 shown
in FIG. 14a. Also, following the submission of a signal to the infrared signal controlling
circuit 70, the speech recognition circuit controller 60 executes software stored in its
ROM 61 to return to the default recognition mode and reset the value TMAXL to zero
25 as shown in steps S331 and S320. As shown in a step S336, a user may elect to either
return to the previous process steps to repeat a previously failing signal learning attempt
or to attempt to learn additional infrared signals or the user may elect to allow the
programming time-out counter of the infrared signal controlling circuit 70 to expire as
shown in step S292 shown in FIG. 12c.

30 After the time-out counters have reached their respective maximum
values, the invention exits this setup programming mode and enters a default recognition
mode, where it becomes available to receive spoken commands from the user and
respond by transmitting infrared control signals to appliances, including any infrared
signals learned during a infrared signal learning setup process as described above.

5

VOICE TRAINING

If the controller 60 detects an input corresponding to a depress of the name command button shown in step S211 in FIG. 12a, a speaker dependent command voice training routine is initiated and executed by said controller as shown in a step S340 in FIG. 15. This training routine generates and stores into read/write memory 54 a user-specific reference pattern for each voice command to be included in a speaker dependent recognition vocabulary set. The speech recognition circuit controller 60 executes software stored in its ROM 61 to set to value zero and start a training program time-out counter as shown in a step S341.

Following the prompting of the user by a speech synthesis prompt, an audio sound and/or the illumination of a green light emitting diode 52a in a step S342, the software enters a mode where it is available for pattern generating in a step S343, waiting for a voice command to be detected. If a maximum allowed time-out value TMAXV is attained before a voice command is detected, the software will terminate the voice training as shown in step S345 and enter a default speech recognition operation mode which is described previously. Until time TMAXV has expired, the speech recognition circuit remains available to generate a pattern when a voice command is detected as shown in steps S343, S344, S345 and S346. If a voice command is detected in a step S344, a pattern is generated in a step S346.

One embodiment of the invention executes a speaker dependent reference pattern generation algorithm that is well known to those familiar with speech recognition art. The algorithm involves the generation of a pattern each time a voice command is spoken by a user. A pattern is a compact representation of the significant acoustic information in a voice command word or phrase. A reference pattern may be, for example, created by averaging patterns generated as the voice command is spoken two or more times. The reference pattern is then stored in a read/write memory 54. As shown in a step S347 and S348, the first pattern generated is stored into a read/write memory 54 location. The user is then prompted in a step S349 to repeat the voice command, returning to step S341 and continuing through step S346 to perform the pattern generation process for the repeated voice command.

5 Following the generation of the second pattern, the second pattern is then compared to the first pattern which is stored in read/write memory 54 to determine if the two patterns match sufficiently to satisfy a predetermined matching criteria as shown in a step S350. If the matching criteria is not satisfied, the two patterns are determined to not match, and the first pattern generated is replaced by storing the second pattern
10 generated into the previously identified read/write memory 54 location, and thus overwriting the first pattern. The user is then prompted in a step S349 to repeat the voice command, returning to step S341 and continuing through step S346 to perform the pattern generation process for the repeated voice command. As shown by steps S341 through S350 this process cycle may be continued until two patterns are generated which
15 are capable of meeting said matching criteria.

 Once two patterns are generated which are capable of meeting said matching criteria, a reference pattern is generated as shown in step S351. A pattern recognition routine is then executed to compare the resulting reference pattern to any other previously generated reference patterns within the intended recognition vocabulary set which are stored in read/write memory 54 to determine if the new reference pattern
20 is sufficiently different than said previously generated reference patterns. This comparison is performed to prevent the acceptance of similar voice commands, which may reduce the recognition accuracy rate. The comparison may calculate distance measurements of the fit of the newly generated reference pattern to the previously
25 generated reference patterns within the intended recognition vocabulary set. The distance measurements between the newly generated reference pattern and the closest matching previously generated reference pattern(s) may then be compared to a predetermined comparison criteria to determine the degree of similarity. If the newly generated reference pattern is too similar to an existing reference pattern, the newly generated
30 reference pattern is rejected, and the user is prompted in a step S353 to select a different voice command name, returning to step S341.

 If the newly generated reference pattern is not found to be too similar to an existing reference pattern, the newly generated reference pattern is compressed and stored into read/write memory 54 as shown in a step S354. In a step S355, the speech

5 recognition circuit controller 60 executes software stored in its ROM 61 to determine if
sufficient capacity remains in read/write memory 54 to allow additional voice commands
to be trained. If there is sufficient capacity in the memory 54, the system returns to step
S341, where the user is prompted to enter another voice command by a speech synthesis
prompt, an audio sound and/or the illumination of a green light emitting diode 52a. If the
10 user desires to exit this voice training mode, the user allows the training program time-
out counter to expire as shown in a step S356. If there is insufficient capacity in the
memory 54, the user is informed accordingly by a speech synthesis prompt, an audio
sound and/or the illumination of a red light emitting diode 52c and the training program
terminates.

15 The contents of the read/write memory 54 may be erased by depressing
and simultaneously holding the name command button and the code button for a brief
period of time. Depressing and momentarily holding two predetermined
buttons on keypad 51 may cause the address pointer for the read/write memory 54 to be
set to zero, allowing any data previously stored within said memory to be overwritten
20 during subsequent write operations to said memory. This enables a user to effectively
“erase” this memory and store different data in a form of speech command reference
pattern data and macro program instruction data.

The read/write memory 54 utilized in the preferred embodiment of the
present invention may be a commercially available I²C™ Serial EEPROM, for example
25 a model number 24LC64 available from MicroChip Technology Inc. and described in a
data sheet entitled; 24AA64/24LC64 64K I²C™ CMOS Serial EEPROM, document
number DS21189C published by MicroChip Technology Inc. copyright 1999, pages 1-12,
available from MicroChip Technology Inc., hereby incorporated by reference. When the
two said buttons are simultaneously depressed, two input pins 68 of IC 55 which are
30 electrically connected to said buttons are brought to a logical low state. The software
stored in ROM 61 of the speech recognition circuit 50 executes a program which detects
this condition and responds by setting the address pointer for the next available address
location for memory 54 to value zero and storing this value in the predetermined address
pointer location of said memory 54. The next attempt by the speech recognition circuit

5 software to store data to said memory 54 will retrieve the value of the address pointer for the next available location from said predetermined location within memory 54, and interpret the value zero as an instruction to begin storing data in the first address configured to accept data.

10 MACRO PROGRAMMING

If the controller 60 detects an input corresponding to a depress of the macro button shown in step S213 in FIG. 12a, a macro programming routine is initiated and executed by said controller as shown in a step S360 in FIG. 16a. As indicated in a step S361, the system executes an appliance category selection routine as described in
15 step S220 in FIG. 12b to identify the appliance category from which the macro will be activated when the macro name is later recognized by the speech recognition circuit 50 as a voice command. If the appliance category name identified during the execution of the appliance category selection routine is incorrect, step S362 shows that the user may elect to press the setup button, returning to step S204 in FIG. 12a and begin the process
20 again.

If the appliance category name identified during the execution of the appliance category selection routine is correct, the user allows the software routine to continue. A step S362 shows that the software enters a speaker dependent recognition mode in a step S363 and a speaker dependent recognition vocabulary set is activated in
25 a step S364. The speaker dependent recognition vocabulary set activated may contain one or more macro names, and possibly other speaker dependent voice commands for non-macro uses, previously trained by the user in accordance with the process steps described in FIG. 15. The speech recognition circuit controller 60 executes software stored in its ROM 61 to set to value zero and start a recognition time-out counter as
30 shown in a step S365.

Following the prompting of the user by a speech synthesis prompt, an audio sound and/or the illumination of a green light emitting diode 52a in a step S366, the software enters a mode where it is available for pattern generating in a step S367, waiting for a voice command to be detected. If a maximum allowed time-out value

5 TMAXM is attained before a voice command is detected, the software will terminate the
macro programming routine as shown in step S368 and the user may elect to press the
setup button, returning to step S204 in FIG. 12a and begin the process again. Until time
TMAXM has expired, the speech recognition circuit remains available to generate a
10 a pattern when a voice command is detected as shown in steps S367, S368, and S369. If
a voice command is detected in a step S369, a pattern is generated in a step S370 and
submitted for pattern recognition processing in a step S371.

During step S371 the acquired unknown pattern is analyzed by the speech
recognition circuit controller 60, utilizing a recognition algorithm stored in its ROM 61,
to determine if it can be classified as a match with any of the reference commands
15 within the active recognition vocabulary set and if the likelihood of correctly recognizing
the unknown pattern exceeds a predetermined threshold. The result of this comparison
is identified in a step S372.

If a match for the acquired pattern is not identified a red light-emitting
diode 52c illuminates briefly to provide a visual indicator to the operator that no match
20 was identified in a step S373 and returns to step S365 to set to value zero and start a
recognition time-out counter. The software then re-enters a mode where it is available
for pattern generating, waiting for a voice command to be detected. As previously
indicated, until time TMAXM has expired, the speech recognition circuit remains
available to generate a pattern when a voice command is detected as shown in steps S367,
25 S368 and S369.

If a match for the acquired pattern is identified in a step S372, the speech
recognition circuit 50 software identifies a read/write memory 54 location associated with
the matching recognition vocabulary set command in a step S374. Said memory 54
location is used to store the sequence of commands instructions to be associated with the
30 macro name identified by the preceding voice command. As shown in a step S375, the
software executed by the speech recognition circuit controller 60 then activates the
default recognition mode associated with the appliance device type previously selected.

As indicated previously, once the macro name is identified, the speech
recognition circuit controller 60 executes software stored in its ROM 61 to enter a default

5 recognition mode and to activate a default recognition vocabulary set as shown in a step S381 in FIG. 16b. This default recognition vocabulary set is made available to enable the user to navigate the recognition vocabulary structure via spoken commands to identify a voice command for which the associated instruction is to be stored within the read/write memory 54 location associated with said macro name voice command.

10 As described previously for speech recognition modes, a recognition time-out counter is set to zero and started in a step S382 when a recognition mode is activated. The user is then expected to select a voice command from the default recognition vocabulary set and respond when prompted by a speech synthesis prompt, an audio sound and/or the illumination of a green light emitting diode 52a as shown in a step S383. As also indicated previously, the default recognition vocabulary set may be comprised of
15 such voice command options as "power," "channel," "change," "volume," "sound," "control" and "private" among which the user may select.

Following the prompting of the user by the illumination of a green light emitting diode 52a in a step S383, the software enters a mode where it is available for
20 pattern generating in a step S384, waiting for a voice command to be detected. If a maximum allowed time-out value TMAXM is attained before a voice command is detected, the software will return to a known default continuous listening recognition mode and the user may continue generating the macro as shown in step S385. Until the time TMAXM has expired, the speech recognition circuit remains available in the active
25 recognition mode to generate a pattern when a voice command is detected as shown in steps S384, S385 and S386. If a voice command is detected in a step S386, a pattern is generated in a step S387.

As shown in a step S388, the acquired unknown pattern is analyzed by the speech recognition circuit controller 60, utilizing a recognition algorithm stored in its
30 ROM 61, to determined if it can be classified as a match with any of the reference commands within the active recognition vocabulary set and if the likelihood of correctly recognizing the unknown pattern exceeds a predetermined threshold. The result of this comparison is identified in a step S389.

5 If a match for the acquired pattern is not identified, the red light-emitting
diode 52c illuminates briefly to provide a visual indicator to the operator that no match
was identified as shown in a step S390 and the value of the recognition time-out counter
is reset to the value zero and restarted as shown in a step S382. The green light-emitting
diode 52a is then activated and remains illuminated as shown in step S383 and the speech
10 recognition circuit 50 executes software to enter a pattern generating mode, returning to
a step S384 and waiting for a voice command to be detected. As previously described,
until the time-out counter value of the currently active recognition mode reaches its
respective maximum value, the speech recognition circuit remains in the active
recognition mode available to generate a pattern when a voice command is detected as
15 shown in steps S384, S385 and S386.

 If a match for the acquired pattern is identified in a step S389, the speech
recognition circuit 50 software identifies the operation associated with the matching
recognition vocabulary set command in a step S391 and determines if the operation is to
send an instruction to the speech recognition circuit controller 60 to activate a different
20 recognition set vocabulary or to output a signal to the infrared controlling circuit 70 using
the speech recognition circuit output 68 pins. If the instruction is to activate a different
recognition vocabulary set, step S391 shows that the routine returns to a step S380 to
enter the appropriate recognition mode and activate the recognition vocabulary set
associated with the recognized voice command in step S381. The user may continue to
25 navigate through different linked, recognition vocabulary sets until a voice command is
recognized that is associated with an instruction to output a signal to the infrared
controlling circuit 70.

 If a voice command is recognized that is associated with an instruction to
output a signal to the infrared controlling circuit 70, the associated instruction is stored
30 within the read/write memory 54 location associated with said macro name voice
command as shown in a step S392. In the memory 54 location sequentially following the
memory location where the instruction is stored, an end marker instruction may be
automatically stored by the speech recognition circuit 50 software as shown in step S393.
The user must then determine if this is the last instruction to be added to the macro

5 program or not. If another instruction is to be added, the user must determine if it is
desirable to insert a time delay between the execution of the currently identified
instruction and a following macro instruction to be selected. As shown in a step S394,
if the insertion of a time delay is desirable, the user may depress a keypad 51 designated
as a time delay button one or more times, where each button depress increases the length
10 of the time delay by a brief period (typically 0.5 seconds or less) by storing one or a series
of time delay instructions within the read/write memory 54 location associated with said
macro name voice command as shown in a step S395. The time delay instructions are
stored into said memory 54 location in a section sequentially following the section of the
instruction previously identified via voice command.

15 If the user determines that another instruction is to be added to the macro
program, then the user depresses the macro button as shown in a step S396, the software
returns to a step S375 shown in FIG. 16a, and the software executed by the speech
recognition circuit controller 60 then activates the default recognition mode associated
with the appliance device type previously selected. As indicated previously, this default
20 recognition vocabulary set is made available to enable the user to navigate the recognition
vocabulary structure via spoken commands to identify another voice command for which
the associated instruction is also to be stored within the read/write memory 54 location
associated with said macro name voice command.

Each additional instruction added to a macro is stored in the same memory
25 54 location as that of the previously stored end marker instruction, which was stored by
the software after the previous macro instruction was stored, thus over-writing the end
markers. This process for adding instructions to said memory location 54 associated with
said macro continues until the user determines the last instruction has been identified via
voice command. At this time, the user depresses a keypad 51 button designated as a
30 program completion button as shown in a step S397 to instruct the speech recognition
circuit controller 60 to execute software stored in its ROM 61 to terminate the macro
programming routine and enter the default recognition mode associated with the
previously identified appliance category as shown in step S398.

5 The macro program resulting from this process is stored in a read/write
memory 54 location comprised of multiple, sequential bytes of memory. Each byte may
contain an instruction to output a signal to the infrared controlling circuit 70, an
instruction to execute a time delay, or an instruction in the form of an end marker to
10 instruct the speech recognition circuit controller 60 software that the last macro
instruction has been retrieved. When a macro name is spoken by a user and recognized
by the speech recognition circuit controller 60 software, said software retrieves and
sequentially executes each of the instructions stored within the read/write memory 54
location associated with said macro name in the same order which the instructions were
stored.

15 Within this macro programming software routine, the use of keypad 51
buttons other than the macro button, such as the code button and signal learning button,
may be used for such functions as time delay insertion and end marker insertion into the
macro sequence. This approach allows for a reduction of the required button count, and
is particularly useful for such relatively infrequently used functions as those identified
20 above.

 Reference is made to FIG. 17 which shows the power supply circuit 90 in
greater detail than that shown in FIG. 1. This circuit is described previously in the
section describing the process steps of FIG. 12a.

25 DESCRIPTION OF OPERATION

 Once successfully setup, the present invention typically remains in a sound
activation mode until sound pressure exceeding a defined threshold (sound activation
sensitivity setting) initiates a "wake up" event. Once the oscillator is started and
stabilized, the system enters a continuous listening default recognition mode awaiting
30 detection and recognition of one of the default menu words associated with a selected
target appliance.

 Control functions for the target appliance can then be activated via voice
commands. Once an appliance has been selected, its default menu remains the active
recognition vocabulary set until changed by the user. Voice commands may then be

5 selected from the available recognition vocabulary set. The vocabulary options made
available by the default menu vary depending upon the category of the appliance selected
(for example, a VCR may have different options available than a TV). Voice commands
may instruct the invention to initiate a control signal to the target appliance or activate
a function sub-menu in the form of a different recognition vocabulary set (which may
10 include access, for example, to different appliance control functions, macro functions,
speaker dependent commands or device selection commands).

The unit then remains in a continuous listening default recognition mode
for a defined period of time or until a defined number of consecutive unsuccessful
recognition attempts occur, whichever occurs first. If any default menu word is
15 recognized, the invention executes the appropriate command. If no default menu words
are recognized, the unit returns to sound activation mode. Upon returning to default
recognition mode from sound activation mode, the software remains in default
recognition mode until a defined period of time where no recognition (successful) activity
has elapsed after the last recognized command (a “user settling period”) or until a defined
20 number of consecutive unsuccessful recognition attempts occur, whichever occurs first.

When in a continuous listening default recognition mode, a green LED
52a remains illuminated to provide a visual cue to the user when the device is ready to
receive commands for recognition and a red LED 52c will illuminate when unavailable.
Following activation from sound activation mode, the invention returns to the default
25 menu of the most recently selected appliance.

Default Menu Vocabulary for a Television:

As an example, Table 1 below identifies seven words comprising a default
menu recognition vocabulary set available for a television. Fig. 5 shows the process steps
30 associated with the software executed during this mode.

If the speaker independent command “*Power*” is recognized, the invention
transmits the IR signal for the Power command, turning the currently controlled appliance
on or off.

5

Recognition Vocabulary - Television

Power	Channel	Change	Volume	Sound	Control	Private
-------	---------	--------	--------	-------	---------	---------

10

Table 1

Table 2 below identifies words (digit names) comprising a channel number recognition vocabulary set. If the word "*Channel*" is recognized, a pattern queuing routine is initiated, as shown in FIG. 9, and makes the following speaker independent sub-menu available for recognition:

15

Recognition Vocabulary- Television

Power	Channel	Change	Volume	Sound	Control	Private
		Zero				
		One				
		Two				
		Three				
		Four				
		Five				
		Six				
		Seven				
		Eight				
		Nine				

20

25

30

Table 2

The green LED 52a then prompts a user to say a digit name. After detecting the first digit, the invention's green LED 52b then quickly prompts the user for

35

5 another digit name. In one embodiment of the invention, the routine prompts the user for up to 3 digit names. If a second digit (or third) is not detected within a predetermined period of time, the invention performs the speech recognition process and transmits the IR signal(s) associated with any recognized channel number names and returns to the default recognition mode.

10 Table 3 below identifies words comprising a directional channel changing recognition vocabulary set. If the word "**Change**" is recognized, the invention enters a response prompting recognition mode as shown in FIG. 8 and the following speaker independent sub-menu is made available for recognition:

15

Recognition Vocabulary - Television

Power	Channel	Change	Volume	Sound	Control	Private
		Up				
		Down				
		Back				

20

Table 3

25 "**Up**" and "**Down**" are instructions to advance forward or in reverse order to the next sequentially available channel number, respectively. "**Back**" is an instruction to return to the channel number established prior to the current channel number.

30 If the words "**Up**," "**Down**" or "**Back**" are recognized, the invention transmits the associated IR signal associated with the indicated channel directional change and awaits, for a predetermined period of time, for another Up/Down/Back command before returning to the default menu recognition mode. This sequence continues until no Up/Down/Back commands are recognized within said predetermined period of time of a previous command, at which time the software returns to the default menu recognition mode.

35 Table 4 identifies words comprising the volume changing recognition vocabulary set. If the word "**Volume**" is recognized, the invention enters a response prompting recognition mode as shown in FIG. 8 and the following speaker independent sub-menu is made available for recognition:

5

Recognition Vocabulary - Television

Power	Channel	Change	Volume	Sound	Control	Private
			Up			
			Down			

10

Table 4

15

“*Up*” and “*Down*” are instructions to increment or decrement the volume level, respectively. If the words “*Up*” or “*Down*” are recognized, the invention transmits the associated IR signal associated with the indicated volume level change and awaits, for a predetermined period of time, for another Up/Down command before returning to the default menu recognition mode. This sequence continues until no Up/Down commands are recognized within said predetermined period of time of a previous command, at which time the software returns to the default menu recognition mode.

20

Table 5 below identifies a word in the default recognition vocabulary for the muting function. If the word “*Sound*” is recognized, the invention transmits the IR signal for the muting command and returns to default recognition mode.

25

Recognition Vocabulary- Television

Power	Channel	Change	Volume	Sound	Control	Private
-------	---------	--------	--------	-------	---------	---------

30

Table 5

35

Table 6 below identifies the words comprising the device selection/control recognition vocabulary set. If the word “*Control*” is recognized, the invention enters a response prompting recognition mode as shown in FIG. 8 and the following speaker independent sub-menu is made available for recognition:

40

Recognition Vocabulary - Television

Power	Channel	Change	Volume	Sound	Control	Private
					Television	
					Video	
					Satellite	

45

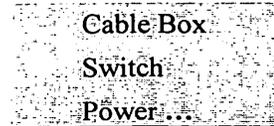


Table 6

50

If the words "*Television*," "*Video*," "*Satellite*" or "*Cable Box*" are recognized, the invention makes the specified appliance type available for subsequent control.

If the word "*Switch*" is recognized, the invention transmits an IR signal associated with the "TV/Video" switching function and returns to the default recognition mode.

55

If the word "*Power*" is recognized, the software returns to response prompting recognition mode, awaiting a repeat of this command to ensure the invention is not accidentally powered down. If a second word "*Power*" is recognized, the invention utilizes a speech recognition circuit 50 input/output 68 pin to activate a switch 93 to disconnect the power source from the power supply circuit 90. Manually depressing a power button is required to re-activate the invention.

60

Table 7 below indicates how a speaker dependent vocabulary recognition set sub-menu may be accessed if speaker dependent vocabulary words have previously been trained. If the word "*Private*" is recognized, the software enters speaker dependent recognition mode and makes a recognition vocabulary set containing speaker dependent function names, device names and macro names available for recognition. It should be noted that this recognition vocabulary set remains empty until the user has entered speaker dependent names via the voice training setup process shown in FIG. 15. The recognition of any speaker dependent voice command causes the software to execute the instruction(s) associated with the recognized command, including the transmission of any associated IR signals, and remain in speaker dependent recognition mode awaiting another command from this recognition vocabulary set. If no words are detected for a predetermined period of time or if a predetermined number of consecutive recognition error occur, the software automatically returns to a continuous listening default recognition mode, awaiting speaker independent commands.

65

70

5

Recognition Vocabulary - Television

Power	Channel	Change	Volume	Sound	Control	Private	
-------	---------	--------	--------	-------	---------	---------	--

10

Custom Name 1

Custom Name 2

etc.

Macro Name 1

Macro Name 2

etc.

15

Table 7

20

Default Menu Vocabulary for Video:

In addition to the default recognition vocabulary set commands available for a *“Television,”* the device selection of *“Video”* (VCR, DVD, etc.) may also make voice commands named *“Play,” “Stop,” “Pause,” “Record,” “Rewind”* and *“Fast Forward”* available. If any of these are recognized, the invention transmits the IR signal associated with the indicated function and returns to continuous listening default recognition mode. The voice command *“Record”*, however, is an exception. If the word *“Record”* is recognized, the software returns to recognition mode awaiting a repeat of this command to ensure there is no unintentional recording onto the media within the VCR or other such device.

25

30

Macros:

As described previously, a user has the option of creating one or more macros, where a single speaker dependent word command may produce a series of infrared signal transmissions to one or more target appliances. For example, the voice command *“HBO”* may generate infrared signals for digits *“1,” “2,”* and *“3,”* causing the TV to change to channel number *“123.”* FIG. 16a and FIG. 16b describe the macro programming process in detail.

35

5 Obviously, many modifications and variations of the present invention are possible in light of the above teachings. Thus, it is to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically described above. For example, the circuitry and related software disclosed herein may be otherwise integrated and/or combined differently than represented by the
10 embodiments of this invention. For example, one such alternate approach may involve providing direct electrical connections between predetermined speech recognition circuit IC output pins 68 and remote control controller IC 76 input pins. For this example, software executed by the speech recognition circuit 50 may emulate the signals output by the output by the output pins of a conventional remote control controller when one of
15 its keypad buttons are depressed, whereby the remote control controller output pins are generally electrically connected to remote control controller input pins. Other approaches may integrate the features of this invention differently than disclosed therein into one or more microcontrollers, processors, digital signal processors (DSP), application-specific integrated circuits (ASIC) and the like.

20 In addition, the hands-free voice-operated remote control transmitter software is not limited to executing a speaker independent, continuous listening default recognition mode. For example, a setup process may be provided where a user is prompted to train speaker dependent words in a manner which would generate a speaker dependent vocabulary structure similar to the speaker independent vocabulary structure
25 disclosed for the present invention.

 Furthermore, the software executed by the present invention may be adapted to guide a user through controlled appliance setup processes, for example programming a VCR with or without VCR-PLUS[®] capability to record a televised program, in a prompt -driven manner.

30 Moreover, sound-activation circuitry utilized by the present invention is not limited to use of inverting Schmitt trigger circuits. Similar circuitry capable of performing amplification and comparator operations, such as that based upon one or more operational amplifiers, may also be used. Furthermore, the mode of activation of the

5 present invention is not limited to sound activation. Similar schemes, for example, such at those utilizing light detection circuitry or motion detection circuitry may also be used.

CLAIMS:

1. An audio signal activated control system for controlling one or more selected appliances, the control system comprising:

a voice recognition system for receiving representative audio signals and converting said representative audio signals to one or more command signals for controlling one or more selected appliances, the voice recognition system including a command signal receiver and memory for receiving and storing command signal data to be associated with said representative audio signals.

2. The control system as recited in claim 1, wherein said command signals receiver is configured as a wireless receiver.

3. The control system as recited in claim 2, wherein said wireless receiver is an infrared receiver.

4. The control system as recited in claim 2, wherein said wireless receiver is an RF receiver.

5. An audio signal activated control system for controlling one or more selected appliances, the control system comprising:

an audio signal recognition system for receiving representative first audio signals and converting said representative first audio signals to command signal data for one or more command signals for controlling one or more selected appliances, the audio signal recognition system including a memory for storing said command signal data to be associated with representative second audio signals and a transmitter for transmitting command signals associated with said command signal data to selected appliances when said second audio signals are received and decoded by said audio signal recognition system.

FIG. 1

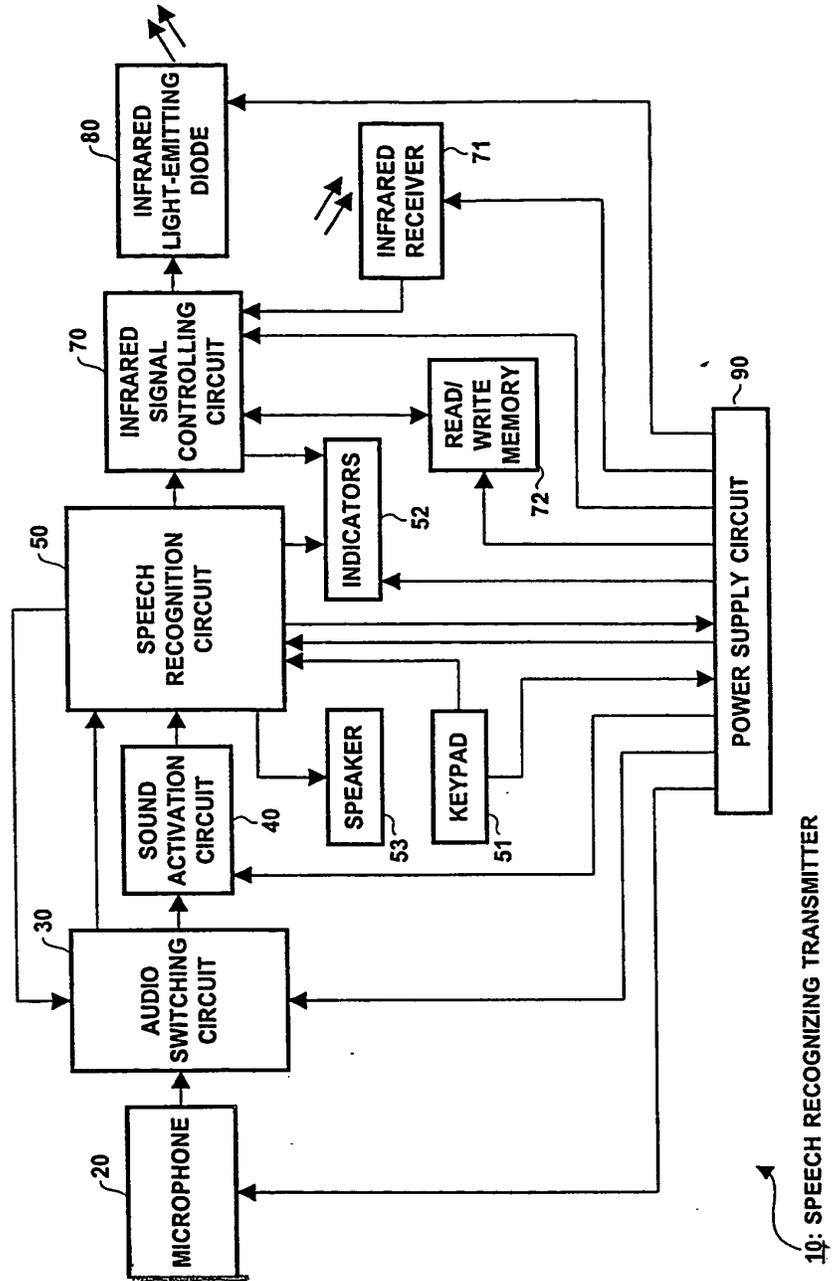


FIG. 2a

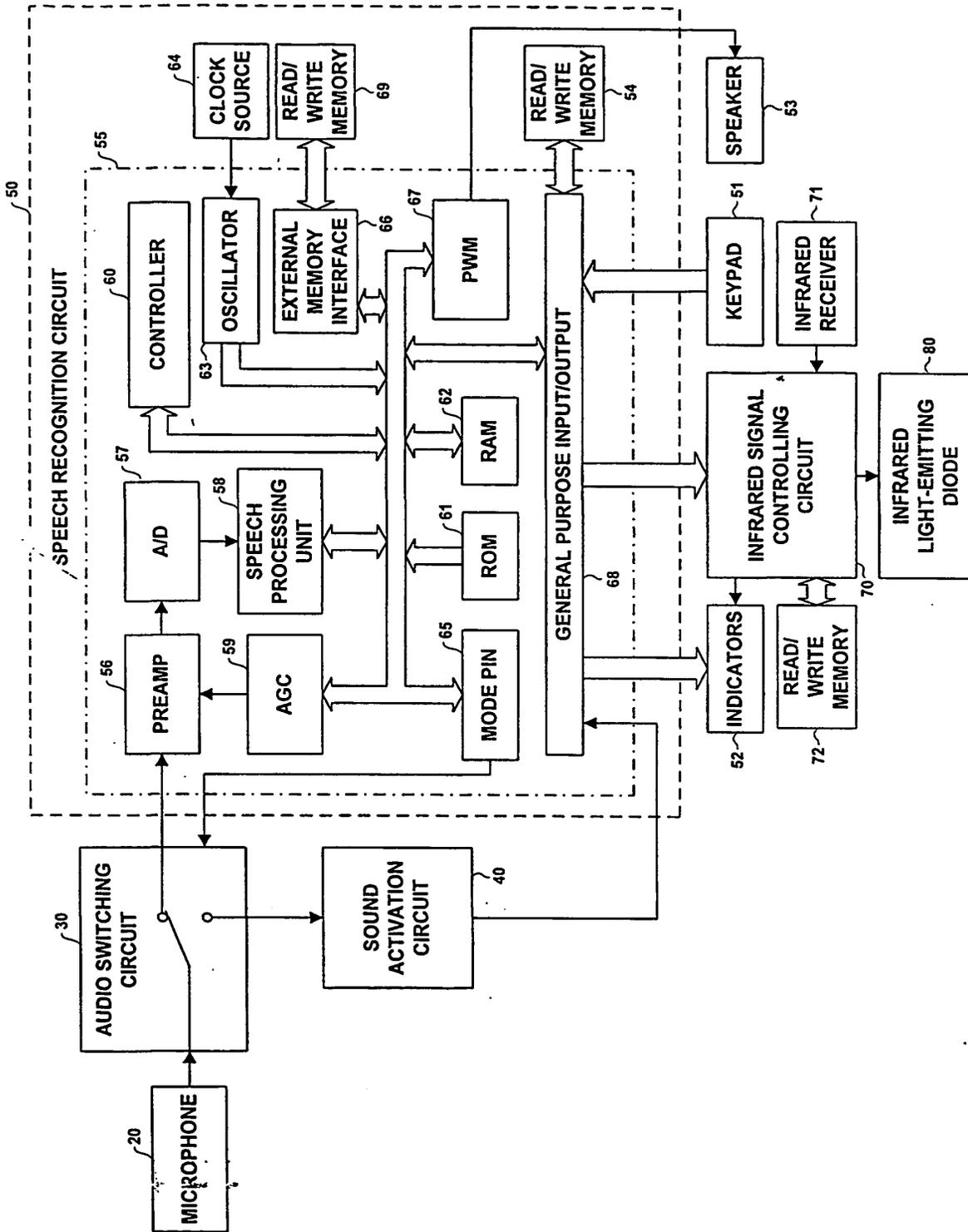
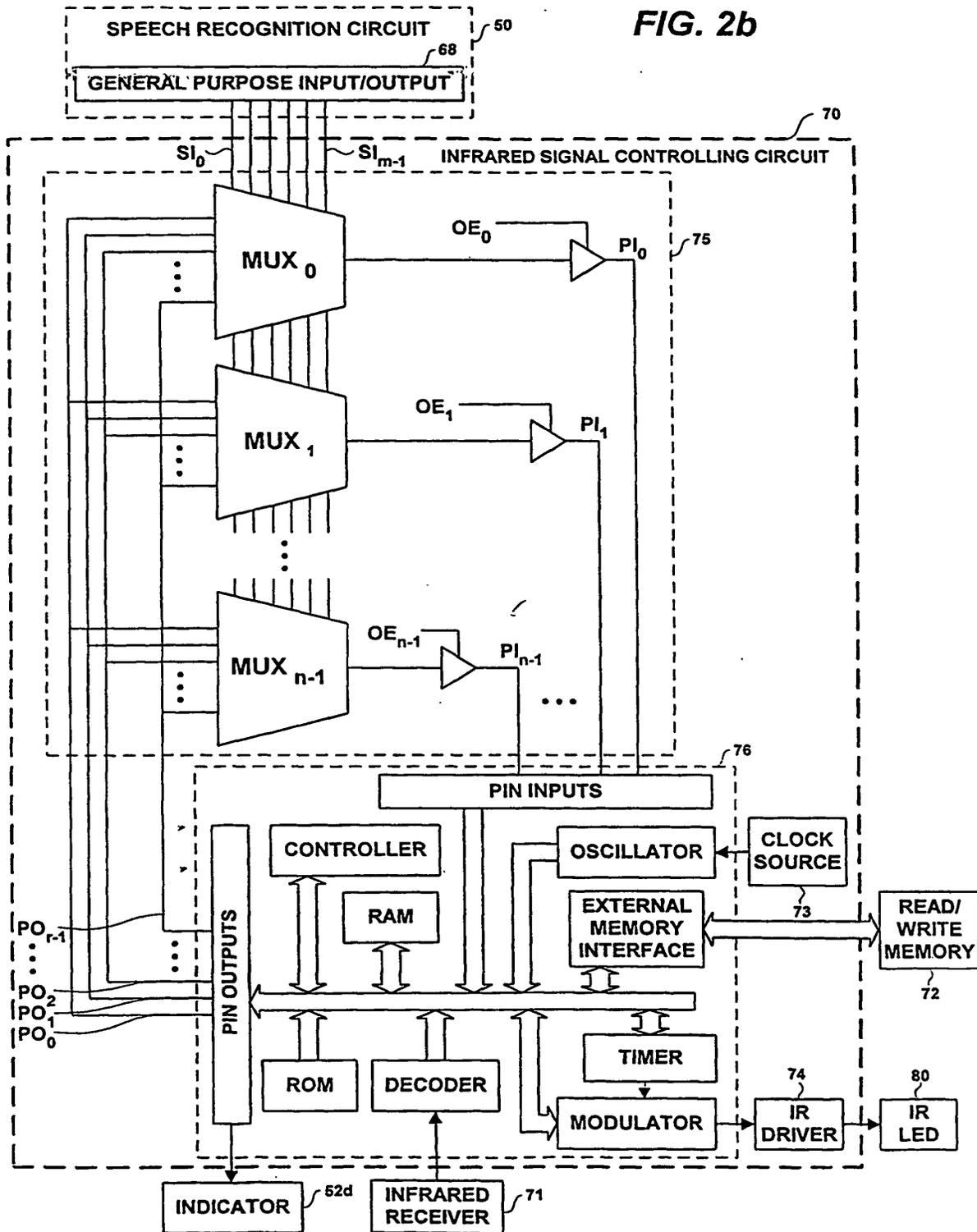
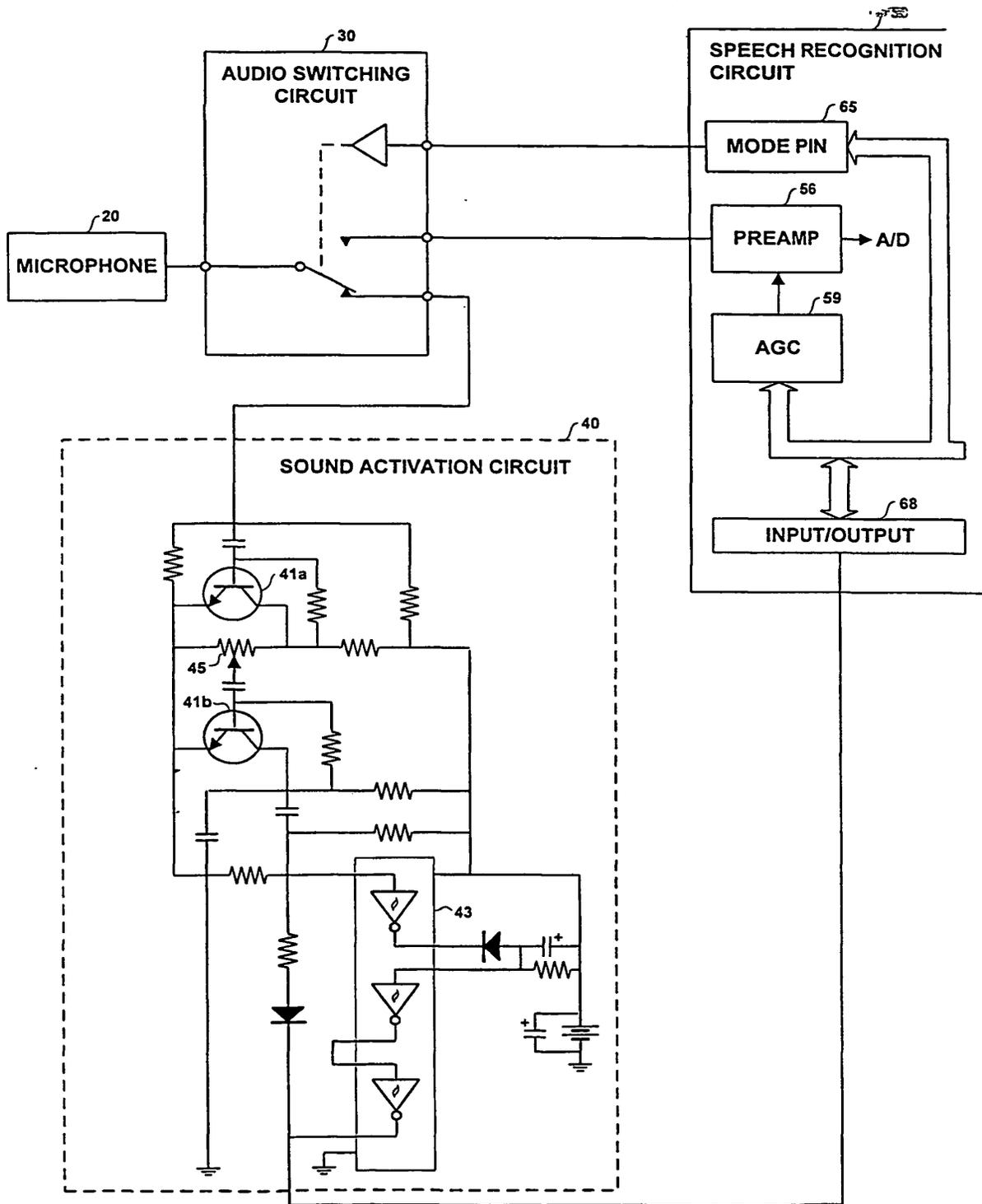


FIG. 2b



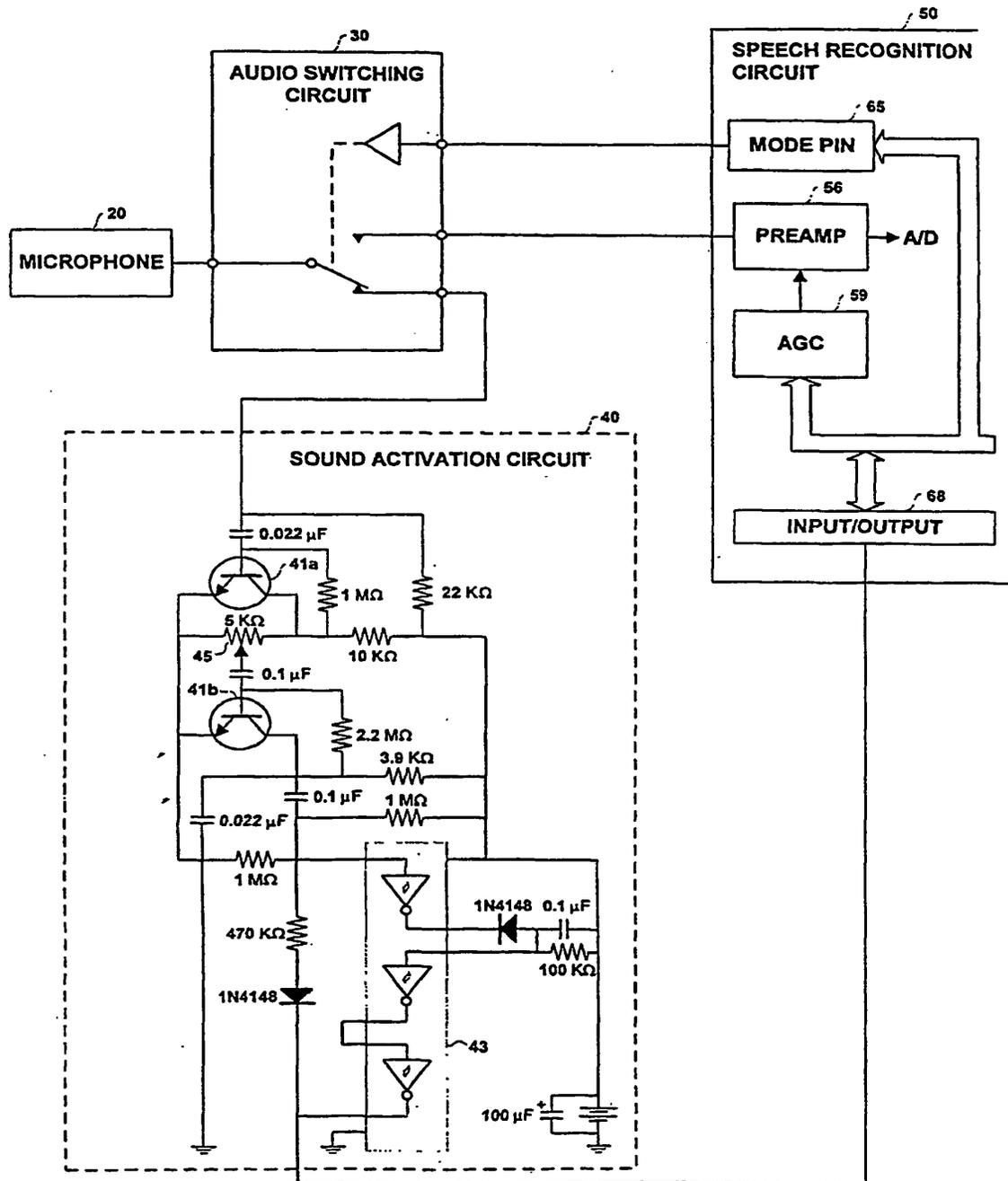
4/30
FIG. 2c



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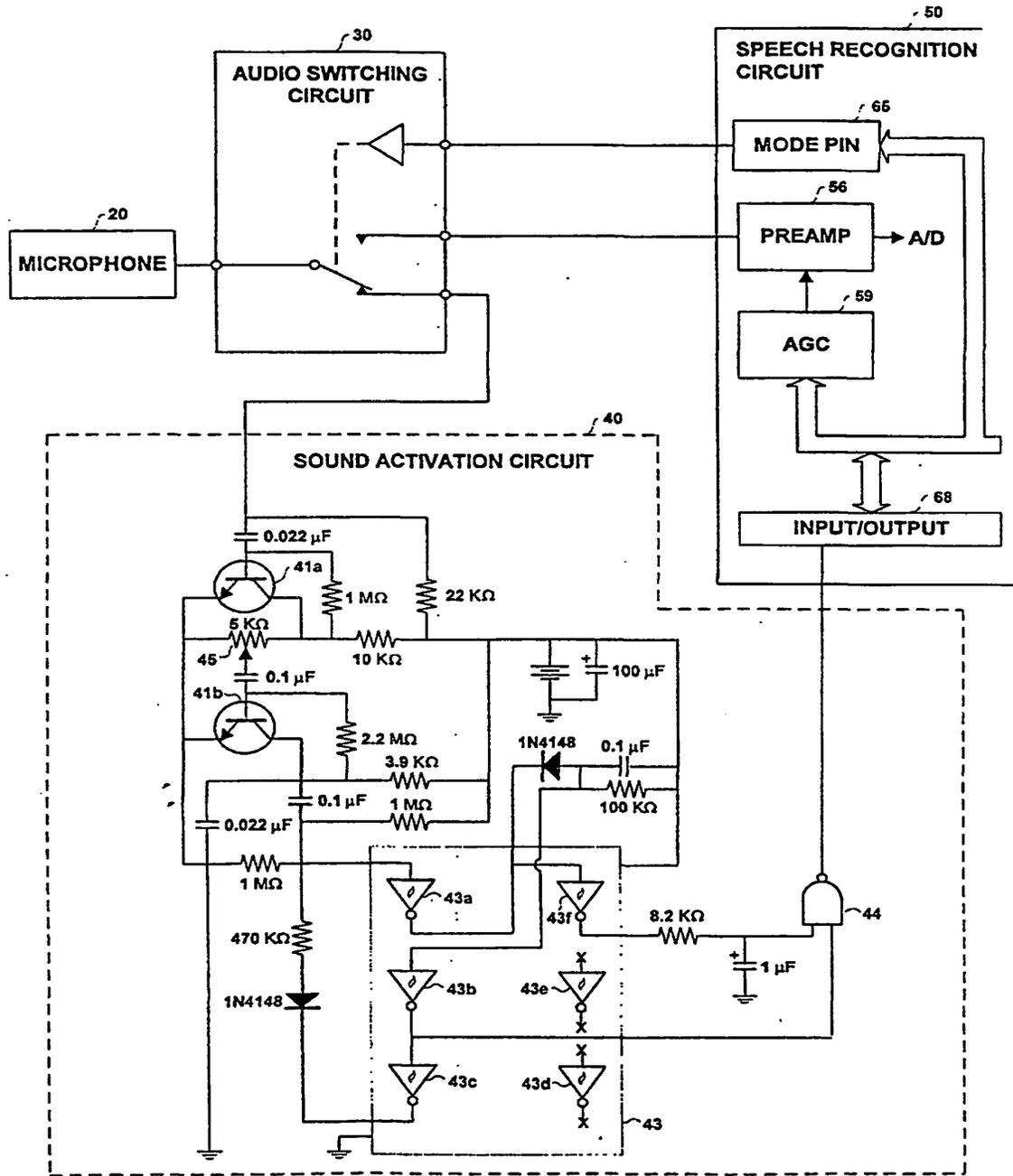
FIG. 2d



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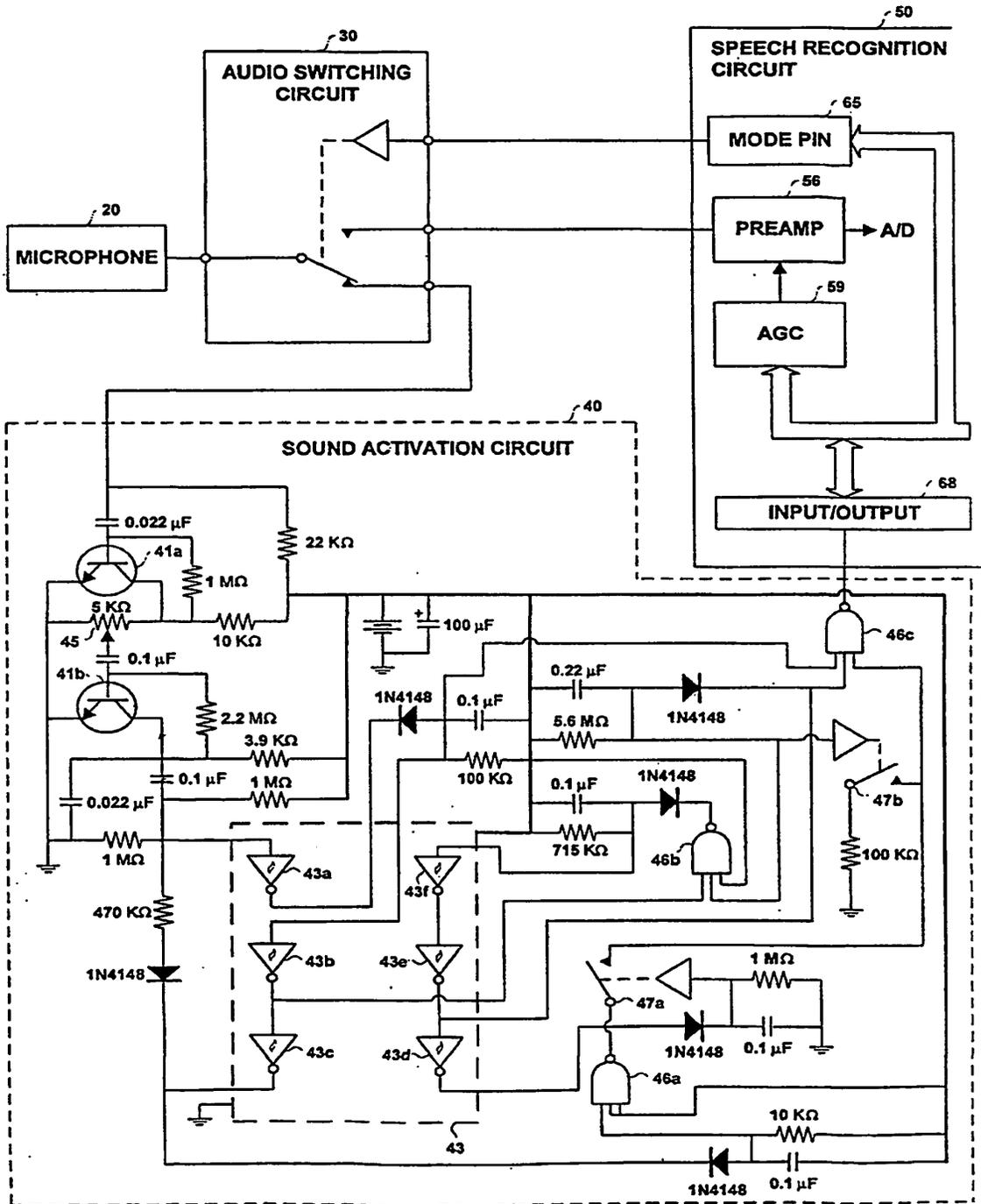
FIG. 2e



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FIG. 2f



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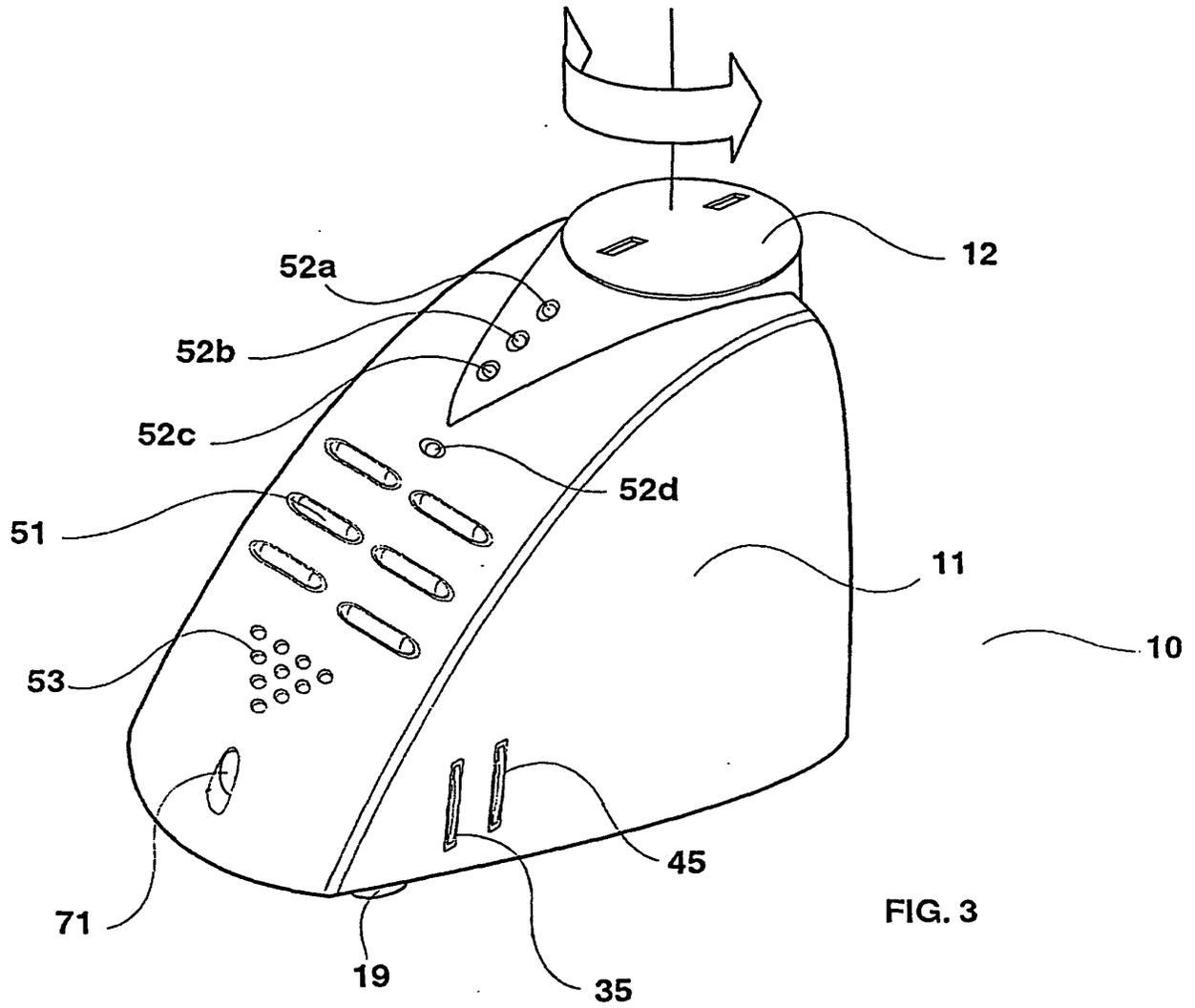
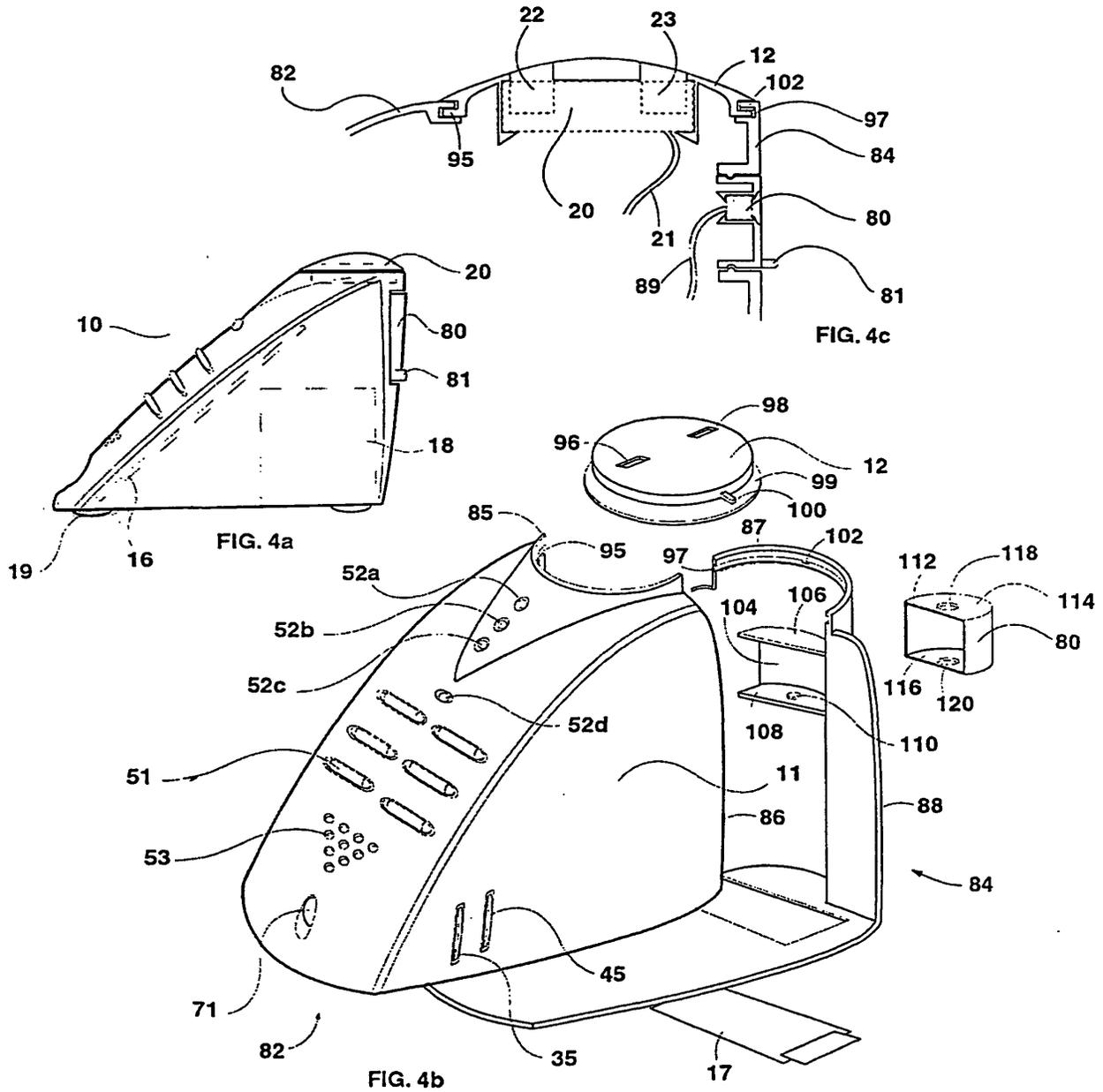


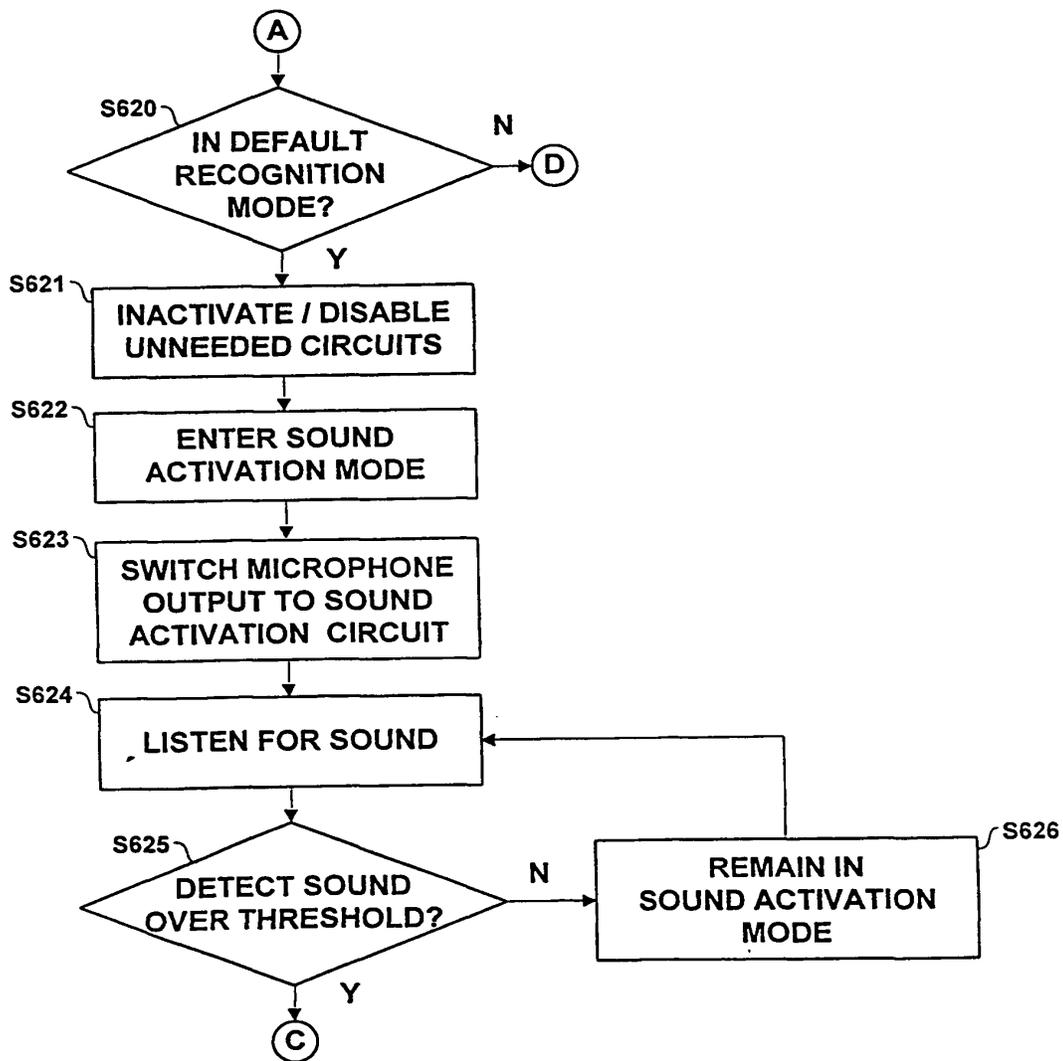
FIG. 3

9/30



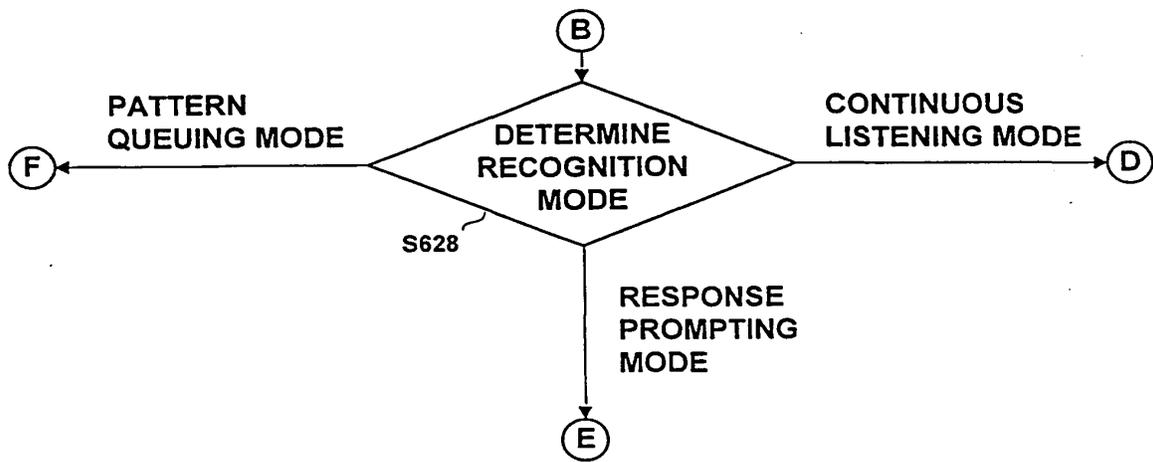
11/30

FIG. 6



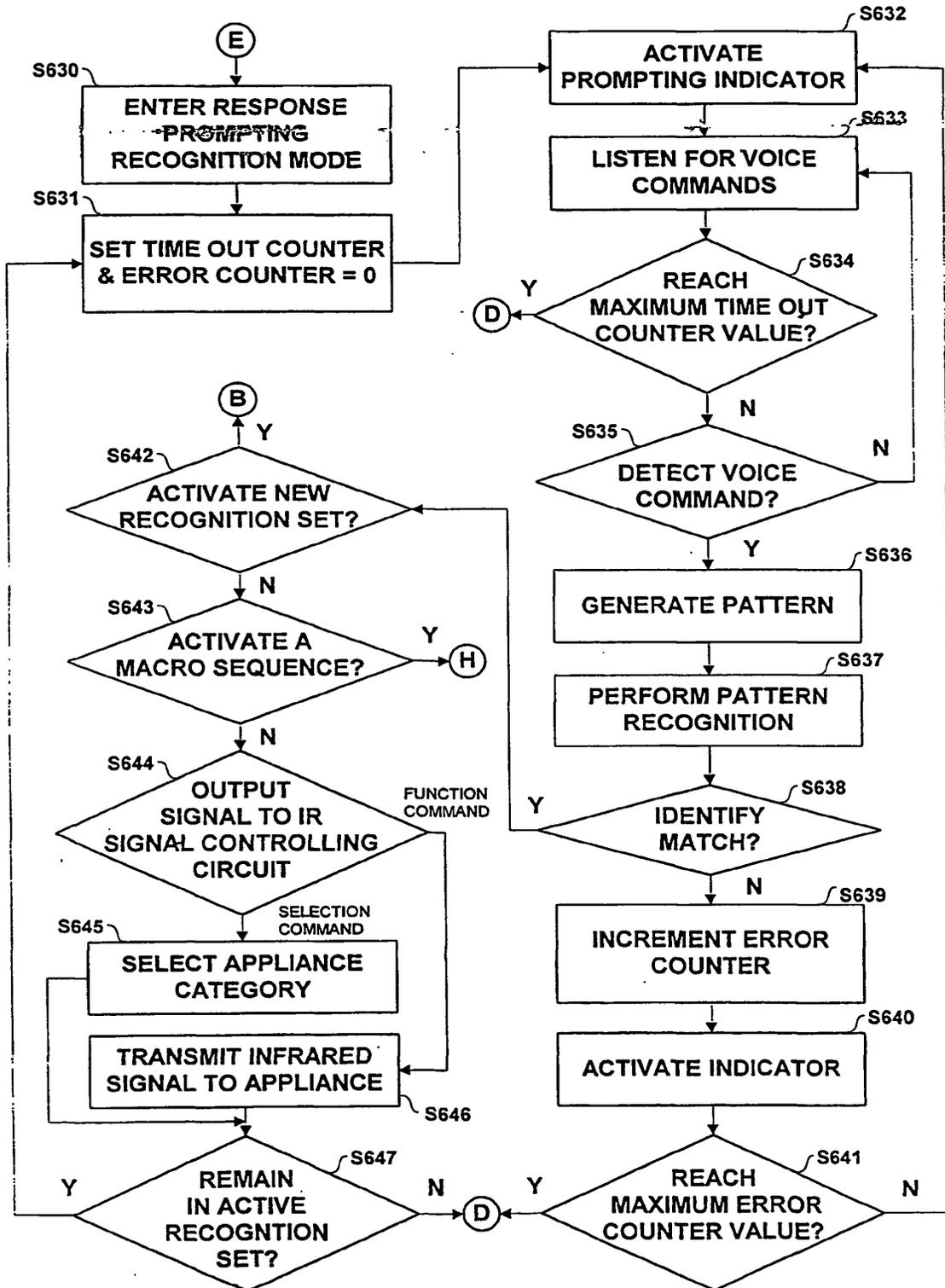
12/30

FIG. 7



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FIG. 8



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FIG. 9

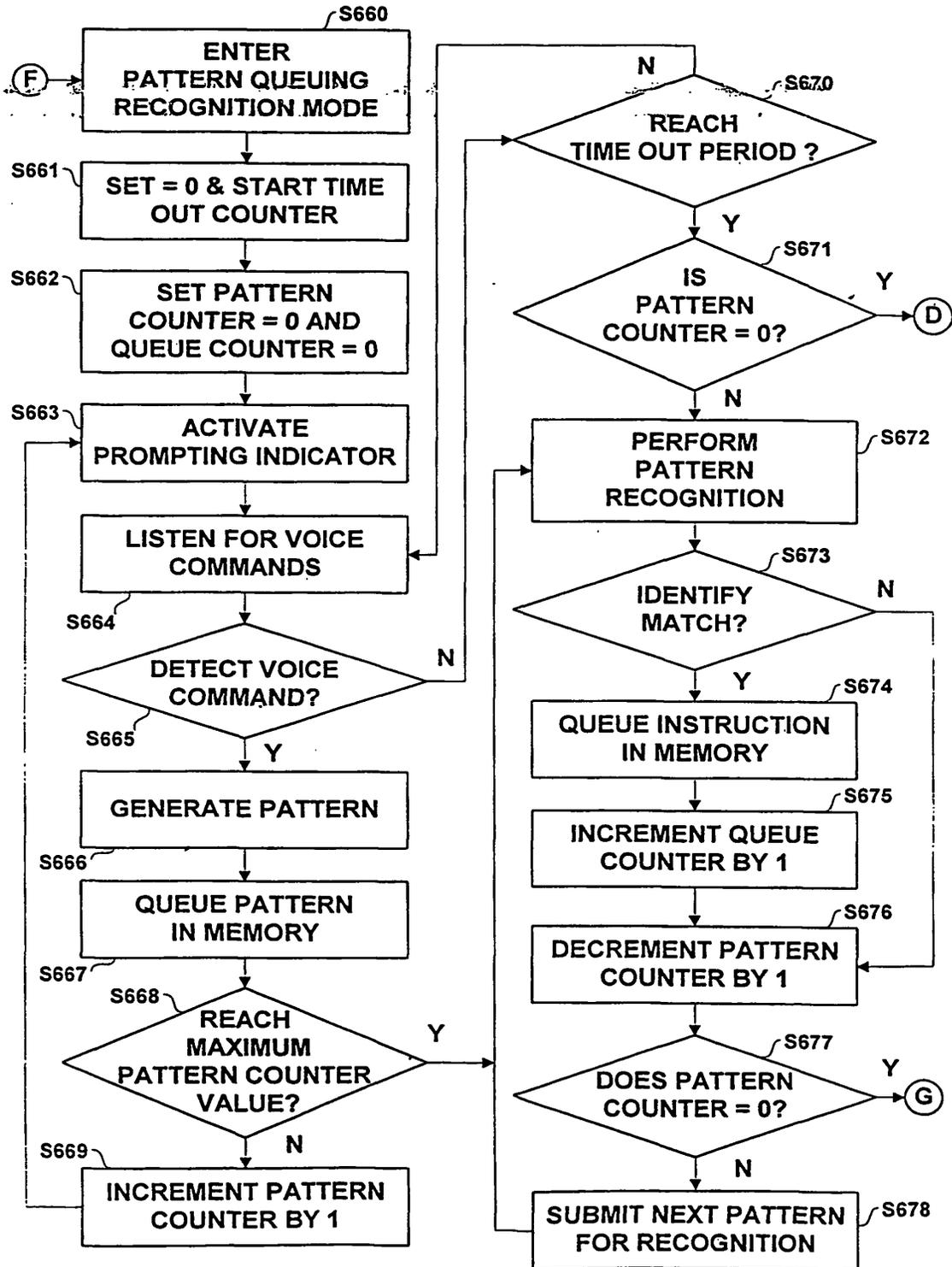


FIG. 10

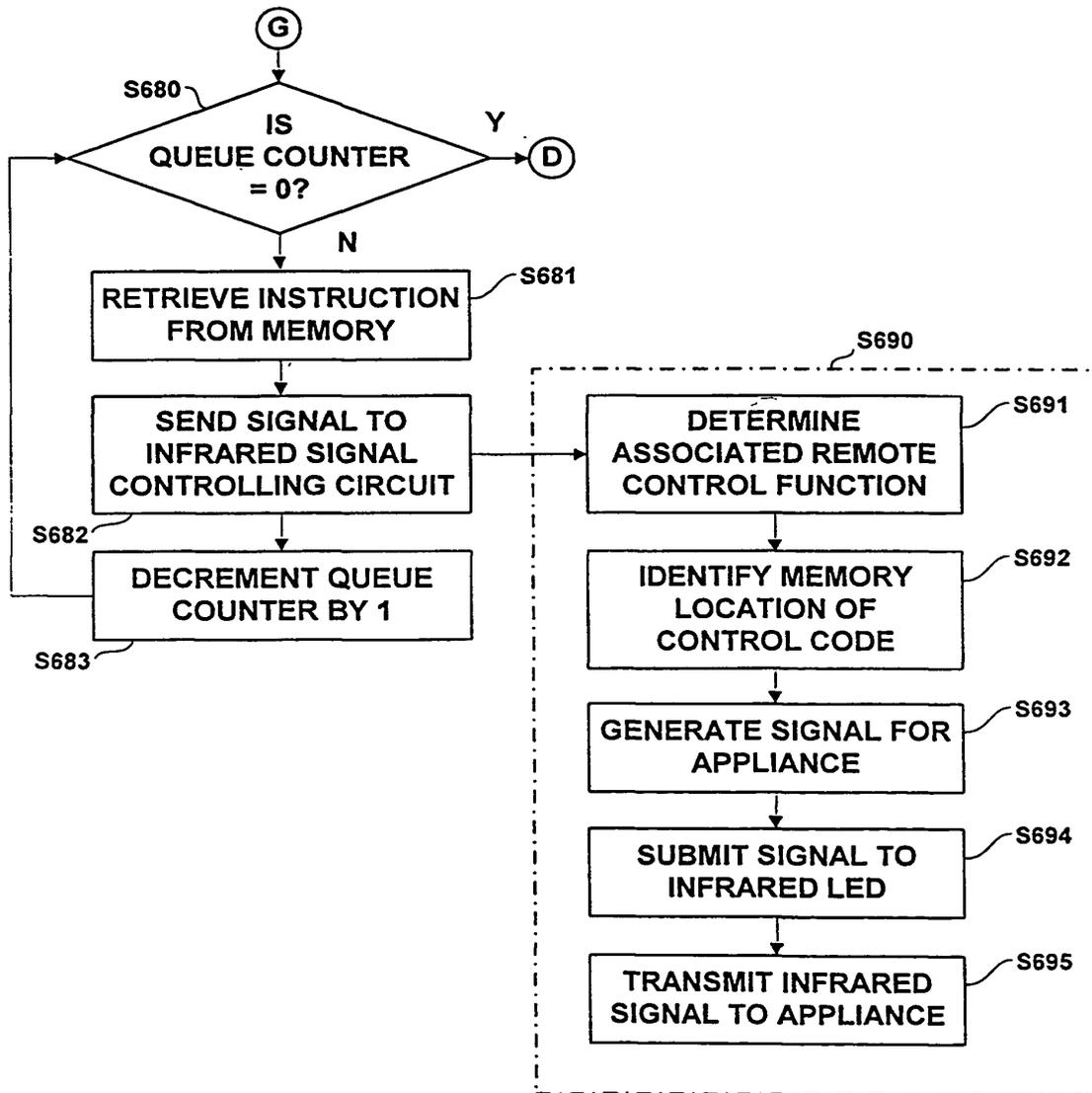
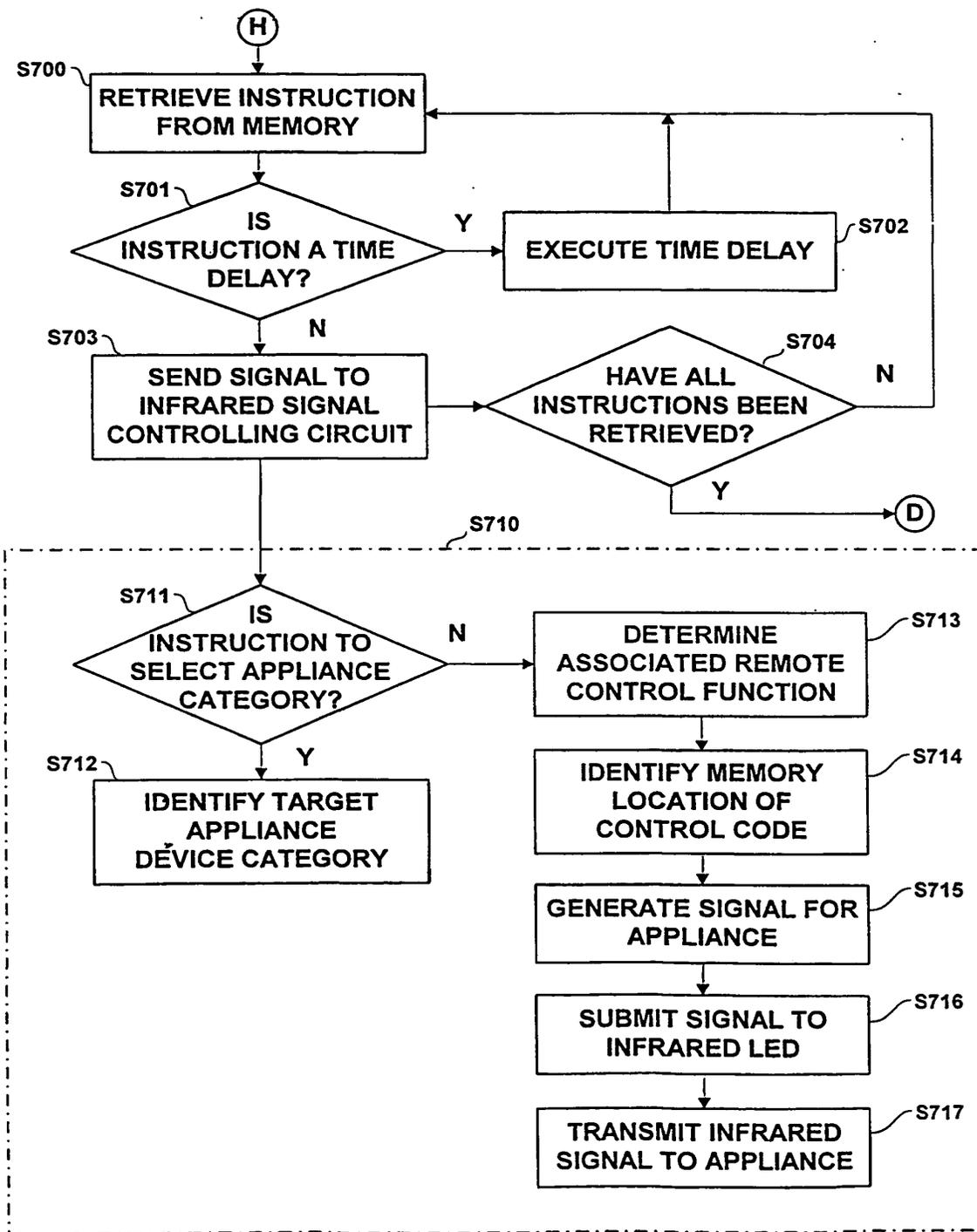


FIG. 11



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FIG. 12a

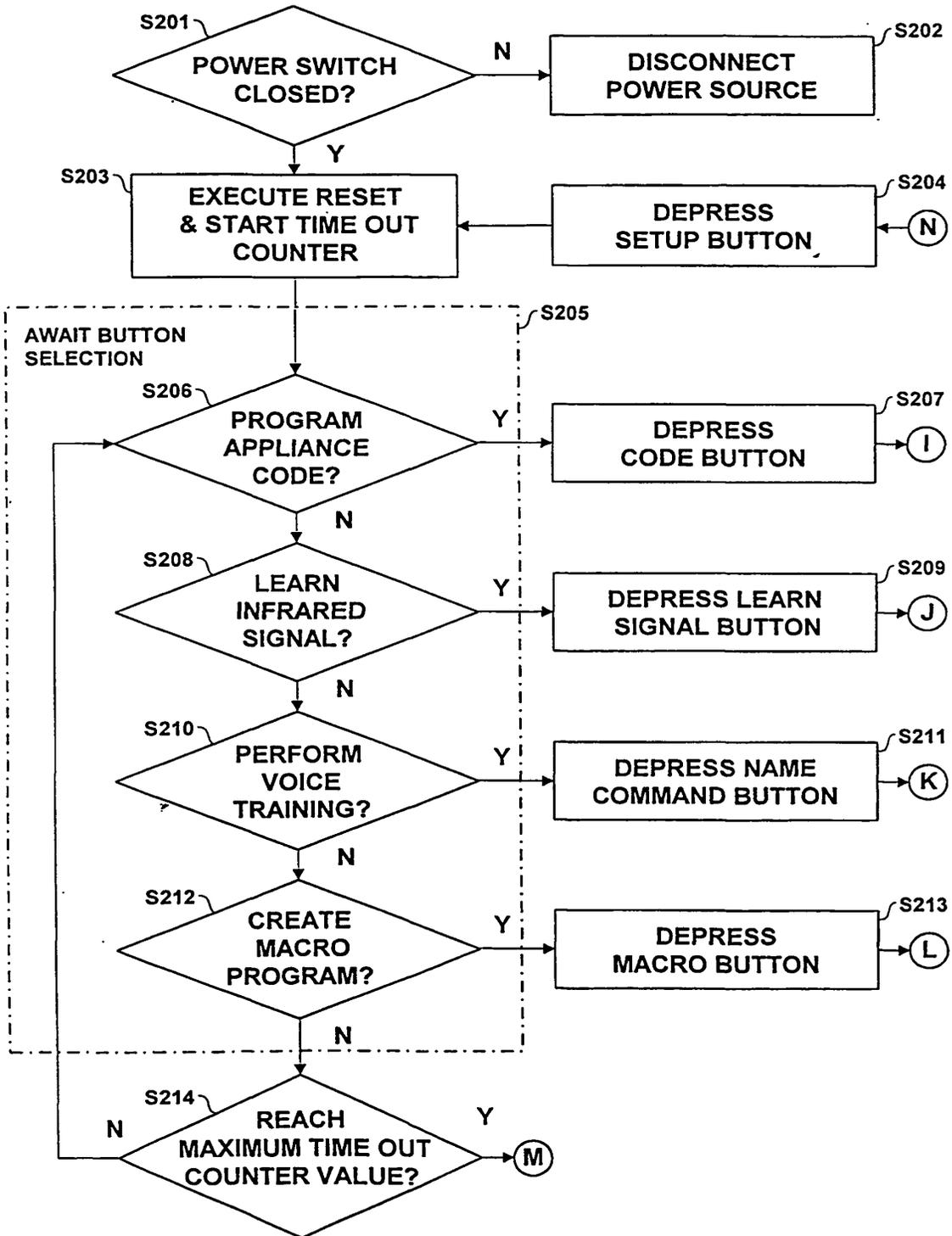


FIG. 12b

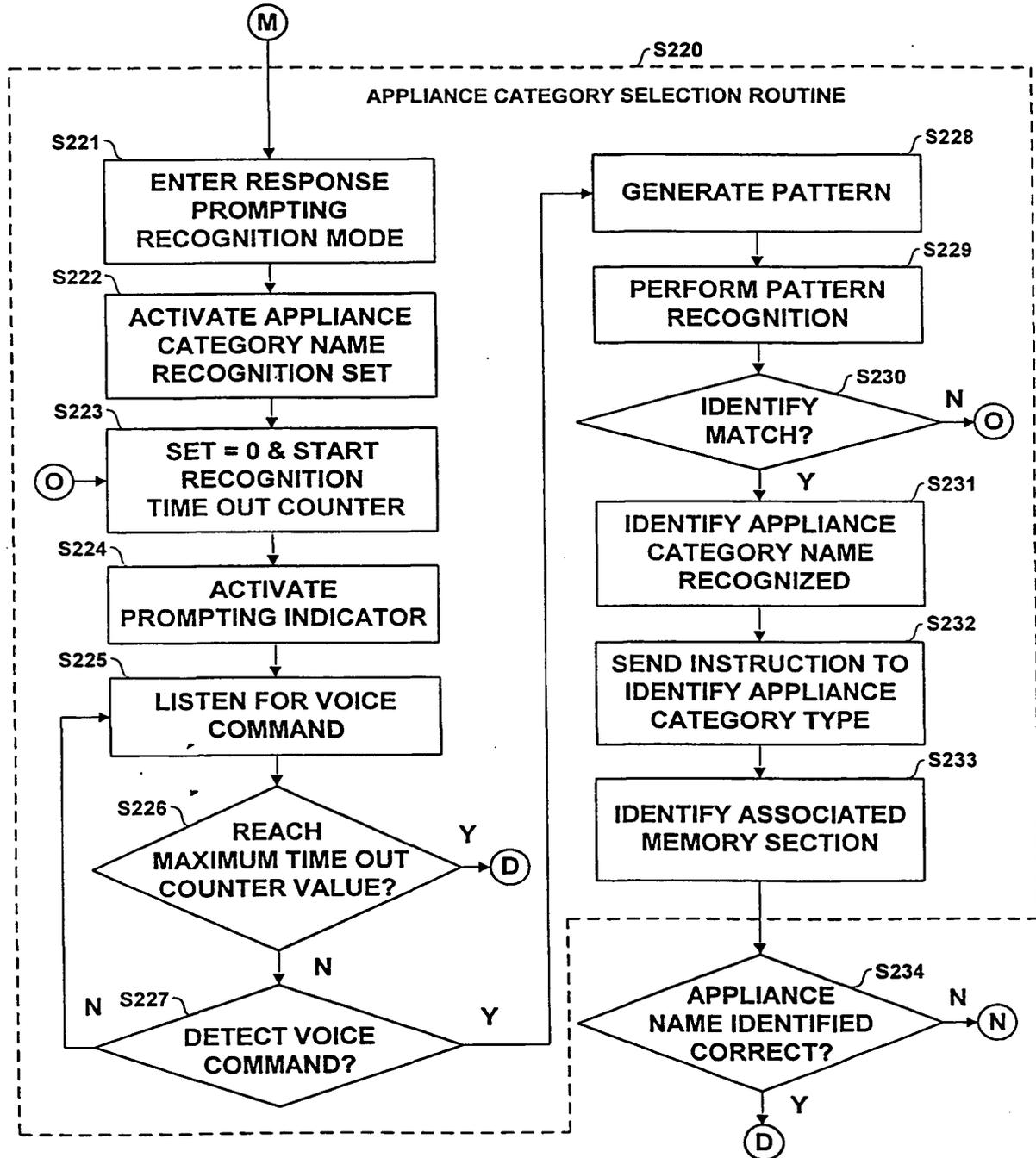
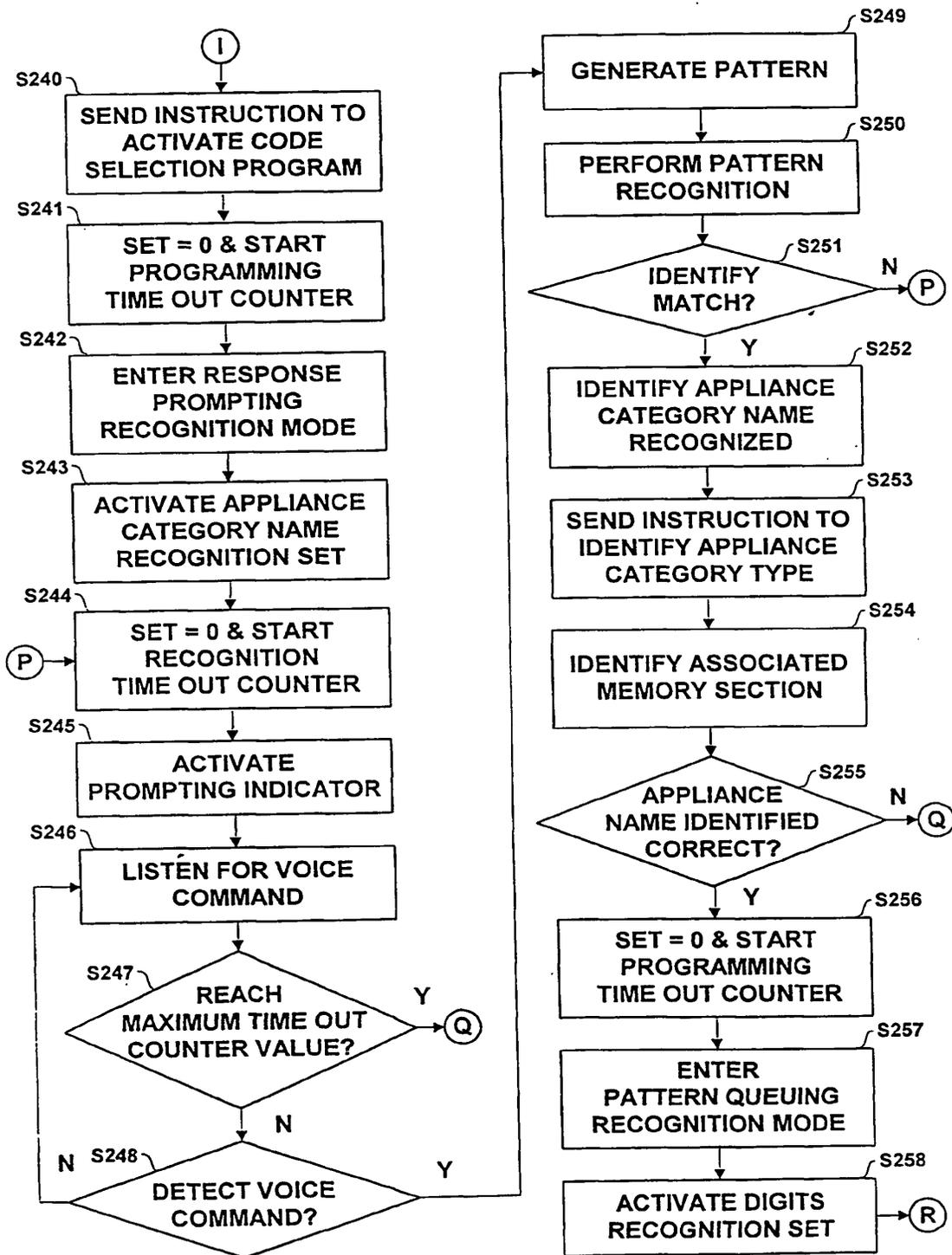


FIG. 13a



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FIG. 13b

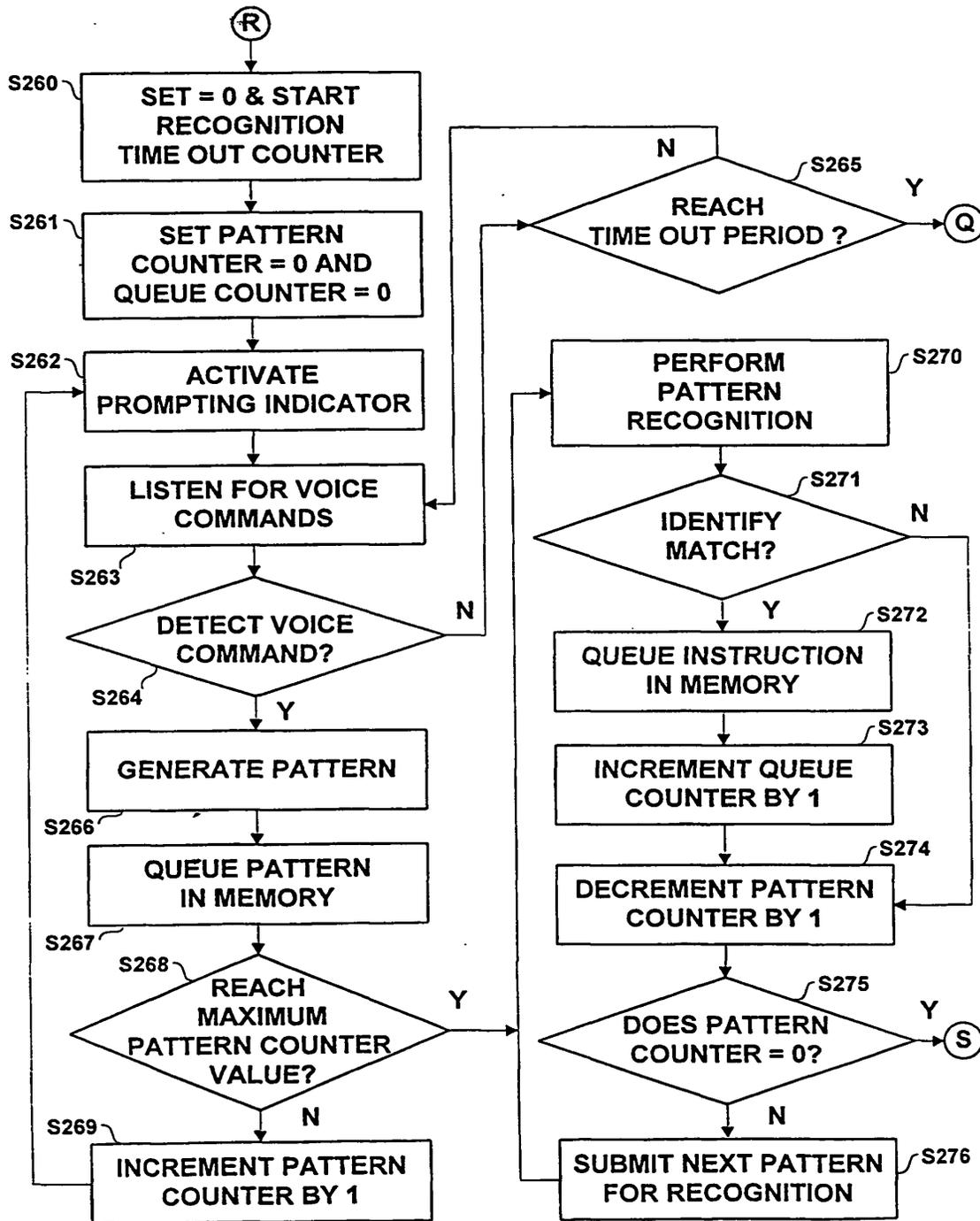
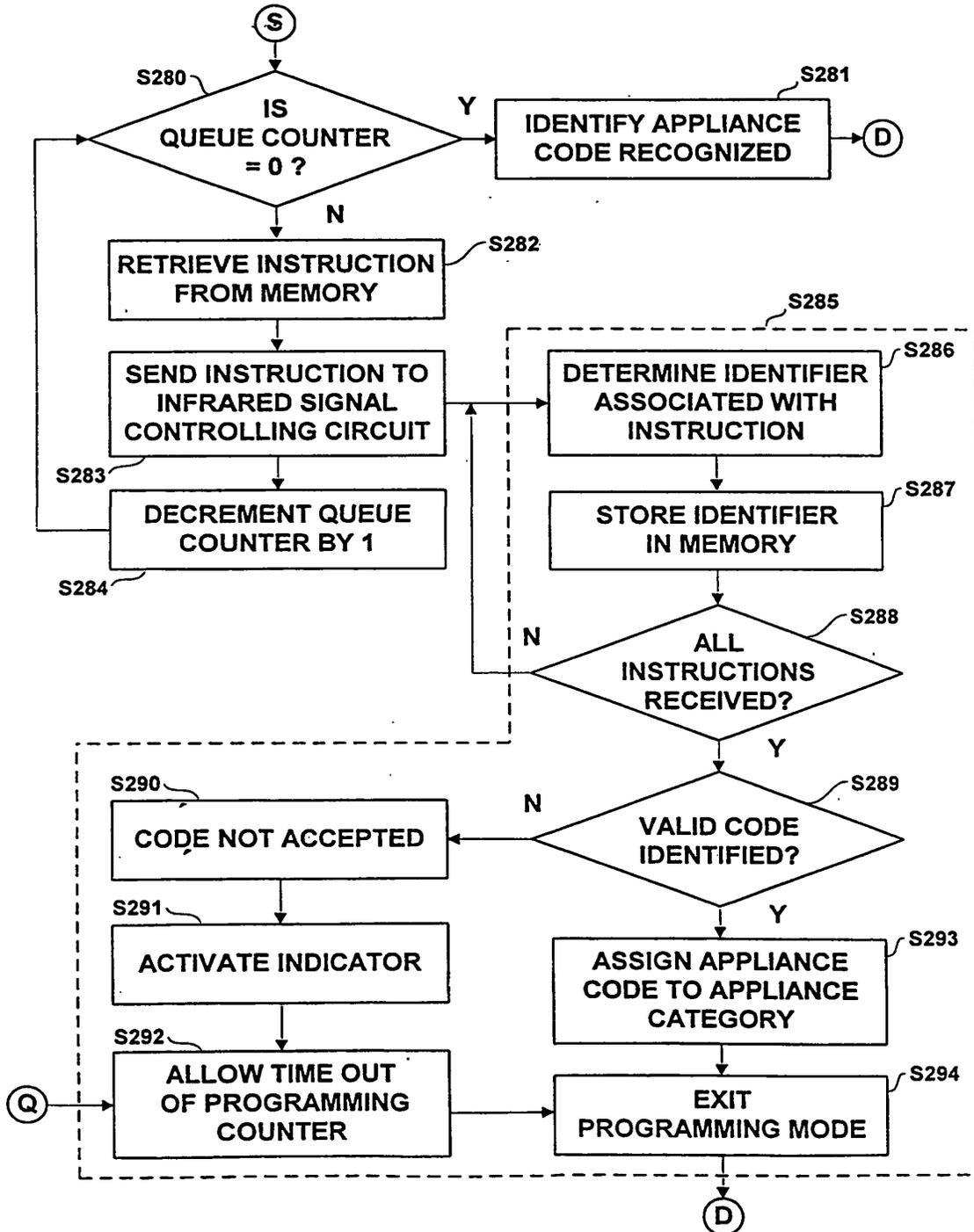
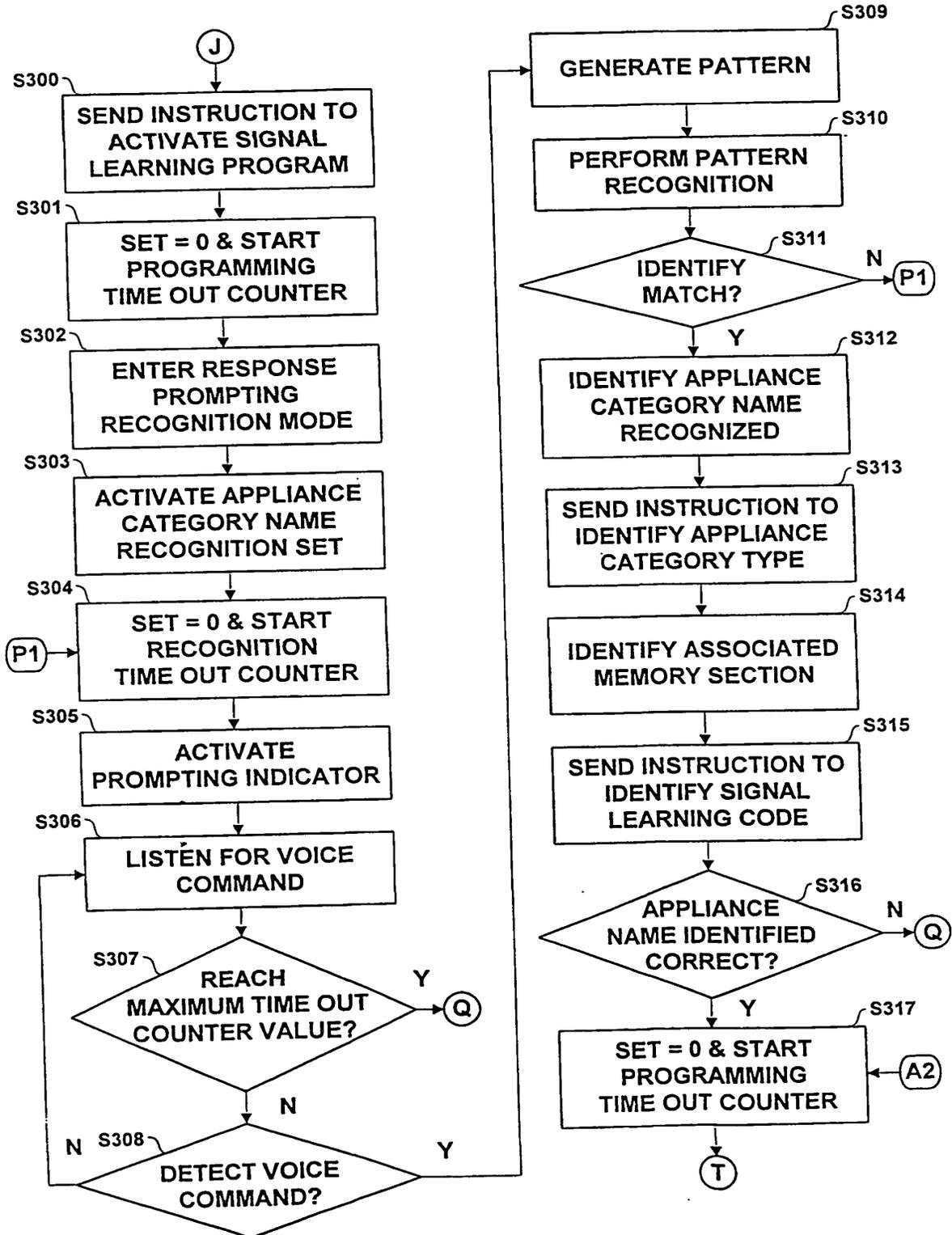


FIG. 13c



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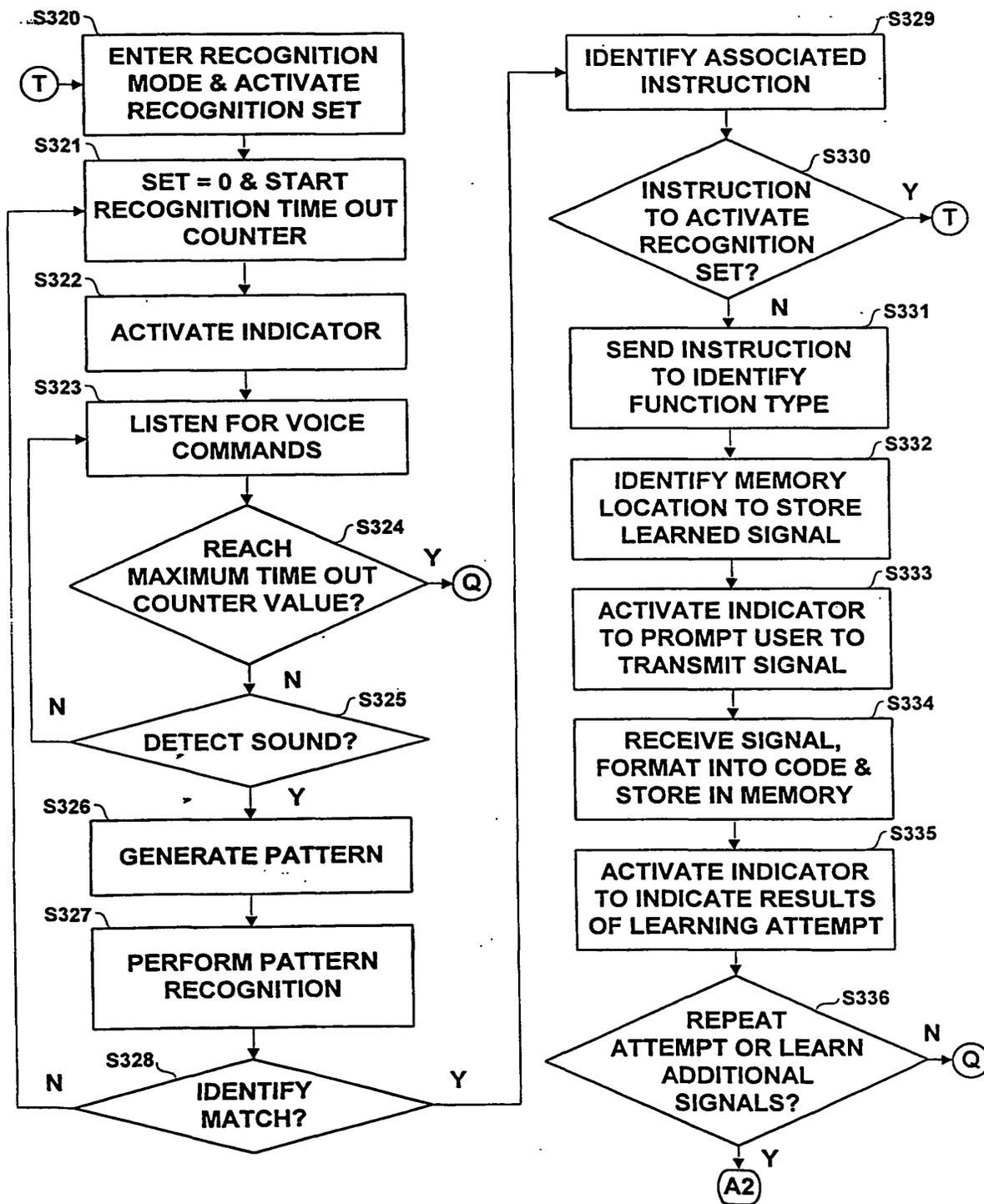
FIG. 14a



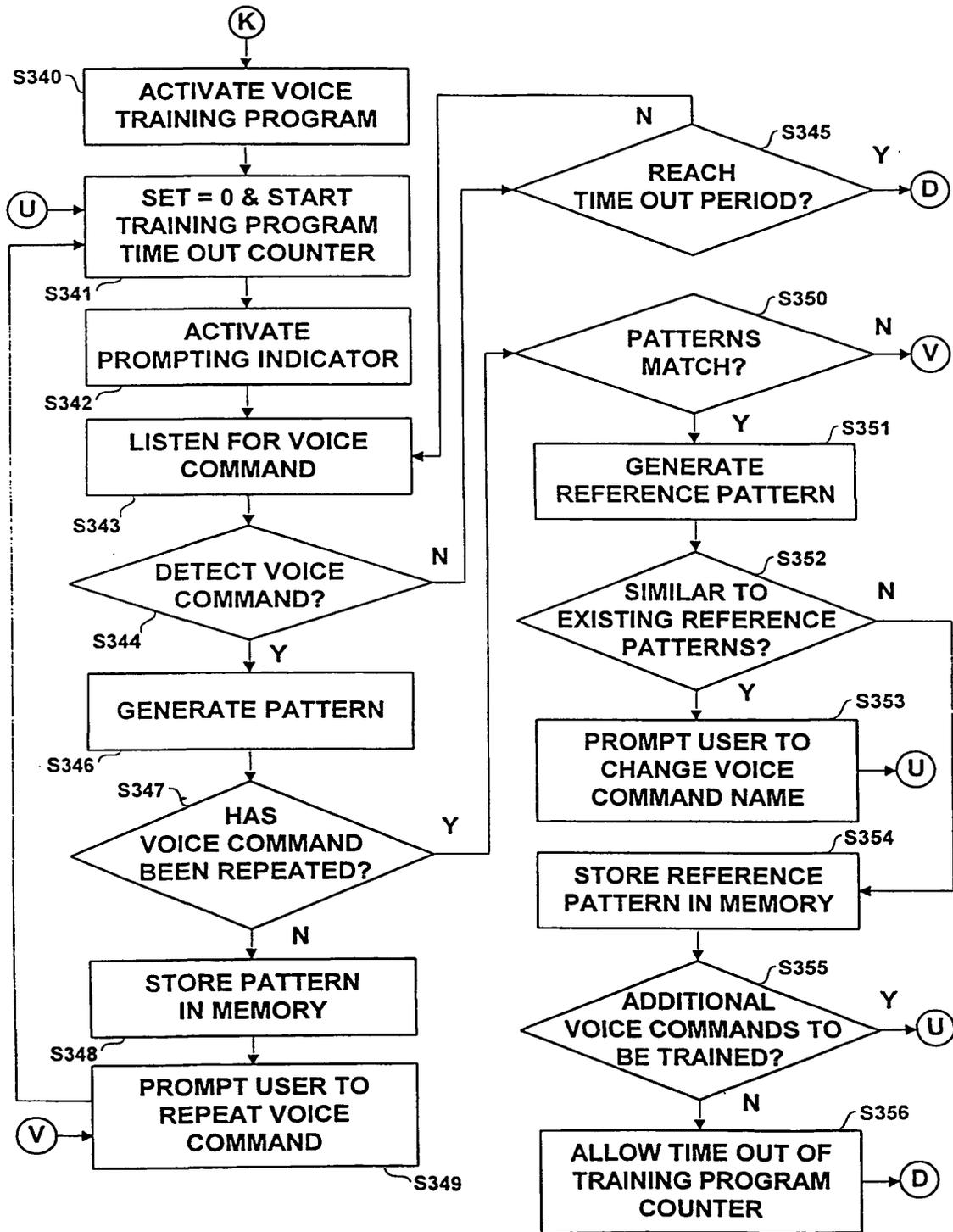
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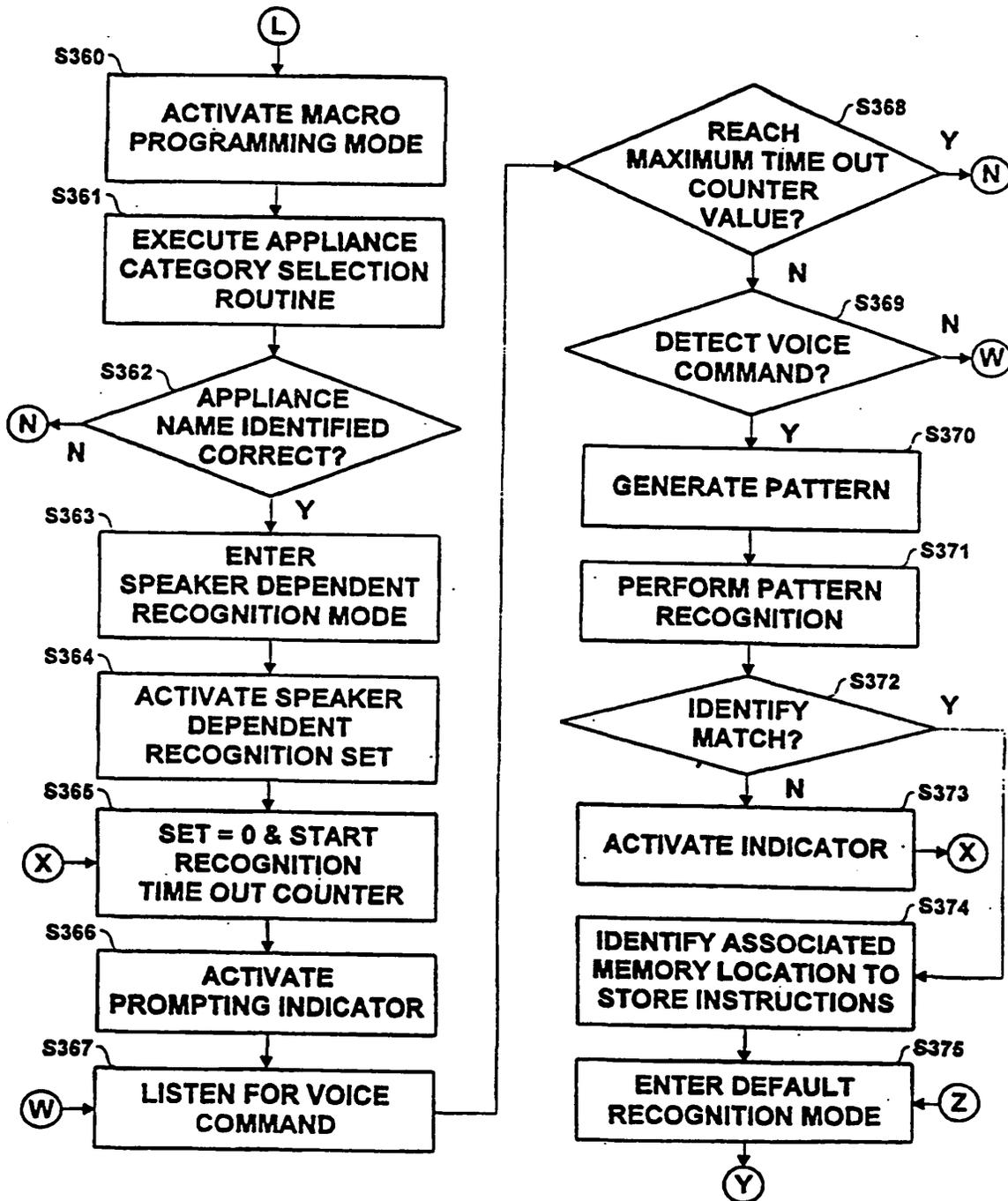
FIG. 14b



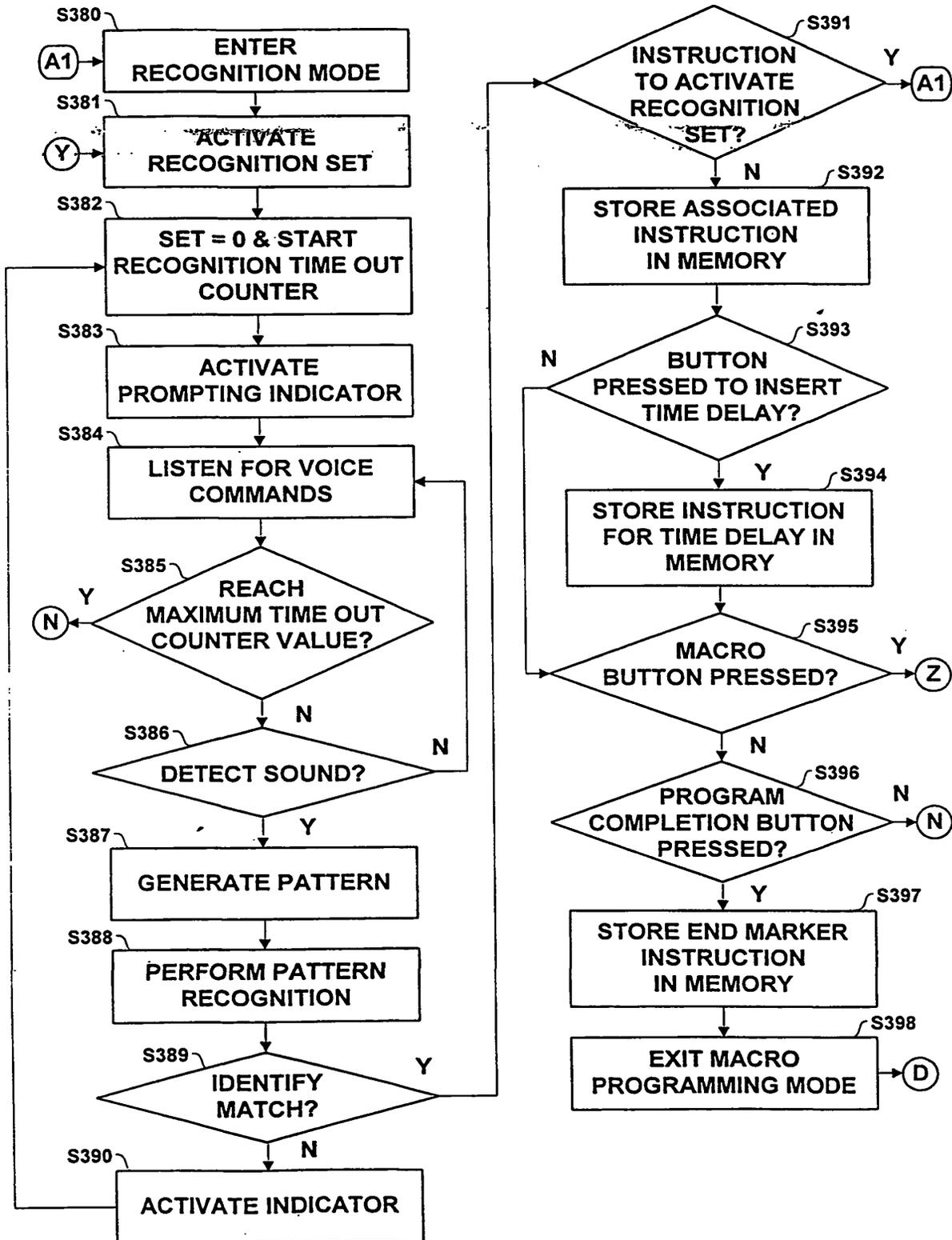
24/30
FIG. 15



25/30
FIG. 16a



26/30
FIG. 16b



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FIG. 17

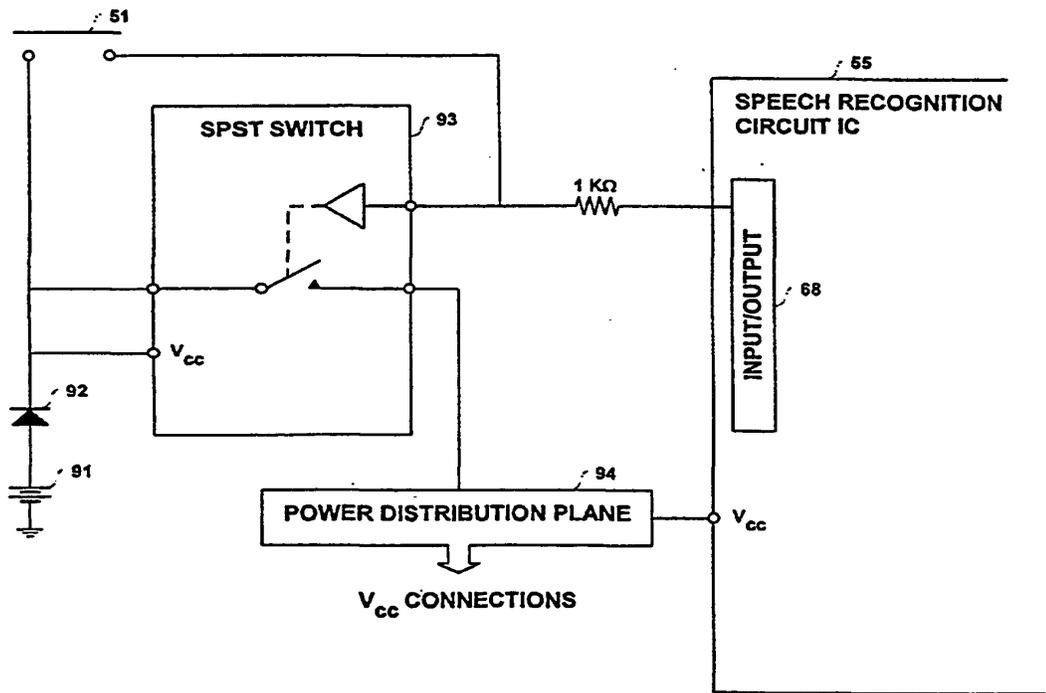


FIG. 18a

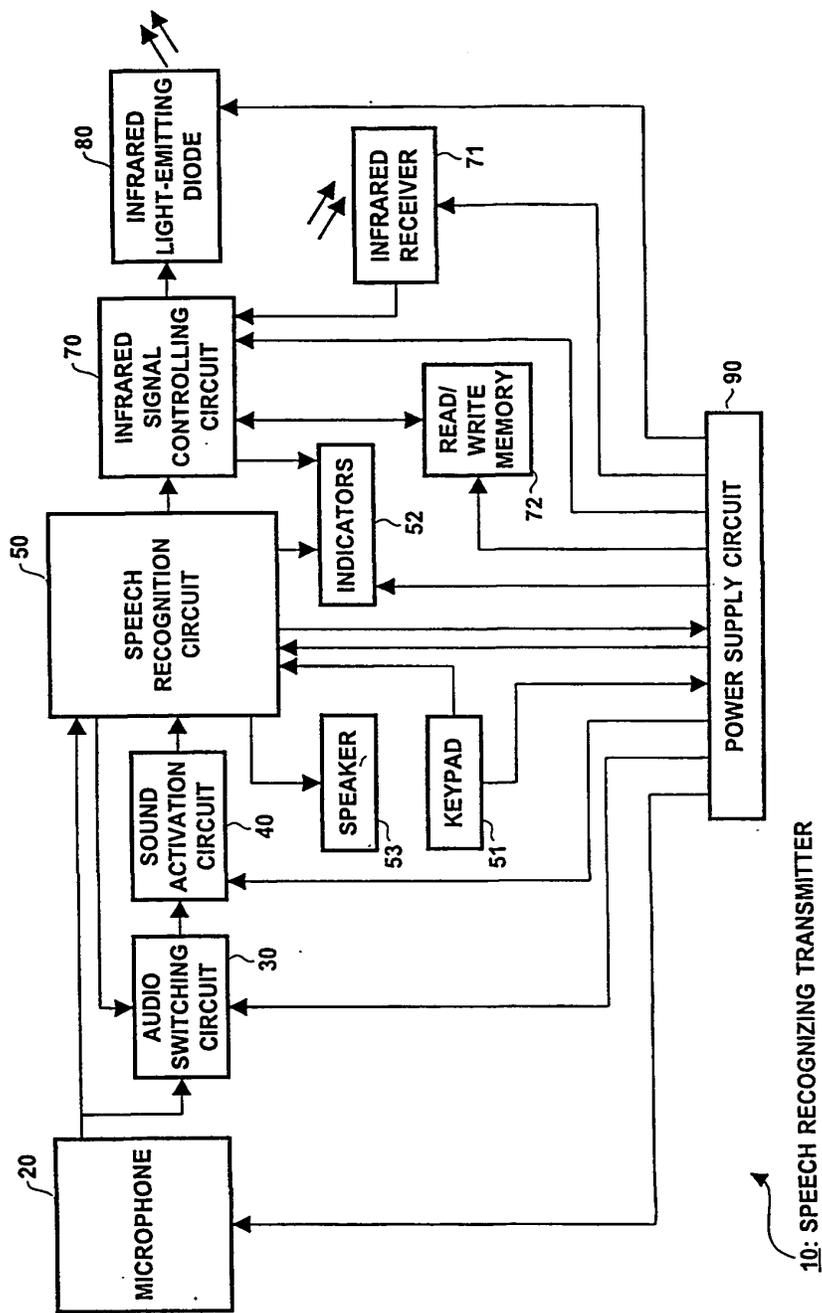


FIG. 18b

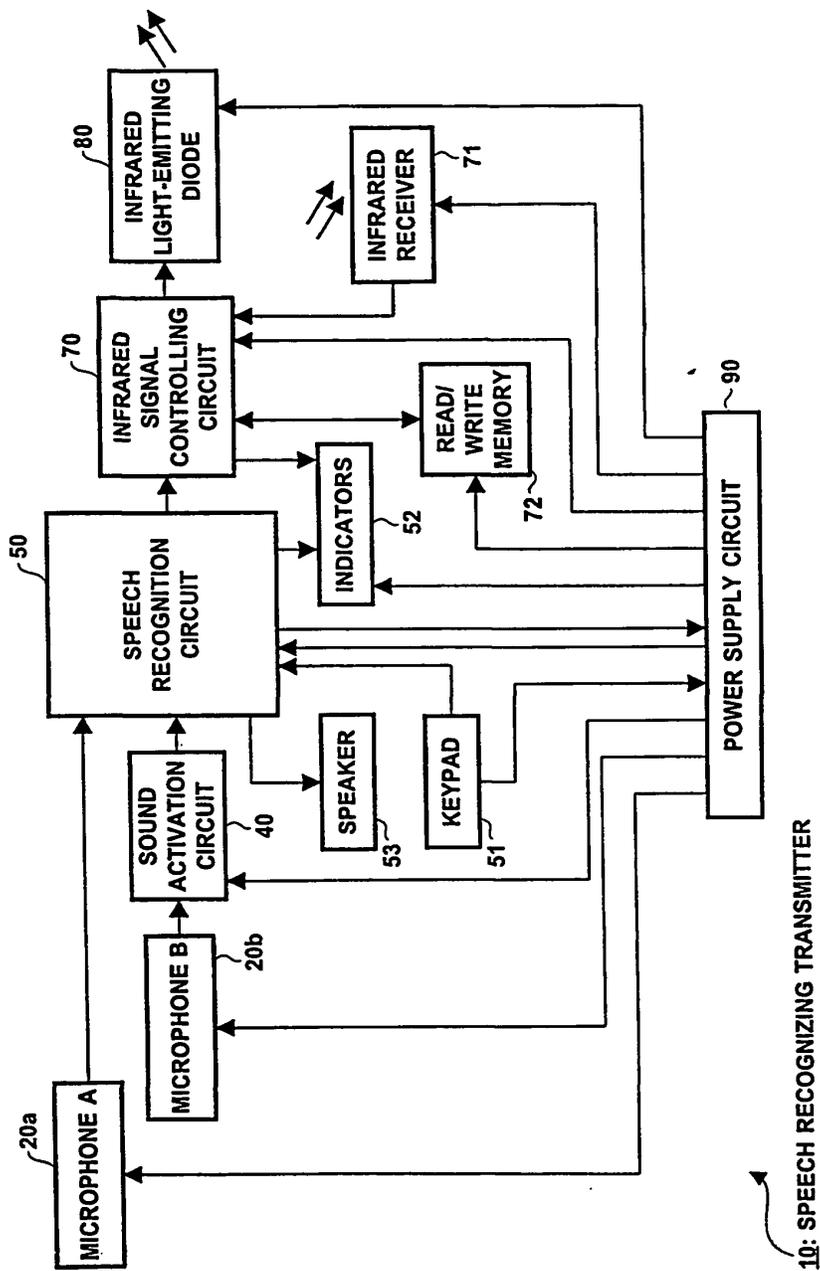
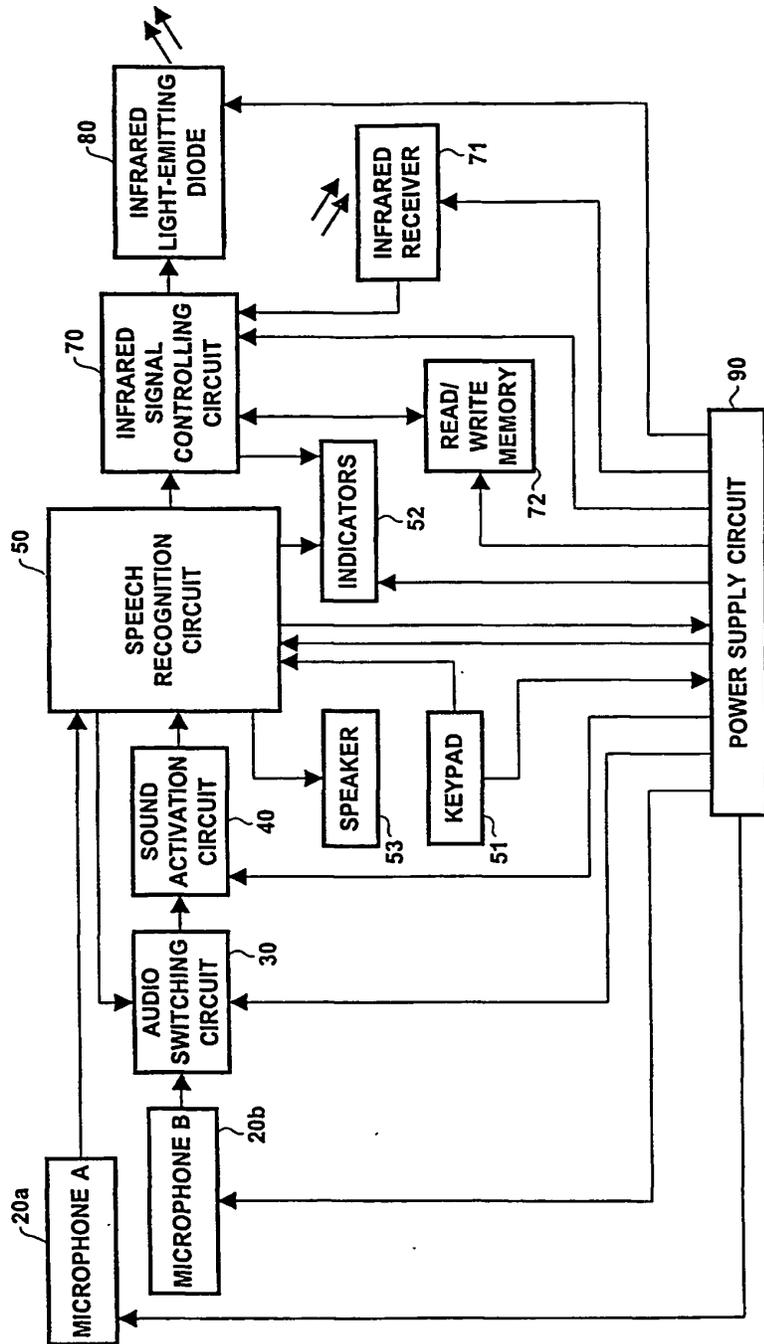


FIG. 18C



10: SPEECH RECOGNIZING TRANSMITTER

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US00/35107

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G10L 15/22
 US CL : 704/275

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 U.S. : 704/275, 200, 270, 272

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
 US Patents Full text database, Derwent World Patent Index, IBM Technical Disclosure Bulletins

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,199,080 A (KIMURA et al) 30 March 1993 (19.03.1993), Figs. 4 and 5.	1-22
X	US 5,444,673 A (MATHURIN) 22 August 1995 (22.08.1995), column 2 line 63 to column 3, line 30.	1-22
A	US 4,725,827 A (GALLEGOS, Jr. et al) 16 February 1988 (16.02.1988), Abstract.	1-22
Y, P	US 6,012,029 A (CIRINO et al) 04 January 2000 (04.01.2000), Fig. 2.	1-22
Y	US 4,771,283 A (IMOTO) 13 September 1988 (13.09.1988), Abstract.	1-22

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:	"T"
"A" document defining the general state of the art which is not considered to be of particular relevance	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 26 January 2001 (26.01.2001)	Date of mailing of the international search report 20 MAR 2001
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230	Authorized officer Richemond Dorvil Telephone No. (703) 305-3900

Form PCT/ISA/210 (second sheet) (July 1998)

U.S. APPL. NO. 1068,935 INTERNATIONAL APPL. US00/35107
APPLICATION FILED BY: 20 MOS. OR 30 MOS. SCREENED BY

INTERNATIONAL APPLICATION PAPERS IN THE APPLICATION FILE:

- International application
- Article 19 amendments
- Priority Document(s) No. _____
- Request Form PCT/RO/101
- PCT/IB/302
- PCT/IB/304
- PCT/IB/306
- PCT/IB/308
- PCT/IB/331
- OTHER PCT/IB/ _____
- PCT/PEA/409 also 416

- 409 annexes to IPBR
- PCT/ISA/210 (Search report)
- Search report References
- Other Papers filed

WIPO PUBLICATION
 PUBLICATION NO. WO 01/46940
 PUBLICATION DATE 28 Jun 01
 PUBLICATION LANG. English
 NOT PUBLISHED
 U.S. only Requested

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- Used the IB copy of the IA
- Description
- Claims
- Drawings 30
- Foreign Language in drawing
- Article 19 Amendments
- Amendment used in application
- Article 34 Amendment
- Amendment used in application
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- 1194 transaction done
- Preliminary Amendment(s) filed _____
- second submission _____
- Information Disclosure Statement _____
- second submission _____
- Assignment _____
- Forward to Assignment Branch _____
- Substitute Specification _____
- Small Entity Statement _____
- Oath/Declaration (date submitted _____)
- Not executed _____
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- Change of Address _____

35 USC Receipt of Request (PTO - 1399 Transmittal Letter) 21 Jun 02
 Date acceptable oath/declaration received 27 Jan 03
 102(e) Date _____
 Date complete 35 USC 371 requirements met _____

DATE NOTICE COMPLETED

- DO/EO 903 Notice of Acceptance
- DO/EO 905 Notice of Missing Requirements
- DO/EO 917 Notice of A defective oath or declaration
- DO/EO 916 Notice of defective response
- DO/EO 913 Notice of defective translation
- DO/EO 909 Notification of Abandonment

PTO/SB/01 (03-01)

Approved for use through 10/31/2002. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63) <input type="checkbox"/> Declaration Submitted with Initial Filing OR <input checked="" type="checkbox"/> Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)	Attorney Docket Number	211548-1US
	First Named Inventor	BUSH
	<i>COMPLETE IF KNOWN</i>	
	Application Number	/
	Filing Date	
	Group Art Unit	
Examiner Name		

As a below named inventor, I hereby declare that:

My residence, mailing address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Hands-Free, Voice-Operated Remote Control Transmitter

(Title of the Invention)

the specification of which

is attached hereto

OR

was filed on (MM/DD/YYYY) 12/21/2000 as United States Application Number or PCT International

Application Number US00/35107 and was amended on (MM/DD/YYYY) (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

[Page 1 of 2]

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DECLARATION — Utility or Design Patent Application

Direct all correspondence to: <input type="checkbox"/> Customer Number or Bar Code Label		<input type="checkbox"/> Correspondence address below	
Name Patent Administrator, Katten Muchin Zavis Rosenman			
Address 525 W. Monroe Street, Suite 1600			
City Chicago	State IL	ZIP 60661	
Country US	Telephone 312-902-5200	Fax 312-577-4532	
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.			
NAME OF SOLE OR FIRST INVENTOR :		<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name (first and middle [if any]) William Stuart		Family Name or Surname Bush	
Inventor's Signature			Date
Residence: City Manhattan Beach	State CA	Country US	Citizenship US
Mailing Address 217 Fifth Place, Manhattan Beach, CA 90266 US			
City Manhattan Beach	State CA	ZIP 90266	Country US
NAME OF SECOND INVENTOR:		<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name (first and middle [if any]) Carlos Ferdinand		Family Name or Surname Roura	
Inventor's Signature			Date
Residence: City Lomita	State CA	Country US	Citizenship US
Mailing Address 1714 West 255th Street			
City Lomita	State CA	ZIP 90717	Country US
<input type="checkbox"/> Additional inventors are being named on the _____ supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto.			

Please type a plus sign (+) inside this box →

PTO/SB/02A (11-00)
Approved for use through 10/31/2002. OMB 0651-0032
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DECLARATION	ADDITIONAL INVENTOR(S) Supplemental Sheet Page ___ of ___
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Name of Additional Joint Inventor, if any:		<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name (first and middle [if any])		Family Name or Surname	
Inventor's Signature		Date	
Residence: City	State	Country	Citizenship
Mailing Address			
Mailing Address			
City	State	ZIP	Country
Name of Additional Joint Inventor, if any:		<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name (first and middle [if any])		Family Name or Surname	
Inventor's Signature		Date	
Residence: City	State	Country	Citizenship
Mailing Address			
Mailing Address			
City	State	ZIP	Country
Name of Additional Joint Inventor, if any:		<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name (first and middle [if any])		Family Name or Surname	
Inventor's Signature		Date	
Residence: City	State	Country	Citizenship
Mailing Address			
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POWER OF ATTORNEY OR AUTHORIZATION OF AGENT	Application Number	
	Filing Date	
	First Named Inventor	Bush
	Title	Hands-Free, Voice-Operated...
	Group Art Unit	
	Examiner Name	
Attorney Docket Number	211548-IUS	

I hereby appoint:

Practitioners at Customer Number → Place Customer Number Bar Code Label here

Practitioner(s) named below:

Name	Registration Number
John S. Paniaguas	31,051

as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith.

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Firm or Individual Name **Katten Muchin Zavis Rosenman**

Address **525 W. Monroe Street**

City **Chicago** State **IL** Zip **60661**

Country **US**

Telephone **312-902-5312** Fax **312-577-4532**

I am the:

Applicant/Inventor.

Assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96).

SIGNATURE of Applicant or Assignee of Record

Name	William Stuart Bush
Signature	
Date	

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

Total of _____ forms are submitted.

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